Software Reference for SwitchBlade® x908 and x900 Series Switches

AlliedWare Plus™ Operating System Version 5.4.2

SwitchBlade® x908
x900-12XT/S
x900-24XS
x900-24XT
x900-24XT-N

C613-50021-01 REV B

Allied Telesis

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Although you can view this document using Acrobat version 5, to get the best from this manual, we recommend using Adobe Acrobat Reader version 8. You can download Acrobat Reader 8 free from http://www.adobe.com/.

New features in this software version

For a list of new and enhanced features and commands in this version, see Appendix B: Changes in Version 5.4.2-0.1 (with links to corresponding sections in this Software Reference), or the Software Release Note for Version 5.4.2. Documentation can be downloaded from the Support area of our website at http://www.alliedtelesis.com. Note that to download software files, you need a valid user account.

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Introduction

This chapter introduces a number of commonly-used management features of the AlliedWare Plus™ Operating System (OS).

How to Login

Step 1: Set the console baud rate

The default baud rate is 9600.

By default the AlliedWare Plus™ OS supports VT100 compatible terminals on the console port. This means that the terminal size is 80 columns by 24 rows.

Step 2: Login with manager/friend

The defaults are:

```
username: manager
password: friend
```

The switch logs you into User Exec mode. From User Exec mode, you can perform high-level diagnostics (some show commands, ping, traceroute etc), start sessions (Telnet, SSH), and change mode.

How to get Command Help

The following kinds of command help are available:

- lists of valid parameters with brief descriptions (the ? key)
- completion of keywords (the Tab key)
- error messages for incomplete or incorrect syntax

Command Abbreviations

The AlliedWare Plus™ CLI contains a number of abbreviations for its commands. For example, the show interface command can be entered in the abbreviated form shown below:

`awplus#`	
`sh in vlan100`	sh in vlan100
`awplus#`	
`configure terminal24`	Enter the Global Configuration mode.
`awplus(config)#`	
`router rip24`	Define a RIP routing process and enter the Router Configuration mode.
`awplus(config-router)#`	
`network 10.10.11.0/24`	Associate networks with the RIP process
`awplus(config-router)#`	
`network 10.10.12.0/24`	Associate networks with the RIP process

Viewing a List of Valid Parameters

To get syntax help, type ? (i.e. “space question mark”) after:

- the prompt. This will list all commands available in the mode you are in.
- one or more parameters. This will list parameters that can come next in the partial command.
- one or more letters of a parameter. This will list matching parameters.

Note

The AlliedWare Plus™ OS only displays one screenful of text at a time, with the prompt “--More--” at the end of each screenful. Press the space bar to display the next screenful or the Q key to return to the command prompt.

Example

To see which commands are available in Privileged Exec mode, enter “?” at the Privileged Exec mode command prompt:

```
awplus# ?
```

This results in the following output:

Figure 1-1: Example output from the ? command

```
Exec commands:
activate         Activate a script
cd               Change the current working directory
clear            Reset functions
clock            Manage clock
configure        Enter configuration mode
copy             Copy from one file to another
debug            Debugging functions (see also 'undebug')
delete           Delete a file
dir              List the files on a filesystem
disable          Turn off privileged mode command
dot1x            IEEE 802.1X Port-Based Access Control
echo             Echo a string
edit             Text Editor
enable           Turn on privileged mode command
erase            Erase the system startup configuration
exit             End current mode and down to previous mode
help             Description of the interactive help system
license          Activate software feature license
logout           Exit from the EXEC
mail             Send an email
mkdir            Make a new directory
move             Rename or move a file
mstat            Show statistics after multiple multicast
                 traceroutes
mtrace            Trace multicast path from source to destination
no               Negate a command or set its defaults
ping             Send echo messages
platform         Execute built-in self-tests
pwd              Print the current working directory
quit             Exit current mode and down to previous mode
reboot           Halt and perform a cold restart
reload           Halt and perform a cold restart
remote-command   Remote stack member command execution
restart          Restart routing protocol
rmdir            Remove a directory
rmon             Debugging functions (see also 'undebug')
show             Show running system information
ssh              Open an SSH connection
tcpdump          Execute tcpdump
telnet           Open a telnet connection
terminal         Set terminal line parameters
test             Test device functionality
traceroute       Trace route to destination
trigger          Automatic scripted responses to device events
undebug          Disable debugging functions (see also 'debug')
wait             Wait for a specified number of seconds
write            Write running configuration to memory, file or
                 terminal
```

Example To see which commands are available in Configuration mode, enter "?" at the Config mode command prompt:.

```
awplus# configure terminal
awplus(config)# ?
```

This results in the following output:

Figure 1-2: Example output from the ? command

```
Configure commands:
  aaa                   Authentication,Authorization and Accounting
  access-list           Add an access list entry
  arp                   Address Resolution Protocol (ARP)
  auth-web-server     Web authentication server configuration
                        commands
  banner                Define a login banner
  bgp                   Border Gateway Protocol (BGP)
  boot                  Boot configuration
  class-map             Class map command
  clock                 Manage clock
  crypto                Security Specific Commands
  cvlan                 Configure C-VLAN parameters
  debug                 Debugging functions (see also 'undebug')
  default               Restore default settings
  do                    To run exec commands in config mode
  dot1x                 IEEE 802.1X Port-Based Access Control
  enable                Modify enable password parameters
  epsr                  Ethernet Protection Switching Ring (EPSR)
  exception             Configure exception settings
  exit                  End current mode and down to previous mode
  fib                   FIB information
  help                  Description of the interactive help system
  hostname              Set system's network name
  interface             Select an interface to configure
  ip                    Internet Protocol (IP)
  ipv6                  Internet Protocol version 6 (IPv6)
  key                   Authentication key management
  lacp                  LACP commands
  line                  Configure a terminal line
  log                   Logging control
  loop-protection       Loop Protection
  mac                   mac address
  mail                  Send an email
  max-fib-routes        Set maximum fib routes number
  max-static-routes     Set maximum static routes number
  maximum-access-list   Maximum access-list entries
  maximum-paths         Set multipath numbers installed to FIB
  mls                   Multi-Layer Switch(L2/L3)
  no                    Negate a command or set its defaults
  ntp                   Configure NTP
  ospf                  Open Shortest Path First (OSPF)
  ping-poll             Ping Polling
  platform            Configure global settings for the switch
                        asic
  policy-map            Policy map command
  radius-server         Radius server
  remote-command        Remote stack member command execution
  rip                   Routing Information Protocol (RIP)
  rmon                  Remote Monitoring Protocol (RMON)
  route-map           Create route-map or enter route-map command
                        mode
  router                Enable a routing process
  router-id             Router identifier for this system
  service               Modify use of network based services
  show                  Show running system information
  snmp-server           Enable the snmp agent
  spanning-tree         Spanning tree commands
  ssh                   Secure Shell
  stack                 Manage VCS feature
  system                System properties
  telnet                Configure telnet
  trigger             Automatic scripted responses to device
                        events
  undebug             Disable debugging functions (see also
                        'debug')
  username              Establish User Name Authentication
  virtual-server        Virtual-server configuration
  vlan                  Configure VLAN parameters
  vrrp                  VRRP configuration
```

Example To see which show commands that start with “i” are available in Privileged Exec mode, enter “?” after show i:

```
awplus# show i?
```

This results in the following output:

Figure 1-3: Example output from the **show i?** command

```
interface          Select an interface to configure
  ip                 Internet Protoc6ol (IP)
  ipv6               Internet Protocol version 6 (IPv6)
```

Examples To use the ? help to work out the syntax for the clock timezone command, enter the following sequence of commands:

```
awplus(config)# clock ?
```

```
summer-time  Manage summer-time
timezone     Set clock timezone
```

```
awplus(config)# cloc timezone ?
```

```
TIMEZONE  Timezone name, up to 5 characters
```

```
awplus(config)# clock timezone NZST ?
```

```
minus  negative offset
plus   positive offset
```

```
awplus(config)# clock timezone NZST plus ?
```

```
<0-12>  Time zone offset to UTC
```

```
awplus(config)# clock timezone NZST plus 12
```

The above example demonstrates that the ? help only indicates what you can type next. For commands that have a series of parameters, like clock timezone, the ? help does not make the number of parameters obvious.

Completing Keywords

To complete keywords, type the Tab key after part of the command.

If only one keyword matches the partial command, the AlliedWare Plus™ OS fills in that keyword. If multiple keywords match, it lists them.

Examples In this example we use Tab completion in successive steps to build the complete command show ip dhcp server summary. We have included "<Tab>" to show where to type the Tab key - this is not displayed on screen.

```
awplus# show ip <Tab>
```

Figure 1-4: Example output after entering the command, **show ip** <Tab>

```
as-path-access-list  bgp                  community-list
dhcp                 dhcp-relay           domain-list
domain-name          extcommunity-list    filter
forwarding           igmp                 interface
irdp                 mroute               mvif
name-server          nat                  ospf
pim                  protocols            rip
route                rpf
```

```
awplus# show ip d<Tab>
```

Figure 1-5: Example output after entering the command, **show ip d**<Tab>

```
dhcp         dhcp-relay       domain-list      domain-name
```

```
awplus# show ip dhcp <Tab>
```

Figure 1-6: Example output from the **show ip dhcp** <Tab> command

```
binding  pool        server
```

```
awplus# show ip dhcp server s<Tab>
```

Figure 1-7: Example output from the **show ip dhcp s**<Tab> command

```
statistics           summary
```

Viewing Command Error Messages

The switch displays the following generic error messages about command input:

% Incomplete command—this message indicates that the command requires more parameters. Use the ? help to find out what other parameters are available.

```
awplus# interface
```

```
% Incomplete command.
```

% Invalid input detected at '^' marker—this indicates that the switch could not process the command you entered. The switch also prints the command and marks the first invalid character by putting a '^' under it. Note that you may get this error if you enter a command in the wrong mode, as the following output shows.

```
awplus# interface port1.0.1
```

```
interface port1.0.1
 ^
% Invalid input detected at '^' marker.
```

% Unrecognized command—when you try to use ? help and get this message, it indicates that the switch can not provide help on the command because it does not recognize it. This means the command does not exist, or that you have entered it in the wrong mode, as the following output shows.

```
awplus# interface ?
```

```
% Unrecognized command
```

Note

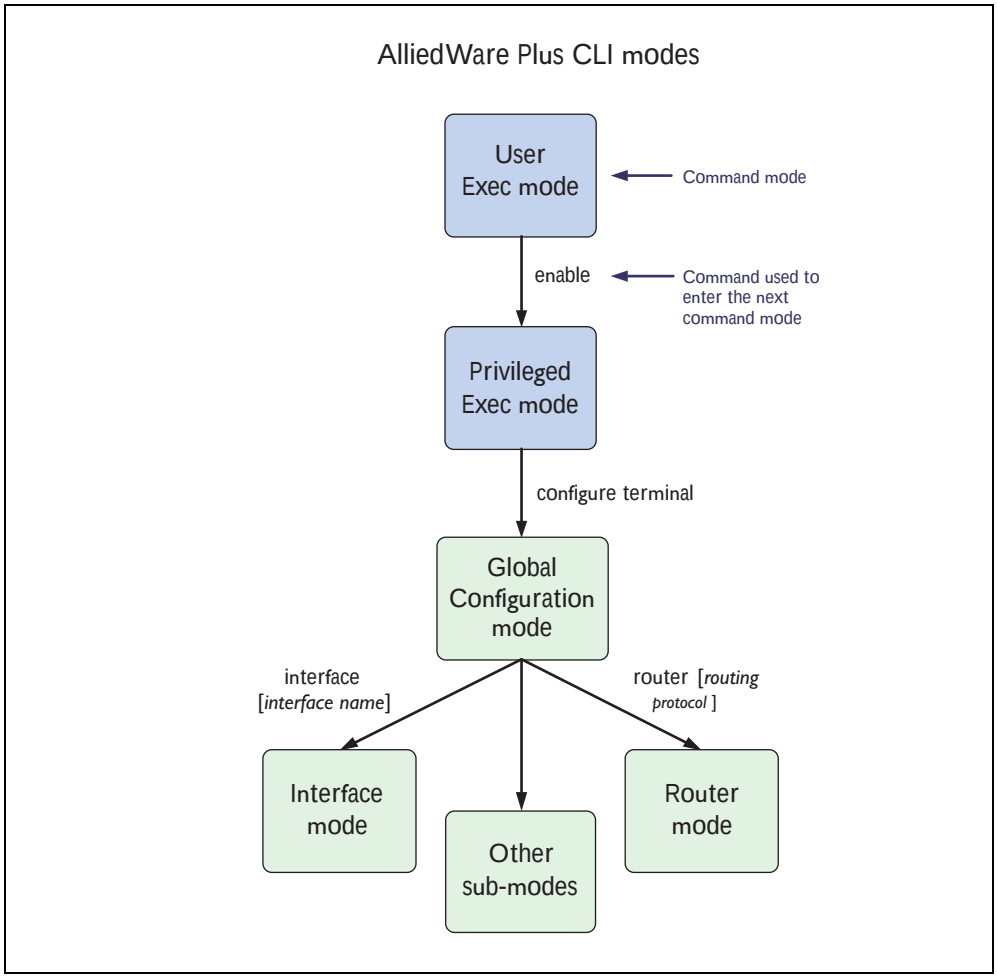
The AlliedWare Plus™ OS does not tell you when commands are successful. If it does not display an error message, you can assume the command was successful.

How to Work with Command Modes

The following figure shows the command mode hierarchy and the commands you use to move to lower-level modes.

Multiple users can telnet and issue commands using the User Exec mode and the Privileged Exec mode. However, only one user is allowed to use the Configure mode at a time. This prevents multiple users from issuing configuration commands simultaneously.

Figure 1-8: AlliedWare Plus™ CLI modes



User Exec mode

User Exec mode is the mode you log into on the switch.

It lets you perform high-level diagnostics (show commands, ping, traceroute etc), start sessions (Telnet, SSH), and change mode.

The default User Exec mode prompt is awplus>.

Privileged Exec mode

To change from User Exec to Privileged Exec mode, enter the command:

```
awplus> enable
```

Privileged Exec mode is the main mode for monitoring—for example, running show commands and debugging. From Privileged Exec mode, you can do all the commands from User Exec mode plus many system commands.

The default Privileged Exec mode prompt is awplus#.

Global Configuration mode

To change from Privileged Exec to Global Configuration mode, enter the command:

```
awplus# configure terminal
```

From Global Configuration mode, you can configure most aspects of the switch.

The default Global Configuration mode prompt is awplus(config)#.

Lower-level configuration modes

A number of features are configured by entering a lower-level mode from Global Configuration mode. The following table lists these features.

Table 1-1: Features configured using the lower level modes

Mode	What it configures	Command	Default prompt
Interface	Switch ports, VLANs, the management Eth port.	interface <*name*>	`awplus(config-if)#`
Class map	QoS classes, which isolate and name specific traffic flows (classes) from all other traffic.	class-map <*name*>	`awplus(config-cmap)#`
EPSR	Ethernet Protection Switching Ring, a loop protection mechanism with extremely fast convergence times.	epsr configuration	`awplus(config-epsr)#`
Line	Console port settings or virtual terminal settings for telnet.	line console 0 line vty *number*	`awplus(config-line)#`
Ping poll	Ping polling, which checks whether specified devices are reachable or not.	ping-poll <*number*>	`awplus(config-ping-poll)#`
Policy map	QoS policies, a collection of user-defined QoS classes and the default class.	policy-map <*name*>	`awplus(config-pmap)#`
Policy map class	The QoS actions to take on a class-map, and which class-maps to associate with a QoS policy. This mode is a sub-mode of Policy map mode.	(in Policy map mode) class <*name*>	`awplus(config-pmap-c)#`
Route map	Route maps, which select routes to include or exclude from the switch's routing table and/or route advertisements.	route-map *name* deny|permit <*entry-number*>	`awplus(config-route-map)#`
Router	Routing using BGP, IP, IPv6, OSPF, RIP, or VRRP.	router <*protocol other-parameters*>	`awplus(config-router)#`
MST	Multiple Spanning Tree Protocol.	spanning-tree mst configuration	`awplus(config-mst)#`
Trigger	Triggers, which run configuration scripts in response to events.	trigger <*number*>	`awplus(config-trigger)#`
VLAN database	VLANs.	vlan database	`awplus(config-vlan)#`

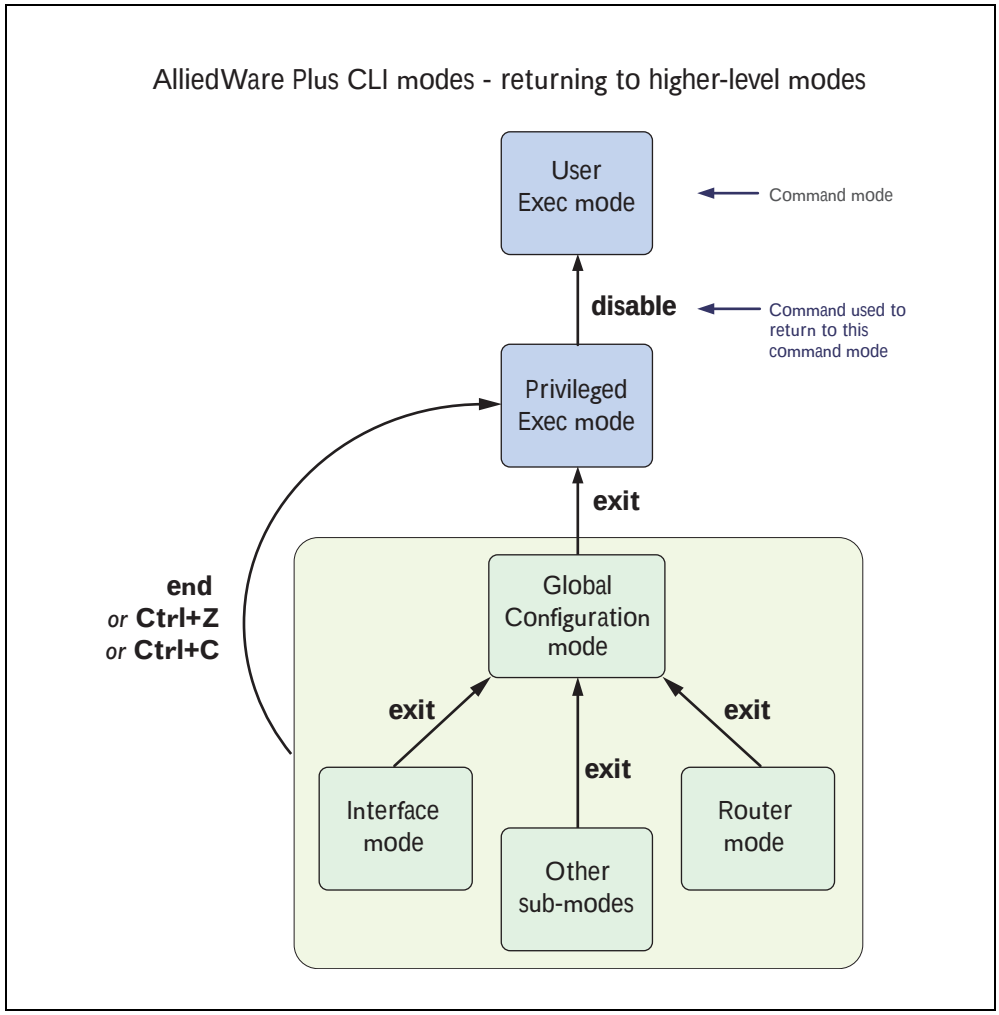
Some protocols have commands in both Global Configuration mode and lower-level configuration modes. For example, to configure MSTP, you use:

- Global Configuration mode to select MSTP as the spanning tree mode
- MST mode to create instances and specify other MSTP settings
- Interface Configuration mode to associate the instances with the appropriate ports.

Returning to higher-level modes

The following figure shows the commands to use to move from a lower-level mode to a higher-level mode.

Figure 1-9: Returning to higher-level modes



Examples

To go from Interface Configuration to Global Configuration mode:

```
awplus(config-if)# exit
awplus(config)#
```

To go from Interface Configuration to Privileged Exec mode:

```
awplus(config-if)# end
awplus#
```

To go from Privileged Exec to User Exec:

```
awplus# exit
awplus>
```

Entering Privileged Exec Commands When in a Configuration Mode

As you configure the switch you will be constantly entering various show commands to confirm your configuration. This requires constantly changing between configuration modes and Privileged Exec mode.

However, you can run Privileged Exec commands without changing mode, by using the command:

```
do <command you want to run>
```

You cannot use the ? help to find out command syntax when using the do command.

Example To display information about the IP interfaces when in Global Configuration mode, enter the command:

This results in the following output:

```
awplus(config)# do show ip int brief
```

Figure 1-10: Example output after entering the command, **do show ip int brief**

```
Interface          IP-Address      Status          Protocol
vlan1              unassigned      admin up        running
vlan2              unassigned      admin up        running
```

Main Command Modes Summary The table below lists the main command modes, how to access each mode, the prompt for each command mode. From any mode, use exit to move up a mode, or end to move to the Privileged Exec mode.

Table 1-2: Main command modes and modal prompts

Present Mode	Prompt	Command	New Mode
User Exec	awplus>	enable	Privileged Exec
Privileged Exec	awplus#	configure terminal	Global Configuration
Global Configuration	awplus(config)#	vlan database	VLAN Configuration
Global Configuration	awplus(config)#	line vt <line-number>	Line Configuration

Sub-modes Summary The table below lists the sub-modes, how to access each mode, the prompt for each command mode, and how to exit that mode. Prompts listed use the default awplus.

Table 1-3: Sub-modes, prompt for each sub-mode, how to access each sub-mode, and how to exit each sub-mode

Mode	Prompt and Command Examples	How to Enter Mode	How to Exit Mode

Ping Poll Configuration	`awplus#configure terminal`
	`awplus(config)#ping-poll`
	`awplus(config-ping-poll)#`
		Use the ping-poll command available from the Global Configuration mode.	Use the exit command to return to the Global Configuration mode.
			Use the end command to return to the Privileged Exec mode.

Route Map Configuration	`awplus#configure terminal`
	`awplus(config)#route-map route1 permit 1`
	`awplus(config-route-map)#`
		Use the route-map command available from the Global Configuration mode.	Use the exit command to return to the Global Configuration mode.
			Use the end command to return to the Privileged Exec mode.

Router Configuration	`awplus#configure terminal`
	`awplus(config)#router rip`
	`awplus(config-router)#`
		Use one of the following commands available from the Global Configuration mode:
		■ router rip
		■ router ipv6 rip
		■ router ospf
		■ router bgp
		■ router vrrp (interface)
			Use the exit command to return to the Global Configuration mode.
			Use the end command to return to the Privileged Exec mode.

MST (Multiple Spanning Tree) Configuration	`awplus#configure terminal`
	`awplus(config)#spanning-tree mst configuration`
	`awplus(config-mst)#`
		Use the spanning-tree mst configuration command available from the Global Configuration mode.	Use the exit command to return to the Global Configuration mode.
			Use the end command to return to the Privileged Exec mode.

Trigger Configuration	`awplus#configure terminal`
	`awplus(config)#trigger 1`
	`awplus(config-trigger)#`
		Use the trigger command from Global Configuration mode.	Use the exit command to return to the Global Configuration mode.
			Use the end command to return to the Privileged Exec mode.

EPSR Configuration	`awplus#configure terminal`
	`awplus(config)#epsr configuration`
	`awplus(config-epsr)#`
		Use the epsr configuration command available from the Global Configuration mode.	Use the exit command to return to the Global Configuration mode.
			Use the end command to return to the Privileged Exec mode.

Class Map Configuration (QoS)	`awplus#configure terminal`
	`awplus(config)#class map cmap1`
	`awplus(config-cmap)#`
		Use the class-map command available from the Global Configuration mode.	Use the exit command to return to the Global Configuration mode.
			Use the end command to return to the Privileged Exec mode.

Table 1-3: Sub-modes, prompt for each sub-mode, how to access each sub-mode, and how to exit each sub-mode

Mode	Prompt and Command Examples	How to Enter Mode	How to Exit Mode

Policy Map Configuration (QoS)	`awplus#configure terminal`
	`awplus(config)#policy-map pmap1`
	`awplus(config-pmap)#`
		Use the policy-map command available from the Global Configuration mode.	Use the exit command to return to the Global Configuration mode.
			Use the end command to return to the Privileged Exec mode.

Policy Map Class Configuration (QoS)	`awplus#configure terminal`
	`awplus(config)#policy-map pmap1`
	`awplus(config-pmap)#class cmap1`
	`awplus(config-pmap-c)#`
		Use the class command available from the Policy map mode.	Use the exit command to return to the Policy Map Configuration mode.
			Use the end command to return to the Privileged Exec mode.

How to See the Current Configuration

The current configuration is called the running-config. To see it, enter the following command in either Privileged Exec mode or any configuration mode:

```
awplus# show running-config
```

To see only part of the current configuration, enter the command:

```
awplus# show running-config|include <word>
```

This displays only the lines that contain *word*.

To start the display at a particular place, enter the command:

```
awplus# show running-config |begin <word>
```

This searches the running-config for the first instance of *word* and begins the display with that line.

Note The show running-config command works in all modes except User Exec mode.

Default Settings

When the switch first starts up with the AlliedWare Plus™ OS, it applies default settings and copies these defaults dynamically into its running-config.

These default settings mean that the AlliedWare Plus™ OS:

- encrypts passwords, such as user passwords
- records log message priority in log messages
- turns on jumbo frame support for all ports
- turns on the telnet server so that you can telnet to the switch
- enables the switch to look up domain names (but for domain name lookups to work, you have to configure a DNS server)
- turns off L3 multicast packet switching in the switch's hardware. This prevents L3 multicast from flooding the switch's CPU in its default state as an L2 switch
- sets the maximum number of ECMP routes to 8
- turns on RSTP on all ports. Note that the ports are not set to be edge ports
- sets all the switch ports to access mode. This means they are untagged ports, suitable for connecting to hosts
- creates VLAN 1and adds all the switch ports to it
- allows logins on the serial console port
- allows logins on VTY sessions (for telnet etc)
- has switching enabled, so Layer 2 traffic is forwarded appropriately without further configuration
- allocates all the routing table memory space to IPv4 and IPv6 routes
- has ports set to autonegotiate their speed and duplex mode
- has copper ports set to auto MDI/MDI-X mode

The Default Configuration Script

Most of the above default settings are in the form of commands, which the switch copies to its running-config when it first boots up.

The switch stores a copy of the default configuration commands in the file, default.cfg and uses this as its default start-up file.

For more information about start-up files, see "How to Save and Boot from the Current Configuration" on page 1.22.

The following table shows the contents of the default file.

Contents of default file	Description
`!`	An empty comment line (comments begin with an !).
`service password-encryption` `!`	Forces passwords in the script to be encrypted.
`log record-priority`	Records log message priority.
`username manager privilege 15 password 8 $1$bJoVec4D$JwOJGPr7YqoExA0GVasdE0`	Specifies the password for the manager user
`service telnet` `!`	Turns on the telnet server.
`ip domain-lookup` `!`	Allows domain name lookups.
`no ip multicast-routing` `!`	Turns off L3 multicast packet switching in the switch hardware.
`maximum-paths 8`	Sets maximum number of ECMP routes.
`spanning-tree mode rstp` `!`	Turns on RSTP.
`interface eth0` `!`	A heading for any configuration settings for the management eth0 port. There are no eth0 settings.

`interface port1.X.X-1.X.XX`
`switchport`
`switchport mode access`
`!`
	Sets each switch port to access mode.

`interface vlan1` `!`	Creates VLAN 1.
`line con 0`	A heading for any configuration settings for the console port. There are no console port settings.

`line vty 0 32`
`!`
`end`
	A heading for any configuration settings for VTY sessions. There are no VTY session settings.

How to Change the Password

To change the password for the manager account, enter Global Configuration mode and enter the following command:

```
awplus(config)# username manager password <new-password>
```

The password can be up to 23 characters in length and include characters from up to four categories. The password categories are:

- uppercase letters: A to Z
- lowercase letters: a to z
- digits: 0 to 9
- special symbols: all printable ASCII characters not included in the previous three categories.The question mark ? cannot be used as it is reserved for help functionality.

How to Set Strong Passwords

The password security rules are disabled by default. To set password security rules for users with administrative rights, or privilege level 15, enter Global Configuration mode.

You can then either specify whether the user is forced to change an expired password at the next login, or specify whether the user is not allowed to login with an expired password. You will need to specify a password lifetime greater than 0 before selecting either of these features. Note that the security-password forced-change and the security-password reject-expired-pwd commands cannot be enabled concurrently.

Password lifetime

Enter the following command to specify the password lifetime in days:

```
awplus(config)# security-password lifetime <0-1000>
```

Note that the value 0 will disable lifetime functionality and passwords will never expire. If lifetime functionality is disabled, the security-password forced-change command and the security-password warning command are also disabled.

Password forced change

To specify that a user is forced to change an expired password at the next login, enter the following command:

```
awplus(config)# security-password forced-change
```

If the security-password forced-change command is enabled, users with expired passwords are forced to change to a password that must comply with the current password security rules at the next login.

Reject expired password

To specify that a user is not allowed to login with an expired password, enter the following command:

```
awplus(config)# security-password reject-expired-pwd
```

If the security-password reject-expired-pwd command is enabled, users with expired passwords are rejected at login. Users then have to contact the Network Administrator to change their password.

Caution

Once all users' passwords are expired you are unable to login to the device again if the security-password reject-expired-pwd command has been executed. You will have to reboot the device with a default configuration file, or load an earlier software version that does not have the security password feature.

We recommend you never have the command line "security-password reject-expired-pwd" in a default config file.

Use other password security rules to further configure password security settings.

Password warning

To specify the number of days before the password expires that the user will receive a warning message specifying the remaining lifetime of the password, enter the command:

```
awplus(config)# security-password warning <0-1000>
```

The value 0 will disable warning functionality and the warning period must be less than, or equal to, the password lifetime.

Password history

To specify the number of previous passwords that are unable to be reused enter the command:

```
awplus(config)# security-password history <0-15>
```

The value 0 will disable history functionality. If history functionality is disabled, all users' password history is reset and all password history is lost. A new password is invalid if it matches a password retained in the password history.

Password minimum length

To specify the minimum allowable password length, enter the command:

```
awplus(config)# security-password minimum-length <1-23>
```

Password minimum categories

To specify the minimum number of categories that the password must contain in order to be considered valid, enter the command:

```
awplus(config)# security-password minimum-categories <1-4>
```

The password categories are:

- uppercase letters: A to Z
- lowercase letters: a to z
- digits: 0 to 9
- special symbols: all printable ASCII characters not included in the previous three categories. The question mark ? cannot be used as it is reserved for help functionality

To ensure password security, the minimum number of categories should align with the lifetime selected, i.e. the fewer categories specified the shorter the lifetime specified.

How to add a user is described in "How to Add and Remove Users" on page 1.32.

Display security password settings

To list the configuration settings for the various security password rules, enter the command:

```
awplus(config)# show security-password configuration
```

To list users remaining lifetime or last password change, enter the command:

```
awplus(config)# show security-password user
```

How to Set a Management IP Address

This section describes how to set an IP address on the eth0 management port.

Step 1: If desired, check the current configuration

After logging in, enter Privileged Exec mode by using the command:

```
awplus# enable
```

```
awplus>enable
```

Then check the current configuration by using one of the following commands:

```
awplus# show ip interface eth0 brief
```

This results in the following output:

```
Interface              IP-Address      Status          Protocol
eth0                   172.28.8.200    admin up        running
```

```
awplus# show running-config interface eth0
```

This results in the following output:

```
!
interface eth0
 ip address 172.28.8.200/16
!
```

Step 2: Enter Interface Configuration mode for the eth0 interface

Enter Global Configuration mode and enter the command:

```
awplus(config)# interface eth0
```

Step 3: Enter the IP address and mask

Enter the command:

```
awplus(config-if)# ip address <address/mask>
```

For example, to set the address to 172.28.8.210/16, enter the command:

```
awplus(config-if)# ip address 172.28.8.210/16
```

How to Save and Boot from the Current Configuration

This section tells you how to save your configuration and run the saved configuration when the switch starts up.

You can either:

- save the configuration to the switch's default configuration file (called "default.cfg"). By default, the switch uses that file at start-up.
- create a new configuration file and set the switch to use the new configuration file at start-up.

How to Save to the Default Configuration File

Enter Privileged Exec mode and enter the command:

```
awplus# copy running-config startup-config
```

The parameter startup-config is a short-cut for the current boot configuration file, which will be the default configuration file unless you have changed it, as described in the next section.

How to Create and Use a New Configuration File

Step 1: Copy the current configuration to a new file

Enter Privileged Exec mode and enter the command:

```
awplus# copy running-config <destination-url>
```

Example To save the current configuration in a file called `example.cfg`, enter the command

```
awplus# copy running-config example.cfg
```

Step 2: Set the switch to use the new file at startup

To run the new file's configuration when the switch starts up, enter Global Configuration mode and enter the command:

```
awplus(config)# boot config-file <filepath-filename>
```

Note that you can set the switch to use a configuration file on a SD card if you have saved the configuration file to a card. You can only specify that the configuration file is on a SD card if there is a backup configuration file already specified in Flash. To set a backup configuration file to load if the main configuration file cannot be loaded, enter the command:

```
awplus(config)# boot config-file backup <filepath-filename>
```

For an explanation of the configuration fallback order, see "The configuration file fallback order" on page 6.10.

Example To run the commands in `example.cfg` on startup, enter the command:

```
awplus(config)# boot config-file flash:/example.cfg
```

To set `backup.cfg` as the backup to the main configuration file, enter the command:

```
awplus(config)# boot config-file backup flash:/backup.cfg
```

Step 3: Display the new settings

To see the files that the switch uses at startup, enter Privileged Exec mode and enter the command:

```
awplus# show boot
```

The output looks like this:

```
Boot configuration
-----------------------------------------------------------------
Current software   : x900-5.4.2.rel
Current boot image : flash:/x900-5.4.2.rel
Backup  boot image : flash:/x900-5.4.2.rel
Default boot config: flash:/default.cfg
Current boot config: card:/example.cfg (file exists)
Backup  boot config: flash:/backup.cfg (file exists)
```

Step 4: Continue updating the file when you change the configuration

When you next want to save the current configuration, enter Privileged Exec mode and enter the command:

```
awplus# copy running-config startup-config
```

The parameter startup-config is a short-cut for the current boot configuration file.

How to Return to the Factory Defaults

The switch dynamically adds the default settings to the running-config at start-up if the default file is not present. This section describes how to use this feature to return to the factory defaults.

Note

After reboot the show running-config output will show the default factory settings for your switch once you have removed the default.cfg file. To recreate the default.cfg file enter copy running-config startup-config. When you enter copy running-config startup-config commands the default.cfg file is updated with the startup-config.

Completely restore defaults

To completely remove your configuration and return to the factory default configuration, delete or rename the default file and make sure no other file is set as the start-up configuration file.

To find the location of the default boot configuration file, enter Privileged Exec mode and enter the command:

```
awplus# show boot
```

To delete the default file when it is the current boot configuration file, enter Privileged Exec mode and enter either of the commands:

```
awplus# delete force <filename>
```

or:

```
awplus# erase startup-config
```

Note that erasing startup-config deletes the current boot configuration file—it does not simply stop the file from being the boot file.

To make sure that no other file is loaded at start-up, enter Global Configuration mode and enter the command:

```
awplus(config)# no boot config-file
```

Partially restore defaults

To partially restore the default settings, make a configuration file that contains the settings you want to keep and set this as the start-up configuration file. On start-up, the switch will add the missing settings to the running-config.

For example, to use default settings but still keep an IP address on the eth0 management port, create a file like the following one and set it as the boot configuration file:

```
awplus# show file eth0-ip.cfg
```

The output looks like this:

```
!
interface eth0
 ip address 172.28.8.210/16
!
ip route 0.0.0.0/0 172.28.0.1
!
end
```

How to See System Information

This section describes how to view the following system information:

- overview information
- details of temperature and voltage
- serial number

Viewing Overall System Information

To display an overview of the switch hardware, software, and system settings, enter User Exec or Privileged Exec mode and enter the command:

```
awplus# show system
```

The output looks like this:

```
Switch System Status                                    Fri Dec  5 02:55:58 2008
Board       ID  Bay   Board Name                              Rev  Serial number
-------------------------------------------------------------------------------
Base       280        x900-24XT-N                             A-0  45AX5300X
PSU        212  PSU2  AT-PWR01-AC                             B-1  61400717
Fan module 214  PSU1  AT-FAN01                                F-1  66111841
-------------------------------------------------------------------------------
RAM:  Total: 514264 kB Free: 372404 kB
Flash: 31.0MB Used: 14.8MB Available: 16.2MB
-------------------------------------------------------------------------------
Environment Status : Normal
Uptime             : 0 days 02:12:03
Bootloader version : 1.0.9
Current software   : x900-5.4.2.rel
Software version   : 5.4.1
Build date         : Mon Dec 15 14 13:04:00 NZDT 2010
Current boot config: flash:/default.cfg (file exists)
Territory          : japan
System Name
System Contact
System Location
```

Viewing Temperature, Voltage, and Fan Status

The switch monitors the environmental status of the switch and its power supplies and fan. To display this information, enter User Exec or Privileged Exec mode and enter the command:

```
awplus# show system environment
```

The output looks like the following figure.

```
Environment Monitoring Status
Overall Status: Normal

Resource ID: 1  Name: PSU bay 1
ID  Sensor (Units)                    Reading  Low Limit High Limit Status
1   Device Present                       Yes        -          -       Ok
2   PSU Overtemp                          No        -          -       Ok
3   PSU Fan Fail                          No        -          -       Ok
4   PSU Power Output                      No        -          -       Ok

Resource ID: 2  Name: PSU bay 2
ID  Sensor (Units)                    Reading  Low Limit High Limit Status
1   Device Present                       Yes        -          -       Ok
2   PSU Overtemp                          No        -          -       Ok
3   PSU Fan Fail                          No        -          -       Ok
4   PSU Power Output                     Yes        -          -       Ok

Resource ID: 3  Name: x900-24XT-N
ID  Sensor (Units)                    Reading  Low Limit High Limit Status
1   Voltage: 2.5V (Volts)              2.565      2.344      2.865     Ok
2   Voltage: 1.65V (Volts)             1.629      1.488      1.816     Ok
3   Voltage: 3.3V (Volts)              3.334      2.973      3.627     Ok
4   Voltage: 1.8V (Volts)              1.771      1.615      1.979     Ok
5   Voltage: 12V (Volts)              12.000     10.813     13.188     Ok
6   Temp: Ambient (Degrees C)             33       -127         55     Ok
7   Temp: Mid Internal (Degrees C)        52       -127         85     Ok
8   Temp: Bk Internal (Degrees C)         47       -127         75     Ok
```

Viewing the Serial Number

The switch's serial number is displayed in the output of the show system command on page 8.53, but for convenience, you can also display it by itself. To do this, enter User Exec or Privileged Exec mode and enter the command:

```
awplus# show system serialnumber
```

The output looks like this:

```
P1FY7502C
```

How to Set System Parameters

You can set system parameters to personalize the switch and make it easy to identify it when troubleshooting. This section describes how to configure the following system parameters:

- telnet session timeout
- switch name
- login banner

How to Change the Telnet Session Timeout

By default, telnet sessions time out after 10 minutes of idle time. If desired, you can change this.

To change the timeout for all telnet sessions, enter Global Configuration mode and enter the commands:

```
awplus(config)# line vty 0 32
awplus(config-line)# exec-timeout <new-timeout>
```

The new timeout value only applies to new sessions, not current sessions.

Examples To set the timeout to 30 minutes, enter the command:

```
awplus(config-line)# exec-timeout 30
```

To set the timeout to 30 seconds, enter the command:

```
awplus(config-line)# exec-timeout 0 30
```

To set the timeout to infinity, so that sessions never time out, enter either of the commands:

```
awplus(config-line)# no exec-timeout
awplus(config-line)# exec-timeout 0 0
```

How to Name the Switch

To give the switch a name, enter Global Configuration mode and enter the command:

```
awplus(config)# hostname <name>
```

For example, to name the switch “switch1.mycompany.com”:

```
awplus(config)# hostname switch1.mycompany.com
```

The prompt displays the new name:

```
awplusswitch1.mycompany.com(config)#
```

The name can contain hyphens and underscore characters.

However, the name must be a single word, as the following example shows.

```
awplus(config)#hostname switch1.mycompany.com more words
hostname switch1.mycompany.com more words
                                ^
% Invalid input detected at '^' marker.
```

It also cannot be surrounded by quote marks, as the following example shows.

```
awplus(config)#hostname "switch1.mycompany.com more words"
% Please specify string starting with alphabet
```

Removing the name

To remove the hostname, enter the command:

```
awplusswitch1.mycompany.com(config)# no hostname
```

The prompt changes back to the default prompt:

```
awplus(config)#
```

How to Display a Text Banner at Login

By default, the switch displays the AlliedWare Plus™ OS version and build date before login. You can customize this by changing the Message of the Day (MOTD) banner.

To enter a new MOTD banner, enter Global Configuration mode and enter the command:

```
awplus(config)# banner motd <banner-text>
```

The text can contain spaces and other printable characters. You do not have to surround words with quote marks.

Example To display “this is a new banner” when someone logs in, enter the command:

```
awplus(config)# banner motd this is a new banner
```

This results in the following output at login:

```
awplus login: manager
Password:
this is a new banner
awplus>
```

Removing the banner To return to the default banner (AlliedWare Plus™ OS version and build date), enter the command:

```
awplus(config)# banner motd default
```

To remove the banner instead of replacing it, enter the command:

```
awplus(config)# no banner motd
```

How to Set the Time and Date

There are three aspects to setting the time and date:

- setting the current time and date ("How to Set the Time and Date" on page 1.30)
- setting the timezone ("How to Set the Timezone" on page 1.31)
- configuring the switch to automatically change the time when summer-time begins and ends ("How to Configure Summer-time" on page 1.31)

Instead of manually setting the time, you can use NTP to automatically get the time from another device.

How to Show Current Settings

To display the current time, timezone and date, enter Privileged Exec mode and enter the command:

```
awplus# show clock
```

The output looks like this:

```
UTC Time:   Wed,  3 Dec 2008 16:08:14 +0000
Timezone: UTC
Timezone Offset: +00:00
Summer time zone: None
```

How to Set the Time and Date

To set the time and date, enter Privileged Exec mode and enter the clock set command:

```
clock set <hh:mm:ss> <day> <month> <year>
```

:where:

- *hh* is two digits giving the hours in 24-hour format (e.g. 14)
- *mm* is two digits giving the minutes
- *ss* is two digits giving the seconds
- *day* is two digits giving the day of the month
- *month* is the first three letters of the month name (e.g. sep)
- *year* is four digits giving the year

Example To set the time to 14:00:00 on 25 January 2008, use the command:

```
awplus# clock set 14:00:00 25 jan 2008
```

How to Set the Timezone

To set the timezone, enter Global Configuration mode and enter the clock timezone command:

```
clock timezone <timezone-name> {plus|minus} <0-12>
```

The <*timezone-name*> can be any string up to 6 characters long.

To return the timezone to UTC+0, enter the command:

```
awplus(config)# no clock timezone
```

Example To set the timezone to Eastern Standard Time, use the command:

```
awplus(config)# clock timezone EST minus 5
```

How to Configure Summer-time

There are two approaches for setting summer-time:

- *recurring*, when you specify the week when summer-time starts and ends and each year the switch changes the time at those weeks. For example, Eastern Daylight Time (EDT) starts at 2 am on the second Sunday in March and ends at 2 am on the first Sunday in November.
- *date-based*, when you specify the start and end dates for summer-time for a particular year. For example, Eastern Daylight Time (EDT) starts at 2 am on Sunday, 8 March 2008 and ends at 2 am on Sunday, 2 November 2008.

Recurring To set summer-time with recurring dates, enter Global Configuration mode and enter the clock summer-time recurring command:

```
clock summer-time <zone-name> recurring <start-week> <start-
day> <start-month> <start-time> <end-week> <end-day>
<end-month> <end-time> <1-180>
```

The <*zone-name*> can be any string up to 6 characters long.

The <*start-time*> and <*end-time*> are in the form `hh:mm`, in 24-hour time.

Note that if you specify 5 for the week, this changes the time on the last day of the month, not the 5th week.

Example To configure EDT, enter the command:

```
awplus(config)# clock summer-time EDT recurring 2 Sun Mar 02:00
                1 Sun Nov 02:00 60
```

Date-based To set summer-time for a single year, enter Global Configuration mode and enter the clock summer-time date command:

```
clock summer-time <zone-name> date <start-day> <start-month>
<start-year> <start-time> <end-day> <end-month> <end-year>
<end-time> <1-180>
```

The <*zone-name*> can be any string up to 6 characters long.

The <*start-time*> and <*end-time*> are in the form `hh:mm`, in 24-hour time.

Example For example, to configure EDT for 2008 enter the command:

```
awplus(config)# clock summer-time EDT date 8 Mar 2008 02:00 2
                Nov 2008 02:00 60
```

How to Add and Remove Users

Adding users To add a new user with administrative rights, enter Global Configuration mode and enter the command:

```
awplus(config)# username <name> privilege 15 password
                <password>
```

Both <*name*> and <*password*> can contain any printable character and are case sensitive.

When you add a user with administrative rights, <*password*> will have to conform to the rules specified by the security-password minimum-categories command on page 5.19 and the security-password minimum-length command on page 5.20. If the security-password history command on page 5.16 is enabled, <*password*> is invalid if it matches a password retained in the password history.

The AlliedWare Plus™ OS gives you a choice of 1 or 15 for the privilege level. Level 1 users are limited to User Exec mode so you need to set most users to level 15.

For example, to add user Bob with password 123$%^, enter the command:

```
awplus(config)# username Bob privilege 15 password 123$%^
```

Removing users To remove a user, enter Global Configuration mode and enter the command:

```
no username <name>
```

For example, to remove user Bob, enter the command:

```
awplus(config)# no username Bob
```

Note that you can delete all users, including the user called “manager” and the user you are logged in as. If all privilege 15 user accounts are deleted, a warning message is generated:

```
% Warning: No privileged users exist.
```

If all privilege level 15 user accounts are deleted, and there are no other users configured for the device, you may have to reboot with the default configuration file.

If there is a user account on the device with a lower privilege level and a password has already been set with the enable password command on page 5.4, you can login and still enter privileged mode. When executing the enable command, enter the password created with the enable password command. For example, if the password is mypassword:

```
awplus> enable mypassword

awplus#
```

Displaying users

To list the currently logged-in users, enter User Exec or Privileged Exec mode and enter the command:

```
awplus# show users
```

The output looks like this:

```
Line     User            Host(s)  Idle      Location        Priv Idletime Timeout
con 0    manager         idle     00:00:00  ttyS0           15   10       N/A
vty 0    bob             idle     00:00:03  172.16.11.3     1    0        5
```

To list all configured users, enter User Exec or Privileged Exec mode and enter the command:

```
awplus# show running-config |include username
```

The output looks like this:

```
username manager privilege 15 password 8 $1$bJoVec4D$JwOJGPr7YqoExA0GVasdE0
username Bob privilege 15 password 8 $1$gXJLY8dw$iqkMXLgQxbzSOutNUa5E2.
```

Pre-encrypted Passwords

The running-config output above includes the number 8 after the password parameter. This indicates that the password is displayed in its encrypted form.

You can enter the number 8 and a pre-encrypted password on the command line. You may want to pre-encrypt passwords if you need to load them onto switches via an insecure method (such as HTTP, or by emailing them to remote users).

Caution

Only enter the number 8 if you are entering a pre-encrypted password—otherwise, you will be unable to log in using the password and will be unable to access the switch through that username. The next section describes why.

Testing this feature

If you want to test the effect of this, *create a new user* for the test instead of using the manager user. The test stops you from logging in as the test user, so you need to have the manager user available to log in as.

The following output shows how specifying the number 8 puts the password into the running-config exactly as you typed it:

```
awplus(config)#username Bob privilege 15 password 8 friend
awplus(config)#show running-config |include username Bob
username Bob privilege 15 password 8 friend
```

After entering the command above, logging in as “Bob” with a password of “friend” does not work. This is because the switch takes the password you enter (“friend”), hashes it, and compares the hash with the string in the running-config (“friend”). The hashed value and “friend” are not the same, so the switch rejects the login.

How to Undo Settings

There are two possibilities for undoing settings: the no parameter and the default parameter.

How to Use the *no* Parameter

To undo most settings, simply re-enter the first parameters of the configuration command with the parameter no before them.

Example You can set the timezone to Eastern Standard Time by entering the command:

```
awplus(config)# clock timezone EST minus 5
```

To remove the timezone setting, enter the command:

```
awplus(config)# no clock timezone
```

How to Use the *default* Parameter

Some commands have a default parameter that returns the feature to its default setting.

Example You can change the login banner to “this is a new banner” by entering the command:

```
awplus(config)# banner motd this is a new banner
```

To return to the default banner, enter the command:

```
awplus(config)# banner motd default
```

Note that this command also has a no parameter that lets you remove the banner altogether.

How to Upgrade the Firmware

New releases of the AlliedWare Plus™ OS become available regularly. Contact your customer support representative for more information.

Step 1: Put the new release onto your TFTP server

Step 2: If necessary, create space in the switch's Flash memory for the new release

Note that you cannot delete the current release file.

To see how much space is free, use the command:

```
awplus# show file systems
```

Step 3: Copy the new release from your TFTP server onto the switch

Follow the instructions in "Copying with Trivial File Transfer Protocol (TFTP)" on page 6.15.

Step 4: Set the switch to boot from the new release

Enter Global Configuration mode and enter the command:

```
awplus(config)# boot system <filepath-filename>
```

You can set a backup release file to load if the main release file cannot be loaded. Enter the command:

```
awplus(config)# boot system backup <filepath-filename>
```

Step 5: Check the boot settings

Enter Privileged Exec mode and enter the command:

```
awplus# show boot
```

Step 6: Reboot

Enter Privileged Exec mode and enter the command:

```
awplus# reload
```

Save Power With the Eco-Friendly Feature

You can conserve power by enabling the eco-friendly feature with the ecofriendly led command on page 8.17. This feature disables power to the port LEDs on XEMs installed in the switch, the stack ID LED on the XEM-STK and all port LEDs on the switch, except the eth0 port. On the switch, power to the fault, SD and PSU LEDs is not disabled, and in addition, on the SwitchBlade® x908 power to the stacking status LED is not disabled. On the XEM-1XP and XEM-2XP power to the XFP LED is not disabled.

When the eco-friendly feature is enabled, a change of port status will not affect the display of the associated LED. When the eco-friendly feature is disabled and power is returned to port LEDs, the LEDs will correctly show the current state of the ports.

In a stack environment, enabling the eco-friendly feature on the stack master will apply the feature to every member of the stack.

The eco-friendly feature is disabled by default. To enable the feature, enter the commands:

```
awplus# configure terminal
awplus(config)# ecofriendly led
```

To display the current eco-friendly configuration status of the switch, enter the command:

```
awplus# show ecofriendly
```

For an example of how to configure a trigger to enable the eco-friendly feature, see “Turn Off Power to Port LEDs” on page 96.7.

Trouble-shoot fiber and pluggable issues

Digital Optical Monitoring (DOM) for XFP (10 Gigabit Small Form Factor Pluggable) transceivers and Digital Diagnostics Monitoring (DDM) for SFP (1 Gigabit Small Form-factor Pluggable) and SFP+ (10 Gigabit Small Form-factor Pluggable) transceivers, allow you to measure optical parameters for pluggables installed in a switch and trouble shoot fiber issues.

Fiber cable can be vulnerable to damage. Patch panels and patch cables can be connected with the wrong type of fiber, fiber splices can become faulty and fiber cables can be cut accidentally. Trouble shooting fiber issues has required special equipment and expertise to find the source of a problem causing signal attenuation. XFP DOM and SFP DDM features help find fiber issues.

Different types of SFP, SFP+ and XFP pluggable transceivers are supported in different models of switch. See your Allied Telesis dealer for more information about the particular models of pluggables that your switch supports, and if these SFPs or XFPs also support DDM or DOM.

To display XFP DOM, SFP DDM or SFP+ DDM diagnostic information, depending on the model of XFP, SFP or SFP+ pluggables installed on your switch, enter the following command:

```
awplus# show system pluggable diagnostics
```

The following parameters are measured by DOM for XFP transceivers and DDM for SFP and SFP+ transceivers, and are displayed in show system pluggable diagnostics command output:

- Temperature (Centigrade) inside the XFP, SFP or SFP+ transceiver
- Vcc (Volts) voltage supplied to the XFP, SFP or SFP+ transceiver
- Tx Bias (mA) current to the Laser Diode in the XFP, SFP or SFP+ transceiver
- Tx Power (mW) the amount of light transmitted from the XFP, SFP or SFP+ transceiver
- Rx Power (mW) the amount of light received in the XFP, SFP or SFP+ transceiver

You can track Tx Bias to find out how the Laser Diode in the XFP, SFP or SFP+ transceiver is aging by comparing the Tx Bias for one XFP, SFP or SFP+ transceiver against Tx Bias for others. You can use this information to see if any XFP, SFP or SFP+ transceivers may need replacement.

You can trouble shoot fiber connectivity issues by checking the Tx Power at one end of the fiber link against the Rx Power at the other end of the fiber link to measure the attenuation. Knowing the attenuation enables you to determine if there are anomalies in the fiber cable.

Note that Tx Power differences between the same type of XFP, SFP or SFP + transceivers installed on a switch may indicate that an XFP, SFP or SFP+ transceiver is not seated or locked. Ensuring XFP, SFP or SFP+ transceivers are seated and locked in place with the retaining clip will keep the fiber link up if there is any vibration or movement that can dislodge a fiber cable. Rx Power differences may indicate poor fiber patch cables, poor connectors or poor splices. Tracking Tx Bias for installed XFP, SFP or SFP+ transceivers and measuring attenuation for fiber links allows you to perform periodic preventative maintenance, instead of reacting to a failure. Tracking Tx Power differences can be used as an indicator of failure in an XFP, SFP or SFP+ which may need replacing.

Continuous Reboot Prevention

Occasionally, due to network conditions or to recover from a software failure, the recovery mechanism of the switch is to reboot to resume normal operation. Provided the same error condition does not recur within a short period of time this is acceptable behavior. However, if the error condition repeatedly occurs within a short time period, the switch will go into a cycle of continuous reboots, causing network problems.

Although a switch continuously rebooting will come to the attention of a network administrator who can then resolve the issue, it is likely that in the meantime network problems have arisen. For example, a broadcast storm due to STP becoming unstable and trying to continually reconverge could cause the switch to reboot continuously.

In a VCStack situation, a continually rebooting switch will destabilize the stack and may cause the master and slave devices to continually swap roles as they both reboot. This has a devastating effect on the network since both devices are too busy rebooting and forming the stack to forward traffic.

The continuous reboot prevention feature, enabled with the continuous-reboot-prevention command on page 8.12, allows the user to configure a switch to stop rebooting if the device gets into a cycle of continuous rebooting. The user can configure the time period, the maximum number of times the switch can reboot within the specified time period, referred to as the threshold, and the action to take if the threshold is exceeded.

There are three actions you can specify:

- linkdown

  The reboot procedure continues and all switch ports and stack ports stay link down. This is the default action.

- logonly

  The reboot procedure continues normally.

- stopreboot

  The reboot procedure stops and the user is prompted to enter the key ”c” via the CLI. Normal reboot procedure then continues.

All reboot events are logged and the show tech-support command is executed automatically when continuous reboot prevention occurs.

Note that when the continuous reboot prevention feature is enabled on the switch, user initiated reboots via the CLI and software version auto-synchronization reboots (VCStack implementation) are not counted toward the threshold value.

The continuous reboot prevention feature is disabled by default. To enable the feature, enter the following commands:

```
awplus# configure terminal
awplus(config)# continuous-reboot-prevention enable
```

Unless the period, threshold and action parameter values are explicitly set, the defaults are used:

- period - 600 seconds
- threshold - 1 reboot event
- action - linkdown

To configure the period, threshold and the action to take if the number of reboots exceeds the specified threshold, enter the following commands:

```
awplus# configure terminal

awplus(config)# continuous-reboot-prevention [period <60-
                604800>] [threshold <1-10>]
                [action [linkdown|logonly|stopreboot]]
```

If the action stopreboot is specified, the reboot procedure stops and the following message is displayed:

```
Please input key 'c' if you want to continue processing.
```

When the user has input “c” via the CLI, the reboot procedure continues.

To disable the continuous reboot prevention feature, enter the following commands:

```
awplus# configure terminal

awplus(config)# no continuous-reboot-prevention enable
```

To return either one or more of the period, threshold and the action parameters to the default, use the commands:

```
awplus# configure terminal

awplus(config)# no continuous-reboot-prevention [period]
                [threshold] [action]
```

To display the current continuous reboot prevention configuration, enter the command:

```
awplus# show continuous-reboot-prevention
```

To display the reboot history of the switch, enter the command:

```
awplus# show reboot history
```

Controlling “show” Command Output

You can control the output of show commands by using the | and > or >> tokens in the following ways:

- To display only part of the output, follow the command with **|** and then other keywords (see Output Modifiers below)
- To save the output to a file, follow the command with **>** *filename*
- To append the output to an existing file, follow the command with **>>** *filename*

Using the ? after typing the show command displays the following information about these tokens:

```
awplus#  show users
```

```
| Output modifiers
> Output redirection
>> Output redirection (append)
```

Output Modifiers

Type the | (vertical bar) to use Output modifiers.

```
append    Append output
begin     Begin with the first line that contains matching output
exclude   Exclude lines that contain matching output
include   Include lines that contain matching output
redirect  Redirect output
```

Begin

The begin parameter causes the display to begin at the first line that contains the input string.

```
awplus#  show run | begin vlan1
```

```
...skipping
interface vlan1
 ip address 192.168.14.1
!!
line con 0
 login
line vty 0 4
 login
!
end
```

Exclude

The exclude parameter excludes all lines of output that contain the input string. In the following output all lines containing the word “input” are excluded:

```
awplus#  show interface vlan1 | exclude input
```

```
Interface vlan1
  Scope: both
  Hardware is Ethernet, address is 192.168.14.1
  index 3 metric 1 mtu 1500 <UP,BROADCAST,RUNNING,MULTICAST>
  VRF Binding: Not bound
  Label switching is disabled
  No Virtual Circuit configured
  Administrative Group(s): None
  DSTE Bandwidth Constraint Mode is MAM
    output packets 4438, bytes 394940, dropped 0
    output errors 0, aborted 0, carrier 0, fifo 0, heartbeat 0,
window 0
    collisions 0
```

Include

The include parameter includes only those lines of output that contain the input string. In the output below, all lines containing the word “input” are included:

```
awplus#  show interface vlan1 | include input
```

```
 input packets 80434552, bytes 2147483647, dropped 0, multicast
packets 0
 input errors 0, length 0, overrun 0, CRC 0, frame 0, fifo 1,
missed 0
```

Redirect

The redirect parameter puts the lines of output into the specified file. If the file already exists, the new output overwrites the file’s contents; the new output is not appended to the existing file contents.

| redirect and > are synonyms.

```
awplus#  show history | redirect history.txt
```

Output Redirection

The output redirection token > puts the lines of output into the specified file. If the file already exists, the new output overwrites the file’s contents; the new output is not appended to the existing file contents.

| redirect and > are synonyms.

```
awplus#  show history > history.txt
```

Append Output

The append output token >> adds the lines of output into the specified file. The file must already exist, for the new output to be added to the end of the file’s contents; the new output is appended to the existing file contents.

| append and >> are synonyms.

```
awplus#  show history >> history.txt
```

Commands Available in each Mode

This appendix lists the commands available in the following command modes:

- "User Exec Mode" on page 1.43
- "Privileged Exec Mode" on page 1.44
- "Global Configuration Mode" on page 1.45

User Exec Mode

```
awplus>   ?

Exec commands:
  clear           Reset functions
  debug           Debugging functions (see also 'undebug')
  disable         Turn off privileged mode command
  echo            Echo a string
  enable          Turn on privileged mode command
  exit            End current mode and down to previous mode
  help            Description of the interactive help system
  logout          Exit from the EXEC
  mstat           Show statistics after multiple multicast traceroutes
  mtrace          Trace multicast path from source to destination
  no              Negate a command or set its defaults
  ping            Send echo messages
  quit            Exit current mode and down to previous mode
  remote-command  Remote stack member command execution
  rmon            Debugging functions (see also 'undebug')
  show            Show running system information
  ssh             Open an SSH connection
  telnet          Open a telnet connection
  terminal        Set terminal line parameters
  traceroute      Trace route to destination
```

Privileged Exec Mode

```
awplus# ?

Exec commands:
  activate         Activate a script
  cd               Change the current working directory
  clear            Reset functions
  clock            Manage clock
  configure        Enter configuration mode
  copy             Copy from one file to another
  debug            Debugging functions (see also 'undebug')
  delete           Delete a file
  dir              List the files on a filesystem
  disable          Turn off privileged mode command
  dot1x            IEEE 802.1X Port-Based Access Control
  echo             Echo a string
  edit             Text Editor
  enable           Turn on privileged mode command
  erase            Erase the system startup configuration
  exit             End current mode and down to previous mode
  help             Description of the interactive help system
  license          Activate software feature license
  logout           Exit from the EXEC
  mail             Send an email
  mkdir            Make a new directory
  move             Rename or move a file
  mstat            Show statistics after multiple multicast
                   traceroutes
  mtrace           Trace multicast path from source to destination
  no               Negate a command or set its defaults
  ping             Send echo messages
  platform         Execute built-in self-tests
  pwd              Print the current working directory
  quit             Exit current mode and down to previous mode
  reboot           Halt and perform a cold restart
  reload           Halt and perform a cold restart
  remote-command   Remote stack member command execution
  restart          Restart routing protocol
  rmdir            Remove a directory
  rmon             Debugging functions (see also 'undebug')
  show             Show running system information
  ssh              Open an SSH connection
  tcpdump          Execute tcpdump
```

```
  telnet          Open a telnet connection
  terminal        Set terminal line parameters
  test            Test device functionality
  traceroute      Trace route to destination
  trigger         Automatic scripted responses to device events
  undebug         Disable debugging functions (see also 'debug')
  wait            Wait for a specified number of seconds
  write           Write running configuration to memory, file or
                  terminal
```

Global Configuration Mode

```
awplus(config)# ?

Configure commands:
  access-list          Add an access list entry
  arp                  Address Resolution Protocol (ARP)
  auth-web-server      Web authentication server configuration
                       commands
  banner               Define a login banner
  bgp                  Border Gateway Protocol (BGP)
  boot                 Boot configuration
  class-map            Class map command
  clock                Manage clock
  crypto               Security Specific Commands
  cvlan                Configure C-VLAN parameters
  debug                Debugging functions (see also 'undebug')
  default              Restore default settings
  do                   To run exec commands in config mode
  dot1x                IEEE 802.1X Port-Based Access Control
  enable               Modify enable password parameters
  epsr                 Ethernet Protection Switching Ring (EPSR)
  exception            Configure exception settings
  exit                 End current mode and down to previous mode
  fib                  FIB information
  help                 Description of the interactive help system
  hostname             Set system's network name
  interface            Select an interface to configure
  ip                   Internet Protocol (IP)
  ipv6                 Internet Protocol version 6 (IPv6)
  key                  Authentication key management
  lacp                 LACP commands
  line                 Configure a terminal line
```

```
log                   Logging control
loop-protection       Loop Protection
mac                   mac address
mail                  Send an email
max-fib-routes        Set maximum fib routes number
max-static-routes     Set maximum static routes number
maximum-access-list   Maximum access-list entries
maximum-paths         Set multipath numbers installed to FIB
mls                   Multi-Layer Switch(L2/L3)
no                    Negate a command or set its defaults
ntp                   Configure NTP
ospf                  Open Shortest Path First (OSPF)
ping-poll             Ping Polling
platform              Configure global settings for the switch asic
policy-map            Policy map command
radius-server         RADIUS server configuration commands
rip                   Routing Information Protocol (RIP)
rmon                  Remote Monitoring Protocol (RMON)
route-map             Create route-map or enter route-map command
                      mode
router                Enable a routing process
router-id             Router identifier for this system
security-password     Configure strong security passwords
service               Modify use of network based services
show                  Show running system information
snmp-server           Manage snmp server
spanning-tree         Spanning tree commands
ssh                   Secure Shell
stack                 Virtual Chassis Stacking (VCS)
system                System properties
telnet                Configure telnet
trigger               Select a trigger to configure
undebug               Disable debugging functions (see also'debug')
username              Establish User Name Authentication
virtual-server        Virtual-server configuration
vlan                  Configure VLAN parameters
vrrp                  VRRP configuration
```

AlliedWare Plus GUI

Information on loading and using the AlliedWare Plus™ GUI is outside the scope of the main body of this reference manual. This topic is covered in a separate appendix to this document. See “Appendix C: GUI Reference”.

Chapter 2: Command Syntax Conventions in this Software Reference

The following table describes how command line interface syntax is shown in this Software Reference.

Syntax element	Example	What to enter in the command line

Keywords are shown in lowercase fixed-width font or bold variable-width font	`show spanning-tree mst`
	or
	`show ip route`
		Some keywords are required, and others are optional parameters. Type keywords exactly as they appear in the command syntax.

Number ranges are enclosed in angle-brackets < > and separated by a hyphen.	`<0-255>`	Enter a number from the range. Do not enter the angle brackets.

Placeholders are shown in lowercase italics within angle-brackets < >, or in uppercase italics	`<port-list>`
	or
	`ip dhcp pool NAME`
		Replace the placeholder with the value you require. The placeholder may be an IP address, a text string, or some other value. See the parameter table for the command for information about the type of value to enter.
		Do not enter the angle-brackets.

Repeats are shown with ellipsis.	`param1...`	Enter the parameter one or more times.
Optional elements are shown in brackets: [ ]	`vlan <vid> [name <vlan-name>]`	If you need the optional parameter, enter it. Do not enter the brackets.
Required choices are enclosed in braces and separated by a vertical bar (pipe) : {|}.	`spanning-tree {mstp|rstp|stp} enable`	Enter one only of the options. Do not enter the braces or vertical bar.
Optional choices are enclosed in or brackets and separated by a vertical bar (pipe): [|]	`[param1|param2]`	If needed, enter one only of the options. Do not enter the brackets or vertical bar.
Inclusive options are enclosed in braces, and separated by brackets: {[ ] [ ]}.	`{[param1] [param2] [param3]}`	Enter one or more of the options and separate them with a space. Do not enter the braces or brackets.

Chapter 3: Start-up Sequence

AlliedWare Plus Start-up 3.2
Diagnostic Menu 3.3
Bootloader Menu 3.5
Start-up Sequence 3.9

AlliedWare Plus Start-up

Every switch has a start-up process. A specified version of product software must be loaded and executed. The bootloader is the executable code responsible for setting up the system and loading the release software.

The bootloader is the software that runs the unit when it first powers up, performing basic initialization and executing the product software release. As part of the start-up process of the switch, the bootloader allows you various options before running the product release software.

Previous versions of AlliedWare provide the option to boot to EPROM if a software release cannot be loaded, is unlicensed, or if selected by the user. The EPROM provides enough basic functionality to get a working software release loaded and operational on the switch. In AlliedWare Plus™ this task is handled by the bootloader.

As AlliedWare Plus™ begins its start-up process; there are two options that allow you to access either the diagnostic menu, or the bootloader menu. The following prompt is displayed when these options are temporarily available:

```
Bootloader 1.0.9 loaded
Press <Ctrl+B> for the Boot Menu
```

You can now enter one of the following two options to determine how the start-up process proceeds:

- Enter Ctrl+D to display the diagnostic menu.
- Enter Ctrl+B to display the bootloader menu.

Diagnostic Menu

Enter Ctrl+D during start-up to access the bootloader diagnostic menu, and provide options for performing various hardware tests. This can be useful as a tool for confirming a suspected hardware problem at the direction of network engineering personnel. When you enter Ctrl+D, the stage 1 diagnostics menu is displayed:

```
Bootup Stage 1 Diagnostics Menu:
  0. Restart
  1. Full RAM test
  2. Quick RAM test
  3. Battery backed RAM (NVS) test
  4. Bootloader ROM checksum test
  ---------------------------------
  7. Bootup stage 2 diagnostics menu
  ---------------------------------
  8. Quit to U-Boot shell
  9. Quit and continue booting
Enter selection ==>
```

The options in the stage 1 diagnostics menu allow you to initiate the following tests:

- RAM
  The Bootloader fully tests any/all SDRAM installed in the system.
- NVS
  The Bootloader fully tests any/all non-volatile (battery backed) SRAM installed in the system.
- checksum
  The Bootloader checksum ROM memory for error detection.

For example, enter “2” to select a Quick RAM test:

```
Quick RAM test - press Q to quit, S to skip when failing
Writing pattern  ..............................
Checking pattern ..............................
Writing complemented pattern ..................
Checking complemented pattern ..................
Pass 1  total errors 0
```

Enter “7” to display the stage 2 diagnostics menu:

```
Entering stage 2...
Bootup Stage 2 Diagnostics Menu:
  0. Restart
  2. Test FLASH (Filesystem only)
  4. Erase FLASH (Filesystem only)
  5. Card slot test
  ---------------------------------
  8. Quit to U-Boot shell
  9. Quit and continue booting
```

The options in the stage 2 diagnostics menu allow you to initiate the following tests:

- Flash
  The Bootloader tests the user file system area of Flash. The bootloader is stored in a protected area of Flash that is not accessed by the user file system.
- Flash Erase
  The Bootloader erases the user file system area of Flash only.
- SD (and SDHC) Card slot
  The Bootloader tests the Card slot.

Once any required tests are completed from the diagnostics menu, enter “9” to quit the diagnostic menu and continue the switch boot-up process.

Bootloader Menu

Enter Ctrl+B during start-up to access the bootloader menu where boot options can be set. The boot options shown are explained in detail under this example.

```
Boot Menu:

  ------------------------------------------------------
  B. Boot backup software
  ------------------------------------------------------
  0. Restart
  1. Perform one-off boot from alternate source
  2. Change the default boot source (for advanced users)
  3. Update Bootloader
  4. Adjust the console baud rate
  5. Special boot options
  6. System information
  7. Restore Bootloader factory settings
  ------------------------------------------------------
  9. Quit and continue booting
```

Boot options

A powerful feature of AlliedWare Plus™ is the ability to boot from a variety of sources. Previously the switch was constrained to just booting off the release loaded into Flash memory. The only software release upgrade path being to load a new release into Flash memory and then set this release to be loaded at the next restart.

With AlliedWare Plus™ the switch can boot from other sources, such as a SD card or network server. This provides a very flexible system, with multiple options to upgrade software releases and for system recovery.

Details of the bootloader menu options are as follows:

1. Perform one-off boot from alternate source

Enter "1" to provide the following one-off boot options:

```
Enter selection ==> 1

Select device:

  0. Return to previous menu
  ------------------------------------------------------
  1. Flash   (flash:)
  2. SD Card (card:)
  3. TFTP    (tftp://)
  4. YMODEM  (ymodem:)

Enter selection ==>
```

You can select a one-off boot from Flash, SD (or SDHC) card, network server (TFTP), or ymodem. The selected option will be used for the next restart (only) of the switch. If you select to boot from the network, the bootloader prompts the user for the required network address details.

Note These settings are specific to the Bootloader.
They are not related in any way to what may be configured by the main software release.

```
   Enter IP version [4|6]......... [4]:
   Enter IP address for eth0 ..... [0.0.0.0]: 172.28.8.210
   Enter subnet mask ............. [0.0.0.0]: 255.255.0.0
   Enter gateway IP .............. [0.0.0.0]: 172.28.0.1
   Enter TFTP server IP .......... [0.0.0.0]: 172.30.1.242
   Enter filename ................ []: x900-5.4.2.rel
Loading tftp://172.30.1.242/x900-5.4.2.rel...
```

When the switch is booted up using the 'one-off' selected source for the software release, it provides the option to copy the release just used to Flash for further/ permanent use:

```
login: manager
Password: ******
The system has been booted using the one off boot/recovery
mechanism.
Bootup has successfully completed.
Write this release to flash? (y/n):
```

2. Change the default boot source (for advanced users)

Entering "2" provides the option to set the boot source permanently.

```
NOTE: These settings are specific to the Bootloader.
  They are not related in any way to what may be configured
  by the 'boot system' command in the main software release.
Select device:

  0. Return to previous menu
  ----------------------------------------------------------
  1. Flash   (flash:)
  2. SD Card (card:)
  3. TFTP    (tftp://)
  4. YMODEM  (ymodem:)
  ----------------------------------------------------------
  9. Boot from default (determined by main CLI)

Enter selection ==>
```

The same four boot source options are provided as with the one-off selection, but this time every restart of the switch will result in the unit booting from the selected source.

3. Update Bootloader

This option allows for the bootloader code to be updated. It is not detailed here, as it is envisioned that this would rarely need to be done, and only at the request of (and with support from) Allied Telesis engineering.

4. Adjust the console baud rate

The baud rate of the console session is set here to match the terminal program being used for management of the switch when connected directly to the asynchronous port. The switches default value is 9600. The baud rate selected can be set as the 'new' default for future use if preferred.

```
Select baud rate:

  0. Return to previous menu
  ------------------------------------------------------
  1. 9600
  2. 19200
  3. 38400
  4. 57600
  5. 115200
  6. 230400 (Setting can't be made permanent)
  7. 460800 (Setting can't be made permanent)

Enter selection ==>  1

Change your terminal program baud rate to 9600 and press
enter...  if for some reason you are unable to do this,
power cycle the device and the existing baud rate will be
restored.
Use this baud rate by default? (Y/N) ==> n
```

5. Special boot options

The special boot options allow for system recovery in the event of a forgotten password or to the default configuration.

```
Special boot options menu:

  0. Return to previous menu
  ------------------------------------------------------
  1. Skip startup script (Use system defaults)

Enter selection ==>
```

6. System information

The system information option provides some details on the hardware platform in use, such as CPU, memory, hardware (MAC) address and so on.

```
System information:

  System (Detected values)
  -----------------------------------------------------
  CPU:
    Type ..............: MPC8541E
    Speed .............: 666 MHz
  Memory:
    Total installed ....: 512 MB
    Speed .............: 133 MHz
  Flash:
    Total installed ....: 32 MB
  -----------------------------------------------------

  Product information
  -----------------------------------------------------
  Compatible software ..: 1 (r1)
  Serial ..............: 45AX5300X
  Manufacture date .....: 03/2005
  Product ..............: 280
  Product name .........: x900-24XT-N
  Revision .............: A
  First MAC address ....: 00:00:CD:23:55:C8
  -----------------------------------------------------

  Boot software information
  -----------------------------------------------------
  Version ..............: 1.0.9
  Build time ...........: Aug  3 2007 - 09:07:12
  Built by .............: matthewm
  Build host ...........: matthewm-dl
  Build key ............: at9924ts
  Compatible products:
    255 ................: AT-9924Ts
    256 ................: AT-9924SPs
    270 ................: x900-24XT
    271 ................: x900-24XS
    280 ................: x900-24XT-N
    287 ................: x900-12XT/S
  -----------------------------------------------------

Press any key to continue...
```

7. Restore Bootloader factory settings

This option allows the bootloader to be set back to factory defaults.

Caution

This option erases any settings that may have been configured by this menu

Are you sure? (Y/N) ==>

The bootloader menu provides a powerful set of options for flexibility in the way software releases are upgraded on the switch, and system recovery is performed.

Start-up Sequence

The start-up sequence for a device running AlliedWare Plus™ under normal circumstances will be as seen below - this sequence will be seen when everything loads and runs as expected.

Note

To enter the bootloader or diagnostic menus discussed previously, Ctrl+B or Ctrl+D must be entered when prompted before the software modules start loading.

```
Reading flash:x900-5.4.2.rel...

Verifying release... OK
Booting...
Starting base/first...                                    [  OK  ]

           _______________   ____
        /\ \             / /______\
      /   \ \_      __/ /| ______ |
    /      \ |     |  /  | ______ |
  /         \ \   / /     \ ____ /
/______/\____\ \/ /____________/

Allied Telesis Inc.
AlliedWare Plus (TM) v5.4.2
Original release filename: x900-5.4.2.rel
Built: Fri Nov 14 13:03:59 NZDT 2011 by: maker@awpmaker06-dl

Mounting virtual filesystems...                           [  OK  ]
Mounting static filesystems...                            [  OK  ]
Mounting flash...                                         [  OK  ]
Checking NVS filesystem...                                [  OK  ]
Mounting NVS filesystem...                                [  OK  ]
Starting base/dbus...                                     [  OK  ]
Starting base/klogd...                                    [  OK  ]
Starting base/loopback...                                 [  OK  ]
Starting base/sysctl...                                   [  OK  ]
Starting base/syslog...                                   [  OK  ]
Starting base/appmond...                                  [  OK  ]
Starting base/portmapper...                               [  OK  ]
Starting base/cron...                                     [  OK  ]
Starting hardware/openhpi...                              [  OK  ]
Starting hardware/timeout...                              [  OK  ]
Starting base/autofs...                                   [  OK  ]
Starting base/inet...                                     [  OK  ]
Starting base/modules...                                  [  OK  ]
Received event baseboard.found
Received event hardware.done
Starting network/startup...                               [  OK  ]
Starting hardware/openhpilog...                           [  OK  ]
Starting network/trigger...                               [  OK  ]
23:19:53 awplus HPI: HOTSWAP PSU 2 hotswapped in: AT-PWR01-AC
23:19:53 awplus HPI: HOTSWAP FOM 1 hotswapped in: AT-FAN01
Received event network.enabled

Initializing HA processes:
auth, bgpd, cntrd, epsr, exfx, hostd, hsl
imi, irdpd, lacp, loopprot, mstp, nsm, openhpid
ospfd, pdmd, pimd, ripd, ripngd, rmon, vrrpd

Received event network.initialized
Received event standalone

Assigning Active Workload to HA processes:
hsl, lacpd, loopprotd, mstpd, nsm, pdmd, ripngd
rmond, vrrpd, authd, bgpd, epsrd, irdpd, ospfd
pimd, ripd, imi

Received event network.activated

Loading configuration file flash:/ipgw.cfg, please wait.
..
Received event network.configured


awplus login: manager
Password:

AlliedWare Plus (TM) 5.4.1 11/14/10 13:00:27


Bootloader 1.0.9 loaded
Press <Ctrl+B> for the Boot Menu
```

There are three possible status results displayed for each module loaded - OK, INFO, ERROR:

- OK means that the module has loaded correctly.
- INFO means that an error occurred, but the device is usable.
- ERROR means that an error occurred and device operation may be affected.

Additional specific information accompanies an INFO or ERROR status result. For example, if a corrupt release file was set as the startup release, the following error message would be seen:

```
Bootloader 1.0.9 loaded
Press <Ctrl+B> for the Boot Menu
Reading filesystem...
Error: Release filename is invalid (should be <release>.rel)
Error: There is no backup release file set
Error: Boot failed. Please recover the system using the Boot Menu
Restarting...Bootloader 1.0.9 loaded
Press <Ctrl+B> for the Boot Menu
```

Whether an error message results in a case of the device being unusable will depend on the specific error and message, so will need to be dealt with on a case by case basis. If a software release has been corrupted, as shown on start-up, a new release may need to be loaded.

Chapter 4: CLI Navigation Commands

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Command List

This chapter provides an alphabetical reference for the commands used to navigate between different modes. This chapter also provides a reference for the help and show commands used to help navigate within the CLI.

configure terminal

This command enters the Global Configuration command mode.

Syntax `configure terminal`

Mode Privileged Exec

Example To enter the Global Configuration command mode (note the change in the command prompt), enter the command:

```
awplus# configure terminal
awplus(config)#
```

disable (Privileged Exec mode)

This command exits the Privileged Exec mode, returning the prompt to the User Exec mode. To end a session, use the exit command.

Syntax `disable`

Mode Privileged Exec

Example To exit the Privileged Exec mode, enter the command:

```
awplus# disable
awplus>
```

Related Commands enable (Privileged Exec mode)
end
exit

do

This command lets you to run User Exec and Privileged Exec mode commands when you are in a Configuration mode.

Syntax `do <command>`

Parameter	Description
<command>	Specify the command and its parameters.

Mode Any configuration mode

Example

```
awplus# configure terminal
awplus(config)# do ping 192.0.2.23
```

enable (Privileged Exec mode)

This command enters the Privileged Exec mode and optionally changes the privilege level for a session. If a privilege level is not specified then the maximum privilege level (15) is applied to the session. If the optional privilege level is omitted then only users with the maximum privilege level can access Privileged Exec mode without providing the password as specified by the enable password or enable secret commands. If no password is specified then only users with the maximum privilege level set with the username command can assess Privileged Exec mode.

Syntax `enable [<privilege-level>]`

Parameter	Description
<privilege-level>	Specify the privilege level for a CLI session in the range <1-15>, where 15 is the maximum privilege level, 7 is the intermediate privilege level and 1 is the minimum privilege level. The privilege level for a user must match or exceed the privilege level set for the CLI session for the user to access Privileged Exec mode. Privilege level for a user is configured by username.

Mode User Exec

Usage Many commands are available from the Privileged Exec mode that configure operating parameters for the switch, so you should apply password protection to the Privileged Exec mode to prevent unauthorized use. Passwords can be encrypted but then cannot be recovered. Note that un-encrypted passwords are shown in plain text in configurations.

The username command sets the privilege level for the user. After login, users are given access to privilege level 1. Users access higher privilege levels with the enable (Privileged Exec mode) command. If the privilege level specified is higher than the users configured privilege level specified by the username command, then the user is prompted for the password for that level.

Note that a separate password can be configured for each privilege level using the enable password and the enable secret commands from the Global Configuration mode. The service password-encryption command encrypts passwords configured by the enable password and the enable secret commands, so passwords are not shown in plain text in configurations.

Example The following example shows the use of the enable command to enter the Privileged Exec mode (note the change in the command prompt).

```
awplus> enable
awplus#
```

The following example shows the enable command enabling access the Privileged Exec mode for users with a privilege level of 7 or greater. Users with a privilege level of 7 or greater do not need to enter a password to access Privileged Exec mode. Users with a privilege level 6 or less need to enter a password to access Privilege Exec mode. Use the enable password command or the enable secret commands to set the password to enable access to Privileged Exec mode.

```
awplus> enable 7

awplus#
```

Related Commands

disable (Privileged Exec mode)
enable password
enable secret
exit
service password-encryption
username

end

This command returns the prompt to the Privileged Exec command mode from any other advanced command mode.

Syntax `end`

Mode All command modes

Example The following example shows the use of the `end` command to return to the Privileged Exec mode directly from Interface mode.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# end
awplus#
```

Related Commands disable (Privileged Exec mode)
enable (Privileged Exec mode)
exit

exit

This command exits the current mode, and returns the prompt to the mode at the previous level. When used in User Exec mode, the exit command terminates the session.

Syntax `exit`

Mode All command modes.

Example The following example shows the use of `exit` command to exit Interface mode, and return to Configure mode.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# exit
awplus(config)#
```

Related Commands disable (Privileged Exec mode)
enable (Privileged Exec mode)
end

help

This command displays a description of the AlliedWare Plus™ OS help system.

Syntax `help`

Mode All command modes

Example To display a description on how to use the system help, use the command:

```
awplus# help
```

Output Figure 4-1: Example output from the **help** command

```
When you need help at the command line, press '?'.

If nothing matches, the help list will be empty. Delete
characters until entering a '?' shows the available options.

Enter '?' after a complete parameter to show remaining valid
command parameters (e.g. 'show ?').

Enter '?' after part of a parameter to show parameters that
complete the typed letters (e.g. 'show ip?').
```

logout

This command exits the User Exec or Privileged Exec modes and ends the session.

Syntax `logout`

Mode User Exec and Privileged Exec

Example To exit the User Exec mode, use the command:

```
awplus# logout
```

show history

This command lists the commands entered in the current session. The history buffer is cleared automatically upon reboot.

The output lists all command line entries, including commands that returned an error.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show history`

Mode User Exec and Privileged Exec

Example To display the commands entered during the current session, use the command:

```
awplus# show history
```

Output Figure 4-2: Example output from the **show history** command

```
1 en
2 show ru
3 con t
4 route-map er deny 3
5 exit
6 ex
7 di
```

Chapter 5: User Access Commands

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show privilege 5.30
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telnet 5.33
telnet server 5.34
terminal length 5.35
terminal resize 5.36
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Introduction

This chapter provides an alphabetical reference of commands used to configure user access.

Command List

clear line console

This command resets a console line. If a terminal session exists on the line then the terminal session is terminated. If console line settings have changed then the new settings are applied.

Syntax `clear line console 0`

Mode Privileged Exec

Example To reset the console line (asyn), use the command:

```
awplus# clear line console 0

        % The new settings for console line 0 have been
        applied
```

Related Commands
clear line vty
flowcontrol hardware (asyn/console)
line
show users

clear line vty

This command resets a VTY line. If a session exists on the line then it is closed.

Syntax `clear line vty <0-32>`

Parameter	Description
<0-32>	Line number

Mode Privileged Exec

Example To reset the first vty line, use the command:

```
awplus# clear line vty 1
```

Related Commands
privilege level
line
show telnet
show users

enable password

To set a local password to control access to various privilege levels, use the enable password Global Configuration command. Use the enable password command to modify or create a password to be used, and use the no enable password command to remove the password.

Note that the enable secret command is an alias for the enable password command, and the no enable secret command is an alias for the no enable password command. Issuing a no enable password command removes a password configured with the enable secret command. The enable password command is shown in the running and startup configurations. Note that if the enable secret command is entered then enable password is shown in the configuration.

Note

Do not use encrypted passwords for GUI users. The GUI requires unencrypted user passwords only - not encrypted user passwords. Do not use option `8` for GUI users.

Syntax

```
enable password [<plain>|8 <hidden>|level <1-15> 8 <hidden>]
no enable password [level <1-15>]
```

Parameter	Description
<plain>	Specifies the unencrypted password.
`8`	Specifies a hidden password will follow.
<hidden>	Specifies the hidden encrypted password. Use an encrypted password for better security where a password crosses the network or is stored on a TFTP server.
`level`	Privilege level <1-15>. Level for which the password applies. You can specify up to 16 privilege levels, using numbers 1 through 15. Level 1 is normal EXEC-mode user privileges for User Exec mode. If this argument is not specified in the command or the no variant of the command, the privilege level defaults to 15 (enable mode privileges) for Privileged Exec mode. A privilege level of 7 can be set for intermediate CLI security.

Default The privilege level for enable password is level 15 by default. Previously the default was level 1.

Mode Global Configuration

Usage This command enables the Network Administrator to set a password for entering the Privileged Exec mode when using the enable (Privileged Exec mode) command. There are three methods to enable a password. In the examples below, for each method, note that the configuration is different and the configuration file output is different, but the password string to be used to enter the Privileged Exec mode with the enable command is the same (mypasswd).

From release 5.4.1, a user can have an intermediate CLI security level set with this command for privilege level 7 to access all the show commands in Privileged Exec mode and all the commands in User Exec mode, but not any configuration commands in Privileged Exec mode.

Note that the enable password command is an alias for the enable secret command and one password per privilege level is allowed using these commands. Do not assign one password to a privilege level with enable password and another password to a privilege level with enable secret. Use enable password or enable secret commands. Do not use both on the same level.

Using Plain Passwords

The plain password is a clear text string that appears in the configuration file as configured.

```
awplus#  configure terminal
awplus(config)#  enable password mypasswd
awplus(config)#  end
```

This results in the following show output

```
awplus#show run
Current configuration:
hostname awplus
enable password mypasswd
!
interface lo
```

Using Encrypted Passwords

Configure an encrypted password using the service password-encryption command. First, use the enable password command to specify the string that you want to use as a password (mypasswd). Then, use the service password-encryption command to encrypt the specified string (mypasswd). The advantage of using an encrypted password is that the configuration file does not show mypasswd, it will only show the encrypted string fU7zHzuutY2SA.

Note Do not use encrypted passwords for GUI users. The GUI requires unencrypted user passwords only - not encrypted user passwords. Do not use option 8 for GUI users.

```
awplus#  configure terminal
awplus(config)#  enable password mypasswd
awplus(config)#  service password-encryption
awplus(config)#  end
```

This results in the following show output.

```
awplus#show run
Current configuration:
hostname awplus
enable password 8 fU7zHzuutY2SA
service password-encryption
!
interface lo
```

Using Hidden Passwords

Configure an encrypted password using the HIDDEN parameter (8) with the enable password command. Use this method if you already know the encrypted string corresponding to the plain text string that you want to use as a password. It is not required to use the service password-encryption command for this method. The output in the configuration file will show only the encrypted string, and not the text string

```
awplus#  configure terminal
awplus(config)#  enable password 8 fU7zHzuutY2SA
awplus(config)#  end
```

This results in the following show output.

```
awplus#show run
Current configuration:
hostname awplus
enable password 8 fU7zHzuutY2SA
!
interface lo
```

Related Commands

enable (Privileged Exec mode)
enable secret
service password-encryption
privilege level
show privilege
username
show running-config

enable secret

To set a local password to control access to various privilege levels, use the enable secret Global Configuration command. Use the enable secret command to modify or create a password to be used, and use the no enable secret command to remove the password.

Note that the enable secret command is an alias for the enable password command, and the no enable secret command is an alias for the no enable password command. Issuing a no enable password command removes a password configured with the enable secret command. The enable password command is shown in the running and startup configurations. Note that if the enable secret command is entered then enable password is shown in the configuration.

Note

Do not use encrypted passwords for GUI users. The GUI requires unencrypted user passwords only - not encrypted user passwords. Do not use option `8` for GUI users.

Syntax

```
enable secret [<plain>|8 <hidden>|level <0-15> 8 <hidden>]
no enable secret [level <1-15>]
```

Parameter	Description
<plain>	Specifies the unencrypted password.
`8`	Specifies a hidden password will follow.
<hidden>	Specifies the hidden encrypted password. Use an encrypted password for better security where a password crosses the network or is stored on a TFTP server.
`level`	Privilege level <1-15>. Level for which the password applies. You can specify up to 16 privilege levels, using numbers 1 through 15. Level 1 is normal EXEC-mode user privileges for User Exec mode. If this argument is not specified in the command or the no variant of the command, the privilege level defaults to 15 (enable mode privileges) for Privileged Exec mode. A privilege level of 7 can be set for intermediate CLI security.

Default The privilege level for enable secret is level 15 by default.

Mode Global Configuration

Usage This command enables the Network Administrator to set a password for entering the Privileged Exec mode when using the enable (Privileged Exec mode) command. There are three methods to enable a password. In the examples below, for each method, note that the configuration is different and the configuration file output is different, but the password string to be used to enter the Privileged Exec mode with the enable command is the same (mypasswd).

From release 5.4.1, a user can have an intermediate CLI security level set with this command for privilege level 7 to access all the show commands in Privileged Exec mode and all the commands in User Exec mode, but not any configuration commands in Privileged Exec mode.

Note that the enable secret command is an alias for the enable password command and one password per privilege level is allowed using these commands. Do not assign one password to a privilege level with enable password and another password to a privilege level with enable secret. Use enable password or enable secret commands. Do not use both on the same level.

Using Plain Passwords

The plain password is a clear text string that appears in the configuration file as configured.

```
awplus#  configure terminal
awplus(config)#  enable secret mypasswd
awplus(config)#  end
```

This results in the following show output

```
awplus#show run
Current configuration:
hostname awplus
enable password mypasswd
!
interface lo
```

Using Encrypted Passwords

Configure an encrypted password using the service password-encryption command. First, use the enable password command to specify the string that you want to use as a password (mypasswd). Then, use the service password-encryption command to encrypt the specified string (mypasswd). The advantage of using an encrypted password is that the configuration file does not show mypasswd, it will only show the encrypted string fU7zHzuutY2SA.

Note Do not use encrypted passwords for GUI users. The GUI requires unencrypted user passwords only - not encrypted user passwords. Do not use option 8 for GUI users.

```
awplus#  configure terminal
awplus(config)#  enable secret mypasswd
awplus(config)#  service password-encryption
awplus(config)#  end
```

This results in the following show output:

```
awplus#show run
Current configuration:
hostname awplus
enable password 8 fU7zHzuutY2SA
service password-encryption
!
interface lo
```

Using Hidden Passwords

Configure an encrypted password using the HIDDEN parameter (8) with the enable password command. Use this method if you already know the encrypted string corresponding to the plain text string that you want to use as a password. It is not required to use the service password-encryption command for this method. The output in the configuration file will show only the encrypted string, and not the text string:

```
awplus#  configure terminal
awplus(config)#  enable secret 8 fU7zHzuutY2SA
awplus(config)#  end
```

This results in the following show output.

```
awplus#show run
Current configuration:
hostname awplus
enable password 8 fU7zHzuutY2SA
!
interface lo
```

Related Commands

enable (Privileged Exec mode)
enable secret
service password-encryption
privilege level
show privilege
username
show running-config

exec-timeout

This command sets the interval your device waits for user input from either a console or VTY connection. Once the timeout interval is reached, the connection is dropped. This command sets the time limit when the console or VTY connection automatically logs off after no activity.

The no variant of this command removes a specified timeout and resets to the default timeout (10 minutes).

Syntax

```
exec-timeout {<minutes>} [<seconds>]
no exec-timeout
```

Parameter	Description
<minutes>	<0-35791> Required integer timeout value in minutes
<seconds>	<0-2147483> Optional integer timeout value in seconds

Default The default for the exec-timeout command is 10 minutes and 0 seconds (exec-timeout 10 0)

Mode Line Configuration

Usage This command is used set the time the telnet session waits for an idle VTY session, before it times out. An exec-timeout 0 0 setting will cause the telnet session to wait indefinitely. The command exec-timeout 0 0 is useful while configuring a device, but reduces device security.

If no input is detected during the interval then the current connection resumes. If no connections exist then the terminal returns to an idle state and disconnects incoming sessions.

Examples To set VTY connections to timeout after 2 minutes, 30 seconds if there is no response from the user, use the following commands:

```
awplus# configure terminal
awplus(config)# line vty 0 32
awplus(config-line)# exec-timeout 2 30
```

To reset the console connection to the default timeout of 10 minutes 0 seconds if there is no response from the user, use the following commands:

```
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# no exec-timeout
```

Validation Commands show running-config

Related Commands line
service telnet

flowcontrol hardware (asyn/console)

Use this command to enable RTS/CTS (Ready To Send/Clear To Send) hardware flow control on a terminal console line (asyn port) between the DTE (Data Terminal Equipment) and the DCE (Data Communications Equipment).

Syntax

```
flowcontrol hardware
no flowcontrol hardware
```

Mode Line Configuration

Default Hardware flow control is disabled by default.

Usage Hardware flow control makes use of the RTS and CTS control signals between the DTE and DCE where the rate of transmitted data is faster than the rate of received data. Flow control is a technique for ensuring that a transmitting entity does not overwhelm a receiving entity with data. When the buffers on the receiving device are full, a message is sent to the sending device to suspend the transmission until the data in the buffers has been processed.

Hardware flow control can be configured on terminal console lines (e.g. asyn0). For Reverse Telnet connections, hardware flow control must be configured to match on both the Access Server and the Remote Device. For terminal console sessions, hardware flow control must be configured to match on both the DTE and the DCE. Settings are saved in the running configuration. Changes are applied after reboot, clear line console, or after closing the session.

Use show running-config and show startup-config commands to view hardware flow control settings that take effect after reboot for a terminal console line.

Note that line configuration commands do not take effect immediately. Line configuration commands take effect after one of the following commands or events:

- issuing a clear line console command
- issuing a reboot command
- logging out of the current session

Examples To enable hardware flow control on terminal console line asyn0, use the commands:

```
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# flowcontrol hardware
```

To disable hardware flow control on terminal console line asyn0, use the commands:

```
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# no flowcontrol hardware
```

Related Commands
clear line console
show running-config
speed (asyn)

length (asyn)

Use this command to specify the number of rows of output that the device will display before pausing, for the console or VTY line that you are configuring.

The no variant of this command restores the length of a line (terminal session) attached to a console port or to a VTY to its default length of 22 rows.

Syntax

```
length <0-512>
no length
```

Parameter	Description
<0-512>	Number of lines on screen. Specify 0 for no pausing.

Mode Line Configuration

Default The length of a terminal session is 22 rows. The no length command restores the default.

Usage If the output from a command is longer than the length of the line the output will be paused and the '–More–' prompt allows you to move to the next screen full of data.

A length of 0 will turn off pausing and data will be displayed to the console as long as there is data to display.

Examples To set the terminal session length on the console to 10 rows, use the command:

```
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# length 10
```

To reset the terminal session length on the console to the default (22 rows), use the command:

```
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# no length
```

To display output to the console continuously, use the command:

```
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# length 0
```

Related Commands
service terminal-length
terminal length
terminal resize

line

Use this command to enter line configuration mode for the specified VTYs or the console. The command prompt changes to show that the switch is in Line Configuration mode.

Syntax

```
line vty <first-line> [<last-line>]
line console 0
```

Parameter	Description
<first-line>	<0-32> Specify the first line number.
<last-line>	<0-32> Specify the last line number.
console	The console terminal line(s) for local access.
vty	Virtual terminal for remote console access.

Mode Global Configuration

Usage In Line Configuration mode, you can configure console and virtual terminal settings, including setting speed (asyn), length (asyn), privilege level, and authentication (login authentication) or accounting (accounting login) method lists.

To change the console (asyn) port speed, use this line command to enter Line Configuration mode before using the speed (asyn) command on page 8.74. Set the console speed (Baud rate) to match the transmission rate of the device connected to the console (asyn) port on your switch.

Note that line configuration commands do not take effect immediately. Line configuration commands take effect after one of the following commands or events:

- issuing a clear line console command
- issuing a reboot command
- logging out of the current session

Examples To enter Line Configuration mode in order to configure all VTYs, use the commands:

```
awplus# configure terminal
awplus(config)# line vty 0 32
awplus(config-line)#
```

To enter Line Configuration mode to configure the console (asyn 0) port terminal line, use the commands:

```
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)#
```

Related Commands

accounting login
clear line console
clear line vty
flowcontrol hardware (asyn/console)
length (asyn)
login authentication
privilege level
speed (asyn)

privilege level

This command sets a privilege level for VTY or console connections. The configured privilege level from this command overrides a specific user's initial privilege level at the console login.

Syntax `privilege level <1-15>`

Mode Line Configuration

Usage You can set an intermediate CLI security level for a console user with this command by applying privilege level 7 to access all show commands in Privileged Exec and all User Exec commands. However, intermediate CLI security will not show configuration commands in Privileged Exec.

Examples To set the console connection to have the maximum privilege level, use the following commands:

```
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# privilege level 15
```

To set all vty connections to have the minimum privilege level, use the following commands:

```
awplus# configure terminal
awplus(config)# line vty 0 5
awplus(config-line)# privilege level 1
```

To set all vty connections to have an intermediate CLI security level, to access all show commands, use the following commands:

```
awplus# configure terminal
awplus(config)# line vty 0 5
awplus(config-line)# privilege level 7
```

Related Commands
enable password
line
show privilege
username

security-password history

This command specifies the number of previous passwords that are unable to be reused. A new password is invalid if it matches a password retained in the password history.

The no security-password history command disables the security password history functionality.

Syntax

```
security-password history <0-15>

no security-password history
```

Parameter	Description
<0-15>	The allowable range of previous passwords to match against. A value of *0* will disable the history functionality and is equivalent to the no security-password history command. If the history functionality is disabled, all users' password history is reset and all password history is lost.

Default The default history value is `0`, which will disable the history functionality.

Mode Global Configuration

Examples To restrict reuse of the three most recent passwords, use the command:

```
awplus# configure terminal
awplus(config)# security-password history 3
```

To allow the reuse of recent passwords, use the command:

```
awplus# configure terminal
awplus(config)# no security-password history
```

Validation Commands
show running-config security-password
show security-password configuration

Related Commands
security-password forced-change
security-password lifetime
security-password minimum-categories
security-password minimum-length
security-password reject-expired-pwd
security-password warning

security-password forced-change

This command specifies whether or not a user is forced to change an expired password at the next login. If this feature is enabled, users whose passwords have expired are forced to change to a password that must comply with the current password security rules at the next login.

Note that to use this command, the lifetime feature must be enabled with the security-password lifetime command and the reject-expired-pwd feature must be disabled with the security-password reject-expired-pwd command.

The no security-password forced-change command disables the forced-change feature.

Syntax

```
security-password forced-change
no security-password forced-change
```

Default The forced-change feature is disabled by default.

Mode Global Configuration

Example To force a user to change their expired password at the next login, use the command:

```
awplus# configure terminal
awplus(config)# security-password forced-change
```

Validation Commands
show running-config security-password
show security-password configuration

Related Commands
security-password history
security-password lifetime
security-password minimum-categories
security-password minimum-length
security-password reject-expired-pwd
security-password warning

security-password lifetime

This command enables password expiry by specifying a password lifetime in days.

Note that when the password lifetime feature is disabled, it also disables the security-password forced-change command and the security-password warning command.

The no security-password lifetime command disables the password lifetime feature.

Syntax

```
security-password lifetime <0-1000>
no security-password lifetime
```

Parameter	Description
<0-1000>	Password lifetime specified in days. A value of *0* will disable lifetime functionality and the password will never expire. This is equivalent to the no security-password lifetime command.

Default The default password lifetime is `0`, which will disable the lifetime functionality.

Mode Global Configuration

Example To configure the password lifetime to 10 days, use the command:

```
awplus# configure terminal
awplus(config)# security-password lifetime 10
```

Validation Commands
show running-config security-password
show security-password configuration

Related Commands
security-password history
security-password forced-change
security-password minimum-categories
security-password minimum-length
security-password reject-expired-pwd
security-password warning
show security-password user

security-password minimum-categories

This command specifies the minimum number of categories that the password must contain in order to be considered valid. The password categories are:

- uppercase letters: A to Z
- lowercase letters: a to z
- digits: 0 to 9
- special symbols: all printable ASCII characters not included in the previous three categories. The question mark ? cannot be used as it is reserved for help functionality.

Note that to ensure password security, the minimum number of categories should align with the lifetime selected, i.e. the fewer categories specified the shorter the lifetime specified.

Syntax

```
security-password minimum-categories <1-4>
```

Parameter	Description
<1-4>	Number of categories the password must satisfy, in the range *1* to *4*.

Default The default number of categories that the password must satisfy is `1`.

Mode Global Configuration

Example To configure the required minimum number of character categories to be *3*, use the command:

```
awplus# configure terminal
awplus(config)# security-password minimum-categories 3
```

Validation Commands

show running-config security-password
show security-password configuration

Related Commands

security-password history
security-password forced-change
security-password lifetime
security-password minimum-length
security-password reject-expired-pwd
security-password warning
username

security-password minimum-length

This command specifies the minimum allowable password length. This value is checked against when there is a password change or a user account is created.

Syntax

```
security-password minimum-length <1-23>
```

Parameter	Description
<1-23>	Minimum password length in the range from 1 to 23.

Default The default minimum password length is `1`.

Mode Global Configuration

Example To configure the required minimum password length as `8`, use the command:

```
awplus# configure terminal
awplus(config)# security-password minimum-length 8
```

Validation Commands
show running-config security-password
show security-password configuration

Related Commands
security-password history
security-password forced-change
security-password lifetime
security-password minimum-categories
security-password reject-expired-pwd
security-password warning
username

security-password reject-expired-pwd

This command specifies whether or not a user is allowed to login with an expired password. Users with expired passwords are rejected at login if this functionality is enabled. Users then have to contact the Network Administrator to change their password.

Caution

Once all users' passwords are expired you are unable to login to the device again if the security-password reject-expired-pwd command has been executed. You will have to reboot the device with a default configuration file, or load an earlier software version that does not have the security password feature.

We recommend you never have the command line "security-password reject-expired-pwd" in a default config file.

Note that when the reject-expired-pwd functionality is disabled and a user logs on with an expired password, if the forced-change feature is enabled with security-password forced-change command, a user may have to change the password during login depending on the password lifetime specified by the security-password lifetime command.

The no security-password reject-expired-pwd command disables the reject-expired-pwd feature.

Syntax

```
security-password reject-expired-pwd
no security-password reject-expired-pwd
```

Default The reject-expired-pwd feature is disabled by default.

Mode Global Configuration

Example To configure the system to reject users with an expired password, use the command:

```
awplus# configure terminal
awplus(config)# security-password reject-expired-pwd
```

Validation Commands
show running-config security-password
show security-password configuration

Related Commands
security-password history
security-password forced-change
security-password lifetime
security-password minimum-categories
security-password minimum-length
security-password warning
show security-password user

security-password warning

This command specifies the number of days before the password expires that the user will receive a warning message specifying the remaining lifetime of the password.

Note that the warning period cannot be set unless the lifetime feature is enabled with the security-password lifetime command.

The no security-password warning command disables this feature.

Syntax

```
security-password warning <0-1000>
no security-password warning
```

Parameter	Description
<0-1000>	Warning period in the range from *0* to *1000* days. A value *0* disables the warning functionality and no warning message is displayed for expiring passwords. This is equivalent to the no security-password warning command. The warning period must be less than, or equal to, the password lifetime set with the security-password lifetime command.

Default The default warning period is 0, which disables warning functionality.

Mode Global Configuration

Example To configure a warning period of three days, use the command:

```
awplus# configure terminal
awplus(config)# security-password warning 3
```

Validation Commands
show running-config security-password
show security-password configuration

Related Commands
security-password history
security-password forced-change
security-password lifetime
security-password minimum-categories
security-password minimum-length
security-password reject-expired-pwd

service advanced-vty

This command enables the advanced-vty help feature. This allows you to use TAB completion for commands. Where multiple options are possible, the help feature displays the possible options.

The no service advanced-vty command disables the advanced-vty help feature.

Syntax

```
service advanced-vty
no service advanced-vty
```

Default The advanced-vty help feature is enabled by default.

Mode Global Configuration

Examples To disable the advanced-vty help feature, use the command:

```
awplus# configure terminal
awplus(config)# no service advanced-vty
```

To re-enable the advanced-vty help feature after it has been disabled, use the following commands:

```
awplus# configure terminal
awplus(config)# service advanced-vty
```

service http

This command enables the HTTP (Hypertext Transfer Protocol) service. The HTTP service is enabled by default and is required to support the AlliedWare Plus™ GUI Java applet on a Java enabled browser. See Appendix C: GUI Reference for further information about installing and using the AlliedWare Plus™ GUI.

The no service http command disables the HTTP feature.

Syntax

```
service http
no service http
```

Default The HTTP service is enabled by default.

Mode Global Configuration

Examples To disable the HTTP service, use the command:

```
awplus# configure terminal
awplus(config)# no service http
```

To re-enable the HTTP service after it has been disabled, use the following commands:

```
awplus# configure terminal
awplus(config)# service http
```

service password-encryption

Use this command to enable password encryption. This is enabled by default. When password encryption is enabled, the device displays passwords in the running config in encrypted form instead of in plain text.

Use the no service password-encryption command to stop the device from displaying newly-entered passwords in encrypted form. This does not change the display of existing passwords.

Note Do not use encrypted passwords for GUI users. The GUI requires unencrypted user passwords only - not encrypted user passwords.

Syntax

```
service password-encryption
no service password-encryption
```

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# service password-encryption
```

Validation Commands show running-config

Related Commands enable password

service telnet

Use this command to enable the telnet server. The server is enabled by default. Enabling the telnet server starts the switch listening for incoming telnet sessions on the configured port.

The server listens on port 23, unless you have changed the port by using the privilege level command on page 5.15.

Use the no variant of this command to disable the telnet server. Disabling the telnet server will stop the switch listening for new incoming telnet sessions. However, existing telnet sessions will still be active.

Syntax

```
service telnet [ip|ipv6]
no service telnet [ip|ipv6]
```

Default The IPv4 and IPv6 telnet servers are enabled by default.

The configured telnet port is TCP port 23 by default.

Mode Global Configuration

Examples To enable both the IPv4 and IPv6 telnet servers, use the following commands:

```
awplus# configure terminal
awplus(config)# service telnet
```

To enable the IPv6 telnet server only, use the following commands:

```
awplus# configure terminal
awplus(config)# service telnet ipv6
```

To disable both the IPv4 and IPv6 telnet servers, use the following commands:

```
awplus# configure terminal
awplus(config)# no service telnet
```

To disable the IPv6 telnet server only, use the following commands:

```
awplus# configure terminal
awplus(config)# no service telnet ipv6
```

Related Commands

clear line vty
show telnet
telnet server

service terminal-length

Use this command to specify the number of rows of output that the device will display before pausing, for all console and VTY lines.

Use the no variant of this command to remove the length specified by this command. The default length will apply unless you have changed the length for some or all lines by using the length (asyn) command on page 5.12.

Syntax

```
service terminal-length <lines>
no service terminal-length <lines>
```

Parameter	Description
`terminal-length`	Establish system-wide terminal length configuration.
<lines>	<0-512> Number of rows that the device will display before pausing.

Mode Global Configuration

Usage This command overrides any lengths set by using the length (asyn) command on page 5.12 in Line mode.

Example To display 60 rows of text before pausing, use the following command:

```
awplus# configure terminal
awplus(config)# service terminal-length 60
```

Related Commands

service terminal-length
terminal length
terminal resize

show security-password configuration

This command displays the configuration settings for the various security password rules.

Syntax `show security-password configuration`

Mode Privileged Exec

Example To display the current security-password rule configuration settings, use the command:

```
awplus# show security-password configuration
```

Output Figure 5-1: Example output from the **show security-password configuration** command

```
Security Password Configuration
Minimum password length ............................ 8
Minimum password character categories to match ..... 3
Number of previously used passwords to restrict..... 4
Password lifetime .................................. 30 day(s)
  Warning period before password expires ........... 3 day(s)
Reject expired password at login ................... Disabled
  Force changing expired password at login ......... Enabled
```

Related Commands show running-config security-password
show security-password user

show security-password user

This command displays user account and password information for all users.

Syntax `show security-password user`

Mode Privileged Exec

Example To display the system users' remaining lifetime or last password change, use the command:

```
awplus# show security-password user
```

Output Figure 5-2: Example output from the **show security-password user** command

```
User account and password information

UserName          Privilege    GUI-User   Last-PWD-Change   Remaining-lifetime
-------------------------------------------------------------------------------
manager           15           No           21 day(s) ago   9 days
alice             15           No            3 day(s) ago   27 days
bob               15           Yes          45 day(s) ago   Expired
guest              1           No           35 day(s) ago   No Expiry
```

Related Commands show running-config security-password
show security-password configuration

show privilege

This command displays the current user privilege level, which can be any privilege level in the range <1-15>. Privilege levels <1-6> allow limited user access (all User Exec commands), privilege levels <7-14> allow restricted user access (all User Exec commands plus Privileged Exec show commands). Privilege level 15 gives full user access to all Privileged Exec commands.

Syntax `show privilege`

Mode User Exec and Privileged Exec

Usage From release 5.4.1, a user can have an intermediate CLI security level set with this command for privilege levels <7-14> to access all show commands in Privileged Exec mode and all commands in User Exec mode, but no configuration commands in Privileged Exec mode.

Example To show the current privilege level of the user, use the command:

```
awplus# show privilege
```

Output Figure 5-3: Example output from the **show privilege** command

```
awplus#show privilege
Current privilege level is 15
awplus#disable
awplus>show privilege
Current privilege level is 1
```

Related Commands privilege level

show telnet

This command shows the Telnet server settings.

Syntax `show telnet`

Mode User Exec and Privileged Exec

Example To show the Telnet server settings, use the command:

```
awplus# show telnet
```

Output Figure 5-4: Example output from the **show telnet** command

```
Telnet Server Configuration
-------------------------------------------------------------
Telnet server                : Enabled
Protocol                     : IPv4,IPv6
Port                         : 23
```

Related Commands
clear line vty
service telnet
show users
telnet server

show users

This command shows information about the users who are currently logged into the device.

Syntax `show users`

Mode User Exec and Privileged Exec

Example To show the users currently connected to the device, use the command:

```
awplus# show users
```

Output Figure 5-5: Example output from the **show users** command

```
Line    User            Host(s)  Idle      Location        Priv Idletime Timeout
con 0   manager         idle     00:00:00  ttyS0           15   10       N/A
vty 0   bob             idle     00:00:03  172.16.11.3     1    0        5
```

Table 5-1: Parameters in the output of the **show users** command

Parameter	Description
`Line`	Console port user is connected to.
`User`	Login name of user.
`Host(s)`	Status of the host the user is connected to.
`Idle`	How long the host has been idle.
`Location`	URL location of user.
`Priv`	The privilege level in the range 1 to 15, with 15 being the highest.
`Idletime`	The time interval the device waits for user input from either a console or VTY connection.
`Timeout`	The time interval before a server is considered unreachable.

telnet

Use this command to open a telnet session to a remote device.

Syntax

```
telnet [vrf <vrf-name>] {<hostname>|ip <ipv4-addr>|ipv6 <ipv6-addr>}
   [<port>]
```

Parameter	Description
`vrf`	Apply this command to a VRF instance.
`<vrf-name>`	The name of the VRF instance.
`<hostname>`	The host name of the remote system.
`ip`	Keyword used to specify the IPv4 address or host name of a remote system.
`<ipv4-addr>`	An IPv4 address of the remote system.
`ipv6`	Keyword used to specify the IPv6 address of a remote system
`<ipv6-addr>`	Placeholder for an IPv6 address in the format *`x:x::x:x`*, for example, `2001:db8::8a2e:7334`
`<port>`	Specify a TCP port number (well known ports are in the range 1-1023, registered ports are 1024-49151, and private ports are 49152-65535).

Mode User Exec and Privileged Exec

Examples To connect to TCP port 2602 on the device at 10.2.2.2, use the command:

```
awplus# telnet 10.2.2.2 2602
```

To connect to the telnet server `host.example`, use the command:

```
awplus# telnet host.example
```

To connect to the telnet server `host.example` on TCP port `100`, use the command:

```
awplus# telnet host.example 100
```

To connect to the telnet server `host.example` with an IPv6 connection, use the command:

```
awplus# telnet ipv6 host.example
```

To open a telnet session to a remote host `192.168.0.1` associated with VRF instance `red`, use the command:

```
awplus# telnet vrf red ip 192.168.0.1
```

telnet server

This command enables the telnet server on the specified TCP port. If the server is already enabled then it will be restarted on the new port. Changing the port number does not affect the port used by existing sessions.

Syntax `telnet server {<1-65535>|default}`

Parameter	Description
`<1-65535>`	The TCP port to listen on.
`default`	Use the default TCP port number 23.

Mode Global Configuration

Example To enable the telnet server on TCP port 2323, use the following commands:

```
awplus# configure terminal
awplus(config)# telnet server 2323
```

Related Commands show telnet

terminal length

Use the terminal length command to specify the number of rows of output that the device will display before pausing, for the currently-active terminal only.

Use the terminal no length command to remove the length specified by this command. The default length will apply unless you have changed the length for some or all lines by using the length (asyn) command on page 5.12.

Syntax

```
terminal length <length>
terminal no length [<length>]
```

Parameter	Description
<length>	<0-512> Number of rows that the device will display on the currently-active terminal before pausing.

Mode User Exec and Privileged Exec

Examples The following example sets the number of lines to 15.

```
awplus# terminal length 15
```

The following example removes terminal length set previously.

```
awplus# terminal no length
```

Related Commands

length (asyn)
service terminal-length
terminal resize

terminal resize

Use this command to automatically adjust the number of rows of output on the console, which the device will display before pausing, to the number of rows configured on the user's terminal.

Syntax `terminal resize`

Mode User Exec and Privileged Exec

Usage When the user's terminal size is changed, then a remote session via SSH or TELNET adjusts the terminal size automatically. However, this cannot normally be done automatically for a serial or console port. This command automatically adjusts the terminal size for a serial or console port.

Examples The following example automatically adjusts the number of rows shown on the console:

```
awplus# terminal resize
```

Related Commands length (asyn)
service terminal-length
terminal length

username

This command creates or modifies a user.

Syntax

```
username <name> privilege <0-15> password [8] <password>
username <name> privilege <0-15>
username <name> password [8] <password>
no username <name>
```

Parameter	Description	
<name>	The login name for the user. Do not use punctuation marks, such as single quotes (‘ ‘), double quotes (“ “), or colons (:) with the user login name.	
privilege	The user's privilege level. Use the privilege levels to set the access rights for each user.	
	<0-15>	A privilege level: either 0 (no access), 1-14 (limited access) or 15 (full access). A user with privilege level 1-14 can only access higher privilege levels if an enable password has been configured for the privilege level the user attempts to access, and the user enters that password. A user at privilege level 1 can access the majority of show commands, and at privilege level 7 a user can access the majority of show commands including platform show commands. Privilege level 15 (to access the Privileged Exec command mode) is required to access configuration commands as well as show commands in Privileged Exec.
password	A password that the user must enter when logging in.	
	8	Specifies that you are entering a password as a string that has already been encrypted, instead of entering a plain-text password. The running-config displays the new password as an encrypted string even if password encryption is turned off. Note that the user enters the plain-text version of the password when logging in.
	<password>	The user's password. The password can be up to 23 characters in length and include characters from up to four categories. The password categories are: ■ uppercase letters: A to Z ■ lowercase letters: a to z ■ digits: 0 to 9 ■ special symbols: all printable ASCII characters not included in the previous three categories. The question mark ? cannot be used as it is reserved for help functionality.

Mode Global Configuration

Usage

An intermediate CLI security level (privilege level 7 to privilege level 14) allows a CLI user access to the majority of show commands, including the platform show commands that are not available at privilege level 1 to privilege level 6. Note that some show commands, such as show running-configuration and show startup-configuration, are only available at privilege level 15.

A privilege level of 0 can be set for port authentication purposes from a RADIUS server.

Examples

To create the user `bob` with a privilege level of `15`, for all show commands including show running-configuration and show startup-configuration and to access configuration commands in Privileged Exec command mode, and with the password `bobs_secret`, use the commands:

```
awplus# configure terminal
awplus(config)# username bob privilege 15 password bobs_secret
```

To create a user `junior_admin` with a privilege level of `7`, for intermediate CLI security level access to access all show commands, and the password `show_only`, use the commands:

```
awplus# configure terminal
awplus(config)# username junior_admin privilege 7 password
show_only
```

Related Commands

enable password
security-password minimum-categories
security-password minimum-length

Chapter 6: Creating and Managing Files

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Introduction

This chapter provides information on:

- Working with files
- Creating and Using Configuration Files
- Copying Files To and From Your Device

Working With Files

The AlliedWare Plus™ OS lets you create directory trees for file storage. This section shows:

- “Listing files” on page 6.2—listing files and seeing how much free space you have
- “Displaying the contents of configuration and text files” on page 6.4
- “Navigating through the filesystem” on page 6.4—identifying the current directory, changing directories, and creating and deleting directories
- “Using the editor” on page 6.6

Flash compaction

The Flash memory on the switch automatically compacts itself to recover space available from deleted files. The switch only does this when necessary, and not every file deletion causes Flash compaction. Flash compaction can occur after a file of any size is added to or deleted from the switch.

Caution

While Flash is compacting, the console is unresponsive. Do not restart the switch, as interrupting Flash compaction can damage files.

Listing files

To list files, enter Privileged Exec mode and enter the command:

```
awplus# dir
```

The output lists files and directories in order of modification date, descending. It looks like this:

```
-rw-       534 Jul 12 2011 17:52:50  stp.cfg
-rw-       534 Jul 12 2011 17:12:50  example.cfg
-rw- 12429011 Jul 12 2011 16:26:06  x900-5.4.2.rel
```

Listing files including hidden system files

The dir command does not list all files—it hides system files and directories because users generally do not need to create or edit them. To list all files including system files, enter Privileged Exec mode and enter the command:

```
awplus# dir all
```

The output looks like this:

```
drwx        0 Jul 12 2011 17:16:32  ./
-rw-      401 Jul 12 2011 17:16:32  example.cfg
-rw-      534 Jul 12 2011 17:52:50  stp.cfg
-rw- 12429011 Jul 12 2011 16:26:06  x900-5.4.2.rel
drwx      216 Jul  9 2011 11:31:18  ../
drwx        0 Jun 13 2011 04:31:51  .configs/
-rw-       17 Jun 13 2011 04:27:27  .release
drwx        0 Jul 10 2011 23:40:00  .ssh/
```

The hidden files and directories begin with a dot.

Seeing information about the filesystem

To display information about the different memory types on the switch, enter Privileged Exec mode and enter the command:

```
awplus# show file systems
```

The output includes the amount of free memory and the prefix you type to access that memory type, and looks like this:

```
 Size(b) Free(b)  Type   Flags  Prefixes   S/D/V   Lcl/Ntwk
Avail
-------------------------------------------------------------------
  31.0M    6.0M   flash     rw  flash:     static  local      Y
      -       -   system    rw  system:    virtual local      -
 499.0k  444.0k   nvs       rw  nvs:       static  local      Y
      -       -   sdcard    rw  card:      dynamic local      N
      -       -   tftp      rw  tftp:      -       network    -
      -       -   scp       rw  scp:       -       network    -
      -       -   sftp      ro  sftp:      -       network    -
      -       -   http      ro  http:      -       network    -
```

Listing files in a subdirectory

To list the contents of a directory, enter Privileged Exec mode and enter the command:

```
awplus# dir <directory-name>
```

Tip You can specify the directory with or without a / after the directory name.

Example To display the contents of a directory called “example”, enter the command:

```
awplus# dir example
```

Listing files in NVS memory or on an SD (or SDHC) card

To list the contents of a directory in NVS, enter Privileged Exec mode and enter the command:

```
awplus# dir nvs:<directory-name>
```

To list the contents of a directory on an SD card, enter the command:

```
awplus# dir card:<directory-name>
```

Example To display the contents of a directory in NVS called “example”, enter the command:

```
awplus# dir nvs:example
```

Displaying the contents of configuration and text files

To display the contents of a file, enter Privileged Exec mode and enter the command:

```
awplus# show file <filename>
```

Example To display the contents of the file called “example.cfg”, enter the command:

```
awplus# show file example.cfg
```

Navigating through the filesystem

Showing the current directory

To see which directory you are currently in, enter Privileged Exec mode and enter the command:

```
awplus# pwd
```

For the top-level directory, the output looks like this:

```
flash:/
```

Changing directories

To change to another directory, enter Privileged Exec mode and enter the command:

```
awplus# cd <directory-name>
```

To go to a directory one level higher in the directory tree, enter the command:

```
awplus# cd ..
```

Example To change to a directory called “example”, enter the command:

```
awplus# cd example
```

To go up one level, which returns you to the top level directory, enter the command:

```
awplus# cd ..
```

Changing to a directory in NVS memory or on a SD card

To change to the top-level directory in the NVS memory filesystem, enter Privileged Exec mode and enter the command:

```
awplus# cd nvs:
```

To change to the top-level directory on an SD card, enter the command:

```
awplus# cd card:/
```

Note that the prefix for the SD card is “card” not “sdcard”.

Next, you can change to other directories by entering the command:

```
awplus# cd <directory-name>
```

Alternatively, you can go straight from Flash to a subdirectory in the alternative filesystem, by entering one of the commands:

```
awplus# cd nvs:<directory-name>
```

```
awplus# cd card:/<directory-name>
```

To return to the Flash filesystem, enter the command:

```
awplus# cd flash:/
```

Example To change to the directory within NVS called “example”, enter the command:

```
awplus# cd nvs:example
```

To go up one level, which returns you to the top-level directory of NVS memory, enter the command:

```
awplus# cd ..
```

Creating new directories

To create a directory, enter Privileged Exec mode and enter the command:

```
awplus# mkdir <directory-name>
```

Example To make a directory called “example” within the Flash filesystem, enter the command:

```
awplus# mkdir example
```

Deleting directories

To delete an empty directory, enter Privileged Exec mode and enter the command:

```
awplus# rmdir <directory-name>
```

To delete a directory and all its contents, enter Privileged Exec mode and enter the command:

```
awplus# delete recursive <directory-name>
```

The switch prompts you for confirmation.

Example To delete an empty directory called “example” from within the Flash filesystem, enter the command:

```
awplus# rmdir example
```

Using the editor

The inbuilt editor is JOE (Joe's Own Editor).

To edit an existing file, enter Privileged Exec mode and enter the command:

```
awplus# edit <filename>
```

To open the editor with an empty file, enter the command:

```
awplus# edit
```

When you save the new file, you may need to specify the filesystem to store it on. For Flash, use flash:/<filename>.

Using JOE To format and manipulate text in JOE, you use control-character sequences. The following table summarizes a few useful sequences—for details, see: joe-editor.sourceforge.net/manpage.html.

Function	Control-character sequence
Access the help	Ctrl-K-H
Save the file without exiting (for new files, this prompts for a filename)	Ctrl-K-D
Save the file and exit (this prompts for a filename)	Ctrl-K-X
Exit without saving the file	Ctrl-C
Go to the beginning of the file	Ctrl-K-U
Go to the end of the file	Ctrl-K-V
Go up one full screen of text in the file	Ctrl-U
Go down one full screen of text in the file	Ctrl-V
Select a block of text:	
Mark the beginning of the block	Ctrl-K-B

Function	Control-character sequence
Mark the end of the block	Ctrl-K-K
Copy and paste a selected block of text	Place cursor at destination then enter Ctrl-K-C
Move a selected block of text	Place cursor at destination then enter Ctrl-K-M
Delete a selected block of text	Ctrl-K-Y

Creating and Using Configuration Files

This section provides instructions on:

- Creating a configuration file
- Specifying the start-up configuration script
- Working with configuration files

Creating a configuration file

A configuration file is a text file that contains a sequence of standard commands for a specific purpose. Configuration files have a .cfg extension. Your device has a default configuration script called default.cfg.

You can create and edit configuration files on your device by:

- saving the dynamic configuration on the device, known as the running-config (see "Working with configuration files"). Use the command:

```
awplus# copy running-config (destination-URL)
```

  Where URL specifies a file in Flash.

- using the device's text editor. Use the command:

```
awplus# edit (source-URL)
```

  where source-URL is the name of the copied file in Flash memory.

- creating a file on a remote PC, then copying it to onto your device. See "Copying files" for more information about using the copy commands.

Once you have created a configuration file, you can use it as the startup-config file. See "Specifying the start-up configuration script" for more information.

Specifying the start-up configuration script

When you restart your device, or when it automatically restarts, it executes the pre-configured commands in a configuration script known as the boot config or startup-config file.

When you first start your device, the script set as the startup-config file is default.cfg. If desired, you can overwrite default.cfg with another configuration. Alternatively, you can change the startup-config by specifying a new file as the startup-config. Use the command:

```
awplus(config)# boot config-file URL
```

where URL specifies the name and location of a configuration file. At the next restart, the device executes the commands in the specified file.

You can specify that the configuration file is either in the Flash or the SD card filesystem. However, if you specify that the configuration file is on a SD card then you must first create a backup configuration file stored in Flash. To specify a backup configuration file, use the command:

```
awplus(config)# boot config-file backup URL
```

where URL specifies the name and location of a configuration file.

You can change the content of the file set as the startup-config file by:

- entering commands directly into the CLI, then saving this configuration using the command:

  ```
  awplus# copy running-config startup-config
  ```

  This command saves the device's dynamic configuration into the file that is currently configured as the startup-config file.

- writing commands into a configuration file (see "Creating a configuration file" below), then using the command:

  ```
  awplus# copy SOURCE-URL startup-config
  ```

  This command saves the script from the source file into the file that is currently configured as the startup-config file.

To display the name of the configuration file that is set to execute when the device restarts, enter the command:

```
awplus# show boot
```

To see the commands in the startup-config file, use the command:

```
awplus# show startup-config
```

To erase the file set as the startup-config file, use the command:

```
awplus# erase startup-config
```

At the next restart that occurs after you've erased the file, the device loads the configuration in the file default.cfg. This file is set on the system as a backup configuration file that loads if no other file is set as the startup-config file.

Working with configuration files

When you use the CLI or GUI to configure your device, it stores this dynamic configuration as a list of commands called the running-config. To view the device's running-config, use the command:

```
awplus# show running-config
```

If you turn off the device or restart it, any unsaved changes to the running-config are lost. To save the running-config as a configuration script, use the command:

```
awplus# copy running-config destination-url
```

You may have many configuration files. Storing them on a device allows you to keep a backup device with configuration scripts for every device in the network to speed up network recovery time. Multiple scripts also let you test new configuration scripts before setting them as the startup-config. For example, to test a new script named test.cfg, enter the command:

```
awplus# copy flash:/test.cfg running-config
```

This allows you to run a configuration file any time without restarting the device, by replacing the system's current dynamic configuration with the script in the configuration file. However, note that some commands require you to restart the device before they can take effect, such as the platform commands.

You can also set a trigger to automatically execute a configuration script when a predetermined event occurs. For information about creating triggers, see Chapter 95, Triggers Introduction.

The configuration file fallback order

The configuration fallback order is: configuration file, backup configuration file, default configuration file and then the factory default configuration. It is important to note the there is a distinction in system behavior between when writing to the startup-config file and when the system boots up.

When you copy a configuration script from a source file into the startup-config file the system will write to the first file that is configured. Potentially, this means that if a configuration file and a backup configuration file are not set you will write to the default.cfg.

At system startup the device goes through the fallback sequence until it finds a file that exists. For example, if the configuration file is not found then the backup configuration file becomes the current boot configuration, or startup-config, and so on. In the output displayed by the show boot command, the Current boot config parameter shows the startup-config file that the switch will load during the next boot cycle. The fallback sequence when configuration files are deleted is shown below in output from the show boot command.

In the example output below, the current boot configuration file, my.cfg, is set on the SD card. This is the startup-config file that the device loads at the next boot cycle.

```
awplus#show boot
Boot configuration
-----------------------------------------------------------------
Current software   : x900-5.4.2.rel
Current boot image : card:/x900-5.4.2.rel
Backup  boot image : flash:/x900-5.4.2.rel
Default boot config: flash:/default.cfg
Current boot config: card:/my.cfg (file exists)
Backup  boot config: flash:/backup.cfg (file exists)
```

In the example output below, the no boot-config command has been used to delete the configuration file my.cfg on the SD card. The backup configuration file backup.cfg in Flash then becomes the current boot config.

```
awplus#show boot
Boot configuration
-----------------------------------------------------------------
Current software   : x900-5.4.2.rel
Current boot image : card:/x900-5.4.2.rel
Backup  boot image : flash:/x900-5.4.2.rel
Default boot config: flash:/default.cfg
Current boot config: flash:/backup.cfg (file exists)
Backup  boot config: flash:/backup.cfg (file exists)
```

In the example output below, the no boot-config backup command has been used to delete the backup configuration file backup.cfg. The default configuration file default.cfg then becomes the current boot config.

```
awplus#show boot
Boot configuration
-----------------------------------------------------------------
Current software   : x900-5.4.2.rell
Current boot image : card:/x900-5.4.2.rel
Backup  boot image : flash:/x900-5.4.2.rel
Default boot config: flash:/default.cfg
Current boot config: flash:/default.cfg (file exists)
Backup  boot config: Not set
```

If the current boot configuration file is set on a SD card and then this card has been removed from the switch, the Current boot config parameter field indicates that this file cannot be found, as shown in the following example output.

```
awplus#show boot
Boot configuration
-----------------------------------------------------------------
Current software   : x900-5.4.2.rel
Current boot image : card:/x900-5.4.2.rel
Backup  boot image : flash:/x900-5.4.2.rel
Default boot config: flash:/default.cfg
Current boot config: card:/my.cfg (file not found)
Backup  boot config: flash:/backup.cfg (file exists)
```

At system startup the switch will load the backup configuration file as the startup-config.

Copying Files To and From Your Device

This section provides instructions on:

- URL syntax
- Copying files

URL syntax

Many of the file management commands use the placeholder "URL" to represent the name and location of the file that you want to act on. The following table explains the syntax of this URL for each different type of file location.

When you copy a file...	Use this syntax:
In local Flash memory	`flash:[/][DIRECTORY/]FILENAME`
Stored on an SD (or SDHC) card	`card:[/][DIRECTORY/]FILENAME`
Copying with Hypertext Transfer Protocol (HTTP)	`http://[[USERNAME:PASSWORD]@]{HOSTNAME | HOST-IP}[/FILEPATH]/FILENAME`
Copying with Trivial File Transfer Protocol (TFTP)	`tftp:[[//LOCATION]/DIRECTORY]/FILENAME`
Copying with Secure Copy (SCP)	`scp://USERNAME@LOCATION[/DIRECTORY][/FILENAME]`
Copying with SSH File Transfer Protocol (SFTP)	`sftp:[[//LOCATION]/DIRECTORY]/FILENAME`

Copying files

To copy files, use the copy commands. These commands allow you to copy files:

- between different memory types attached to your device. Use the command:

```
awplus# copy LOCAL-SOURCE LOCAL-DEST FILENAME
```

  See "Copying within a filesystem" and "" for further details.

- across a serial connection using ZMODEM. Use the command:

```
awplus# copy zmodem
```

  See "Copying with ZMODEM" for further details.

- from your device onto a remote device, or to your device from a remote device. To copy a file across an interface with IP configured, use the command:

```
awplus# copy SOURCE-URL DESTINATION-URL
```

To copy files across these interfaces you can use the following protocols:

- « "Copying with Hypertext Transfer Protocol (HTTP)"
- « "Copying with Trivial File Transfer Protocol (TFTP)"
- « "Copying with Secure Copy (SCP)"
- « "Copying with SSH File Transfer Protocol (SFTP)"

Copying within a filesystem

Within a directory

To copy a file within the same directory, enter Privileged Exec mode and enter the command:

```
awplus# copy <source-filename> <destination-filename>
```

If the file already exists, the switch asks whether to overwrite it, with a message like this:

```
Overwrite flash:/example.cfg? (y/n)[n]:
```

To overwrite, press the "y" key then the Enter key.

Between directories

To copy a file to another directory within the same filesystem, enter the command:

```
awplus# copy <source-filename> <directory-name>
```

The / after the directory name is required. Otherwise the switch displays an error ("37: Destination file is a directory").

The switch then prompts you for the destination filename. To give the copy a new name, type the name at the prompt. You can include directory names in the path.

To use the same filename as the original, press the Enter key (do not press the "y" key—that names the copy "y").

Example

To put a copy of example.cfg into the example directory, enter the command:

```
awplus# copy example.cfg example/
```

The prompt and messages look like this:

```
Enter destination file name [example.cfg]:
Copying from source file, please wait...
Copying to destination file, please wait...
0: Successful operation
```

Copying to and from NVS or SD (or SDHC) card

To copy between filesystems, you need to specify the filesystem prefix (`nvs:`, `usb:`, or `card:`).

For example, to copy from Flash to NVS when your current directory is the top-level Flash directory, enter Privileged Exec mode and enter the command:

```
awplus# copy <source-filename> nvs:
```

The switch prompts you for the filename, as described in the previous section.

To copy from NVS to Flash when your current directory is the top-level Flash directory, enter the command:

```
awplus# copy nvs:<source-filename> <destination-filename>
```

Example To copy the file “example.txt” from the directory in NVS called “example” to the top level of Flash, enter the command:

```
awplus# copy nvs:example/example.txt example.txt
```

Copying with ZMODEM

ZMODEM allows you to copy files from a network host over an asynchronous port. Use the command:

```
awplus# copy zmodem
```

to open Minicom and transfer a file. Alternatively you can specify the file name within the command:

```
awplus# copy SOURCE-URL zmodem
```

For example, to copy the file “july.cfg” from Flash memory using ZMODEM, use the command:

```
awplus# copy flash:/july.cfg zmodem
```

Copying with Hypertext Transfer Protocol (HTTP)

You device has a built-in HTTP client. The HTTP client enables the device to act as a browser by sending HTTP "get" or "post" requests to an HTTP server. The client is enabled by default.

For example, to load the file “bob.key” onto Flash from the security directory on the web server at www.company.com, use the command:

```
awplus# copy http://www.company.com/security/bob.key
       flash:/bob.key
```

Copying with Trivial File Transfer Protocol (TFTP)

TFTP runs over User Datagram Protocol (UDP). It is simpler and faster than FTP but has minimal capability, such as no provisions for user authentication.

To copy a file from a TFTP server to Flash memory, enter Privileged Exec mode and enter the command:

```
awplus# copy tftp flash
```

Note

You can specify the server and filename in the command instead of waiting for prompts. Use a format like the following:

```
copy tftp://172.1.1.1/example.cfg flash
```

The switch prompts you for the:

- TFTP server hostname (you can enter its IP address instead)
- source filename on the TFTP server
- destination filename in Flash on the switch

To copy a file from Flash to a TFTP server, enter the command:

```
awplus# copy flash tftp
```

Follow the prompts for source filename, server, and destination filename.

If the file is not in the top level of the TFTP server, include the path as part of the filename.

Example To copy example.cfg to the TFTP server at 172.1.1.1, enter the command:

```
awplus# copy flash tftp
```

The prompts, responses, and messages look like this:

```
Enter source file name []:example.cfg
Enter destination host name []:172.1.1.1
Enter destination file name [example.cfg]:
Copying from source file, please wait...
Copying to destination file, please wait...
0: Successful operation
```

To load the file “bob.key” from a TFTP server, where the file is in the folder “security”, use the command:

```
awplus# copy tftp://security/bob.key flash:/bob.key
```

Copying with Secure Copy (SCP)

Secure Copy (SCP) provides a secure way to copy files to and from a remote device using SSH. The AlliedWare Plus™ OS includes both a SSH server and a SSH client. You must enable the SSH server before your device accepts connections from SCP clients. See the Chapter 74, Secure Shell (SSH) Introduction for more information.

For example, to load the file “beth.key” onto Flash from the key directory on a remote SSH server at 10.10.0.12, using the username “bob”, use the command:

```
awplus# copy scp://bob@10.10.0.12/key/beth.key
       flash:/beth.key
```

Copying with SSH File Transfer Protocol (SFTP)

SSH File Transfer Protocol (SFTP) provides a secure way to copy files onto your device from a remote device. The AlliedWare Plus™ OS includes both a SSH server and a SSH client. SFTP provides additional features from SCP, such as allowing you to manipulate the remote files, and halt or resume file transfers without closing the session.

For example, to load the file “rei.cfg” onto Flash memory from the remote server at 10.0.0.5, use the command:

```
awplus# copy sftp://10.0.0.5/rei.cfg flash:/rei.cfg
```

Copying from a Server to Running Configuration

Use the copy tftp variant of the copy running-config command on page 7.12 to load a configuration file from a server to the running configuration of the switch.

The configuration will be added to the running configuration as if the commands were typed in the command line interface.

The resulting configuration file will be a combination of the previous running configuration and the loaded configuration file. The loaded configuration file has precedence.

The Autoboot Feature

The Autoboot feature enables your switch to automatically load a specific release file and/or configuration file from external media, such as SD card, into Flash memory, providing there is enough free space available. If there is not enough free space, the Autoboot feature will exit and booting will revert to what was previously set by the CLI. This feature is enabled only the first time the device is powered up in the field. Subsequently, the Autoboot feature is disabled by default.

The Autoboot feature minimizes network downtime by avoiding the need for manual configuration of a replacement device.

If you use prepared external media for the first time boot, the Autoboot feature gives you the ability to easily ensure the device boots with your desired release and configuration files. You must prepare the external media for this purpose using an initiation file, `autoboot.txt`, and accompanying release and configuration files.

Use the create autoboot command to create an `autoboot.txt` file on external media. This command will automatically ensure that the keys and values that are expected in this file are correct. After the file is created the command will copy the current release and configuration files across to the external media. The `autoboot.txt` file is read/writable by any desktop operating system currently supported by the AlliedWare Plus™ Operating System. Note that the external media file system is not case sensitive.

When the Autoboot feature is enabled, the device on boot-up:

- checks for a special file called `autoboot.txt` on external media, and if this file exists,
- checks in the file for the “key=value” pair “`Copy_from_external_media_enabled=yes`”, and if this enable flag is set,
- loads the release file and/or configuration file from external media.

An example of a valid `autoboot.txt` file is shown in Figure 6-1 below.

Figure 6-1: Example **autoboot.txt** file

```
; J Smith,  x600-24Ts/XP,  16 July 2011
[AlliedWare Plus]
Copy_from_external_media_enabled=yes
Boot_Release=x900-5.4.2.rel
Boot_Config=network1.cfg
```

If external media is not present, cannot be read, or the internal enable flag is not set to yes in the switch, the switch will boot as normal. Incompatible release files are prevented from loading onto the switch, even if the enable flag is set on the switch. If there is an incompatible release file then the configuration file referenced in the `autoboot.txt` file is also not loaded onto the switch.

We recommend that no directories are present on external media used to hold the `autoboot.txt` file. In addition, large numbers of files on external media may slow the booting process.

Note The Autoboot feature is not supported in a stacked configuration.

Do not remove external media part way through the copy process as this may leave the device in an unstable state.

Configuration files placed on external media reduce security. Therefore, ensure adequate security precautions are taken with external media holding configuration files.

Configuration commands that rely on the presence of a feature license will fail when executed in the replacement switch if the replacement switch does not have the same feature license present.

The bootloader version on the device must be 1.1.6 or greater to support external media. An `autoboot.txt` file on a SD card will not be detected on a device with a bootloader version less than 1.1.6.

Restoring a switch using Autoboot from external media

The example below describes the sequence of events when a switch in the field fails and is restored using this feature:

1. Using the create autoboot command, a network engineer has previously manually created a restore external media device, such as an SD card. The external media device contains the following components:
   - An `autoboot.txt` file with required contents
   - An appropriate release file
   - A configuration file
2. A switch fails in the field.
3. A replacement switch of same model is installed.

Note This replacement switch must already have a xx541-2.6 or later release or bootloader version 1.1.6 or later pre-installed to be able to detect and interpret the `autoboot.txt` file.

4. The previously created external media device is placed into the replacement switch.
5. The switch powers up using its pre-installed release if present. It automatically checks the external media device for the `autoboot.txt` file.
6. The switch finds a valid `autoboot.txt` file on the external media device, with the value “Copy_from_external_media_enabled” set. The release file and configuration file both exist on the external media device.
7. The MD5sum of pre-installed Flash release file is compared to the MD5sum of the release file stored in the external media device. If they do not match, because the release file in the replacement switch is either missing or different, then the release is restored from the

external media device. If the release files already match, then the release file is not copied from the external media device.

8. The MD5sum of the Flash configuration file `default.cfg` (if pre-installed in the replacement switch) is compared to the MD5sum of the configuration file stored in the external media device. If they do not match, because the configuration file in the replacement switch is either missing or different, then the configuration file is restored from the external media device. If the configuration files already match, then the configuration file is not copied from the external media device.

9. The memory space available in the switch Flash is checked to ensure the release and configuration files stored in the external media device will fit. If there is not enough space the Autoboot feature will exit.

10. The release file and configuration files are automatically copied from the external media device to switch Flash memory. The switch release and configuration files are updated to contain the appropriate names.

11. The switch is automatically rebooted.

12. The replacement switch is now running the restored release and configuration files. Subsequent reboots are based on the restored release and configuration files stored in the switch Flash memory.

13. If you want to Autoboot from external media on this specific switch in the future, you must now manually enable the Autoboot feature in the configuration menu via the autoboot enable command. This command resets the enable flag stored internally in the switch NVS memory.

Configure Autoboot

This section describes the commands used to configure the Autoboot feature.

Table 6-1: Configuration procedures for the Autoboot feature

Create an Autoboot file (autoboot.txt)	
`awplus#`	
`create autoboot card`	Create an autoboot.txt file on external media.
Enable the Autoboot feature	
`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`autoboot enable`	The Autoboot feature is enabled by default the first time the device is powered up in the field. Use this command to enable the feature subsequently.

Table 6-1: Configuration procedures for the Autoboot feature

Disable the Autoboot feature	
`awplus(config)#`	
`no autoboot enable`	Use this command to disable the Autoboot feature.
Display Autoboot configuration and status	
`awplus#`	
`show autoboot`	Display detailed information about the current Autoboot configuration and status.
`awplus#`	
`show boot`	Display the status of the Autoboot feature; either enabled or disabled.

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Introduction

This chapter provides an alphabetical reference of AlliedWare Plus™ OS file management commands.

URL Syntax and Keyword Usage

Many of the commands in this chapter use the placeholder "URL" to represent the name and location of the file that you want to act on. The following table explains the syntax of this URL for each different type of file location.

When you copy a file...	Use this syntax:

In local Flash memory	`[DIRECTORY/]FILENAME`
	or
	`flash[:][/][DIRECTORY/]FILENAME`

Stored on an SD (or SDHC) card	`card[:][/][DIRECTORY/]FILENAME`
Using Hypertext Transfer Protocol (HTTP)	`http[://][[USERNAME:PASSWORD]@]{HOSTNAME | HOST-IP}[/FILEPATH]/FILENAME`
Using Trivial File Transfer Protocol (TFTP)	`tftp[:][[//LOCATION]/DIRECTORY]/FILENAME`
Using Secure Copy (SCP)	`scp[://]USERNAME@LOCATION[/DIRECTORY][/FILENAME]`
Using SSH File Transfer Protocol (SFTP)	`sftp[:][[//LOCATION]/DIRECTORY]/FILENAME`
Stored on stack member Flash to stack master Flash	`<stack_hostname>-<stack_member_id>/flash:[/][DIRECTORY]<stack_member_filename> <stack_master_filename>`

Note

When the Flash base directory is required for local filesystems (flash, nvs, and card) you may use flash or flash: or flash:/. and similarly, when the SD (or SDHC) card base directory is required you may use card or card: or card:/.

The keywords flash, nvs, card, tftp, scp, sftp and http are reserved for tab completion when using the copy, move, delete, cd, and dir commands.

Keywords flash, nvs, card, tftp, scp, sftp and http cannot be applied as directory or subdirectory names when using a mkdir command.

A leading slash (/) indicates the root of the current filesystem location.

Command List

autoboot enable

This command enables the device to restore a release file and/or a configuration file from external media, such as an SD card. When the Autoboot feature is enabled, the device looks for a special file called `autoboot.txt` on the external media. If this file exists, the device will check the key and values in the file and recover the device with a new release file and/or configuration file from the external media. An example of a valid `autoboot.txt` file is shown in Figure 7-1 below.

Figure 7-1: Example autoboot.txt file

```
; J Smith,  x600-24Ts/XP,  16 July 2011
[AlliedWare Plus]
Copy_from_external_media_enabled=yes
Boot_Release=x900-5.4.2.rel
Boot_Config=network1.cfg
```

Use the no variant of this command to disable the Autoboot feature.

Note This command is not supported in a stacked configuration.

Syntax

```
autoboot enable
no autoboot enable
```

Default The Autoboot feature operates the first time the device is powered up in the field, after which the feature is disabled by default.

Mode Global Configuration

Example To enable the Autoboot feature, use the command:

```
awplus# configure terminal
awplus(config)# autoboot enable
```

To disable the Autoboot feature, use the command:

```
awplus# configure terminal
awplus(config)# no autoboot enable
```

Related Commands

create autoboot
show autoboot
show boot

boot config-file

Use this command to either set the configuration file to use during the next boot cycle, or to set a backup configuration file to use if the main configuration file cannot be accessed.

Use the no variant of this command to delete either the configuration file or the backup configuration file.

Syntax

```
boot config-file [<filepath-filename>|backup <filepath-filename>]
no boot config-file [backup]
```

Parameter	Description
<filepath-filename>	Filepath and name of a configuration file. The specified configuration file must exist in the Flash, SD card, or SDHC card filesystem. Backup configuration files must be in the Flash filesystem. Valid configuration files must have a .cfg extension.
`backup`	The specified file is a backup configuration file.

Mode Global Configuration

Usage You can only specify that the configuration file is on a SD card if there is a backup configuration file already specified in Flash. If you attempt to set the configuration file on a SD card and a backup configuration file is not specified in Flash, the following error message is displayed:

```
% Backup configuration files must be stored in the flash
filesystem
```

In addition, you can only specify that the configuration file is on a SD card if the card is writable. For example, if you attempt to set the configuration file on a SD card and stack member 2 has a write protected card inserted, the following error message is displayed:

```
% Stack member 2 has a write protected card inserted
```

In a VCStack configuration you can only specify that the configuration file is on a SD card if there is a card inserted in all stack members. If a stack member has a card removed an error message is displayed. For example, if stack member 2 does not have a card inserted the following message is displayed:

```
% Stack member 2 has no card inserted
```

A new stack member cannot join a stack if the stack has the configuration file on a SD card and the new member does not have a card inserted or the new member has a write protected card inserted.

Note

The read speeds of SD cards and SDHC cards varies significantly between different manufacturers and card capacities. Ensure the same brand and size of card is used in all stack members.

For an explanation of the configuration fallback order, see "The configuration file fallback order" on page 6.10.

Examples To run the configuration file `branch.cfg` stored on the switch's Flash filesystem the next time the device boots up, use the commands:

```
awplus# configure terminal
awplus(config)# boot config-file flash:/branch.cfg
```

To set the configuration file `backup.cfg` as the backup to the main configuration file, use the commands:

```
awplus# configure terminal
awplus(config)# boot config-file backup flash:/backup.cfg
```

To run the configuration file `branch.cfg` stored on the switch's SD card filesystem the next time the device boots up, use the commands:

```
awplus# configure terminal
awplus(config)# boot config-file card:/branch.cfg
```

Related Commands

boot system
show boot

boot system

Use this command to either set the release file to load during the next boot cycle, or to set a backup release file to load if the main release file cannot be loaded.

Use the no variant of this command to delete either the release file or the backup release file.

Syntax

```
boot system [<filepath-filename>|backup <filepath-filename>]
no boot system [backup]
```

Parameter	Description
<filepath-filename>	Filepath and name of a release file. The specified release file must exist and must be stored in the root directory of the Flash, SD card, or SDHC card filesystem. Backup release files must be in the Flash filesystem. Valid release files must have a .rel extension.
`backup`	The specified file is a backup release file.

Mode Global Configuration

Usage You can only specify that the release file is on a SD card if there is a backup release file already specified in Flash. If you attempt to set the release file on a SD card and a backup release file is not specified in Flash, the following error message is displayed:

```
% A backup boot image must be set before setting a current boot
image on card
```

Additionally, in a VCStack configuration a release file on a SD card is accepted only if a card is inserted in all stack members and all stack members have a bootloader version that supports booting from card. If a stack member has a card removed an error message is displayed. For example, if stack member 2 does not have a card inserted the following message is displayed:

```
% Stack member 2 has no card inserted
```

Note

The read speed of SD cards and SDHC cards varies significantly between different manufacturers and card capacities. Ensure the same brand and size of card is used in all stack members.

Examples To run the release file `x900-5.4.2.rel` stored on the switch's Flash filesystem the next time the device boots up, use the commands:

```
awplus# configure terminal
awplus(config)# boot system flash:/x900-5.4.2.rel
```

To run the release file `x900-5.4.2.rell` stored on the switch's SD card filesystem the next time the device boots up, use the commands:

```
awplus# configure terminal
awplus(config)# boot system card:/x900-5.4.2.rel
```

To specify the file `x900-5.4.2.rel` as the backup to the main release file, use the commands:

```
awplus# configure terminal
awplus(config)# boot system backup flash:/x900-5.4.2.rel
```

In a VCStack configuration, if there is not enough space to synchronize the new release across the stack, the boot system command has an interactive mode that prompts you to delete old releases.

```
awplus# configure terminal
awplus(config)# boot system x900-5.4.2.rel
```

```
Insufficient flash available on stack member-2 (11370496)
 to synchronize file x900-5.4.2.rel (14821895).

 List of release files on stack member-2
        x900-5.4.2.rel (14822400)

 Select files to free up space,
 Delete awplus-2/flash:/x900-5.4.2.rel? (y/n)[n]:y
```

```
awplus(config)# y
```

```
 Deleting selected files, please
wait.................................
 Successful operation
 VCS synchronizing file across the stack, please
wait.....................................
 File synchronization with stack member-2 successfully completed
 [DONE]
```

Related Commands

boot config-file
show boot

cd

This command changes the current working directory.

Syntax `cd <directory-url>`

Parameter	Description
<directory-url>	URL of the directory.

Mode Privileged Exec

Example To change to the directory called `images`, use the command:

```
awplus# cd images
```

Related Commands
dir
pwd
show file systems

copy current-software

This command copies the AlliedWare Plus™ OS software that the device has booted from to a destination file. Specify whether the destination is Flash, or card when saving the software to the local filesystem.

Syntax `copy current-software <destination-url>`

Parameter	Description
<destination-url>	The URL where you would like the current running-release saved. This command creates a file if no file exists with the specified filename. If a file already exists, then the CLI prompts you before overwriting the file. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.

Mode Privileged Exec

Example To copy the current software as installed in the working directory with the file name `my-release.rel`, use the command:

```
awplus# copy current-software my-release.rel
```

Related Commands
boot system
show boot

copy debug

This command copies a specified debug file to a destination file. Specify whether the destination is Flash or Card when saving the software to the local filesystem.

Syntax

```
copy debug {<destination-url>|card|debug|flash|nvs|scp|tftp}
   {<source-url>|card|debug|flash|nvs|scp|tftp}
```

Parameter	Description
<destination-url>	The URL where you would like the debug output saved. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.
<source-url>	The URL where the debug output originates. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.

Mode Privileged Exec

Example To copy debug output to SD (or SDHC) card with a filename `my-debug`, use the following command:

```
awplus# copy debug card:mydebug
```

Output Figure 7-2: CLI prompt after entering the **copy debug** command

```
Enter source file name []:
```

Related Commands

delete debug
move debug

copy (local)

This command copies a file between local filesystems. This allows you to copy a file stored on Flash memory to or from a different memory type attached to your device, such as an SD (or SDHC) card. By default, the destination filename is the same as the source file.

Syntax `copy <local-source> <local-destination> <filename>`

Parameter	Description	
<local-source>	Filesystem where the original file is stored.	
	`card`	Copies the file from an attached SD (or SDHC) card.
	`flash`	Copies the file from Flash memory.
<local-destination>	Filesystem where the file is copied to.	
	`card`	Copies the file to an attached SD (or SDHC) card.
	`flash`	Copies the file to Flash memory.
<filename>	Filename of the file you are copying.	

Mode Privileged Exec

Example To copy the file `newconfig.cfg` onto your device's Flash from an SD (or SDHC) card, use the command:

```
awplus# copy card flash newconfig.cfg
```

Related Commands
copy (URL)
copy zmodem
show file
show file systems

copy running-config

This command copies the running-config to a destination file, or copies a source file into the running-config. Commands entered in the running-config do not survive a device reboot unless they are saved in a configuration file.

Syntax

```
copy <source-url> running-config
copy running-config <destination-url>
copy running-config startup-config
```

Parameter	Description
<source-url>	The URL of a configuration file. This must be a valid configuration file with a .cfg filename extension. Specify this when you want the script in the file to become the new running-config. The URL can contain the following protocols or location words. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.
<destination-url>	The URL where you would like the current running-config saved. This command creates a file if no file exists with the specified filename. If a file already exists, then the CLI prompts you before overwriting the file. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.
`startup-config`	Copies the running-config into the file set as the current startup-config file.

Mode Privileged Exec

Examples To copy the `running-config` into the startup-config, use the command:

```
awplus# copy running-config startup-config
```

To copy the file `layer3.cfg` into the `running-config`, use the command:

```
awplus# copy layer3.cfg running-config
```

To use SCP to copy the running-config as `current.cfg` to the remote server listening on TCP port 2000, use the command:

```
awplus# copy running-config scp://user@server:2000/
       config_files/current.cfg
```

Related Commands

copy startup-config
write file
write memory

copy startup-config

This command copies the startup-config script into a destination file, or alternatively copies a configuration script from a source file into the startup-config file. Specify whether the destination is Flash, or card when loading from the local filesystem.

Syntax

```
copy <source-url> startup-config
```

```
copy startup-config <destination-url>
```

Parameter	Description
<source-url>	The URL of a configuration file. This must be a valid configuration file with a .cfg filename extension. Specify this to copy the script in the file into the *startup-config* file. Note that this does not make the copied file the new startup file, so any further changes made in the configuration file are not added to the startup-config file unless you reuse this command. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.
<destination-url>	The destination and filename that you are saving the startup-config as. This command creates a file if no file exists with the specified filename. If a file already exists, then the CLI prompts you before overwriting the file. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.

Mode Privileged Exec

Examples To copy the file `Layer3.cfg` to the `startup-config`, use the command:

```
awplus# copy Layer3.cfg startup-config
```

To copy the `startup-config` as the file `oldconfig.cfg` in the current directory, use the command:

```
awplus# copy startup-config oldconfig.cfg
```

Related Commands copy running-config

copy (URL)

This command copies a file. This allows you to:

- copy files from your device to a remote device
- copy files from a remote device to your device
- copy files stored on Flash memory to or from a different memory type, such as an SD card
- create two copies of the same file on your device

Syntax `copy <source-url> <destination-url>`

Parameter	Description
<source-url>	The URL of the source file. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.
<destination-url>	The URL for the destination file. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.

Mode Privileged Exec

Examples To use TFTP to copy the file `bob.key` into the current directory from the remote server at `10.0.0.1`, use the command:

```
awplus# copy tftp://10.0.0.1/bob.key bob.key
```

To use SFTP to copy the file `new.cfg` into the current directory from a remote server at `10.0.1.2`, use the command:

```
awplus# copy sftp://10.0.1.2/new.cfg bob.key
```

To use SCP with the username `beth` to copy the file `old.cfg` into the directory `config_files` on a remote server that is listening on TCP port 2000, use the command:

```
awplus# copy scp://beth@serv:2000/config_files/old.cfg old.cfg
```

To copy the file `config.cfg` into the current directory from an SD (or SDHC) Card, and rename it to `configtest.cfg`, use the command:

```
awplus# copy card:/config.cfg configtest.cfg
```

Stacked Devices In a stacked environment you can use the CLI on a stack master to access filesystems that are located on another stack member. In this case, when you enter the command, specify the stack member's filesystem by using the following syntax:
<hostname>-*<member-id>*/
(for example, `awplus-1/` for a file or directory on stack member 1, `awplus-2/` for member 2 etc).

Example To copy the file `test.txt` from the top level of Flash on stack member 4 to the current directory in the stack master, use the command:

```
awplus# copy awplus-4/flash:/test.txt test.txt
```

Note that you must specify either the NVS or Flash filesystem on the slave stack member (`flash:` in this example).

Related Commands

copy (local)
copy zmodem
show file systems

copy zmodem

This command allows you to copy files using ZMODEM using Minicom. ZMODEM works over a serial connection and does not need any interfaces configured to do a file transfer.

Syntax

```
copy <source-url> zmodem
```

```
copy zmodem
```

Parameter	Description
<source-url>	The URL of the source file. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.

Mode Privileged Exec

Example To copy the local file `asuka.key` using ZMODEM, use the command:

```
awplus# copy asuka.key zmodem
```

Related Commands

copy (local)
copy (URL)
show file systems

create autoboot

Use this command to create an `autoboot.txt` file on external media. This command will automatically ensure that the keys and values that are expected in this file are correct. After the file is created the create autoboot command will copy the current release and configuration files across to the external media. The external media is then available to restore a release file and/or a configuration file to the device.

Syntax `create autoboot card`

Mode Privileged Exec

Example To create an `autoboot.txt` on external media, use the command:

```
awplus# create autoboot card
```

Related Commands
autoboot enable
show autoboot
show boot

delete

This command deletes files or directories.

Syntax `delete [force] [recursive] <url>`

Parameter	Description
`force`	Ignore nonexistent filenames and never prompt before deletion.
`recursive`	Remove the contents of directories recursively.
`<url>`	URL of the file to delete. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.

Mode Privileged Exec

Examples To delete the file `temp.cfg` from the current directory, use the command:

```
awplus# delete temp.cfg
```

To delete the read-only file `one.cfg` from the current directory, use the command:

```
awplus# delete force one.cfg
```

To delete the directory `old_configs`, which is not empty, use the command:

```
awplus# delete recursive old_configs
```

To delete the directory `new_configs`, which is not empty, without prompting if any read-only files are being deleted, use the command:

```
awplus# delete force recursive new_configs
```

Related Commands erase startup-config
rmdir

delete debug

Use this command to delete a specified debug output file.

Syntax `delete debug <source-url>`

Parameter	Description
<source-url>	The URL where the debug output originates. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.

Mode Privileged Exec

Example To delete debug output, use the following command:

```
awplus# delete debug
```

Output Figure 7-3: CLI prompt after entering the **delete debug** command

```
Enter source file name []:
```

Related Commands copy debug
move debug

dir

This command lists the files on a filesystem. If no directory or file is specified then this command lists the files in the current working directory.

Syntax `dir [all] [recursive] [<url>|card|debug|flash|nvs]`

Parameter	Description
`all`	List all files.
`recursive`	List the contents of directories recursively.
`<url>`	URL of the directory or file. If no directory or file is specified, then this command lists the files in the current working directory.
`card`	SD (or SDHC) card root directory
`debug`	Debug root directory
`flash`	Flash memory root directory
`nvs`	NVS memory root directory

Mode Privileged Exec

Usage In a stacked environment you can use the CLI on a stack master to access filesystems that are located on another stack member. In this case, when you enter the command, specify the stack member's filesystem by using the following syntax:
<hostname>-<member-id>/
(for example, `awplus-1/` for a file or directory on stack member 1, `awplus-2/` for member 2 etc).

Examples To list the files in the current working directory, use the command:

```
awplus# dir
```

To list the non-hidden files in the root of the Flash filesystem, use the command:

```
awplus# dir flash
```

To list all the files in the root of the Flash filesystem, use the command:

```
awplus# dir all flash:
```

To list recursively the files in the Flash filesystem, use the command:

```
awplus# dir recursive flash:
```

To list the files within the Flash filesystem for stack member 3, use the command:

```
awplus# dir awplus-3/flash:/
```

Note that you must specify the filesystem, on the stack member (`flash` in this example).

Related Commands cd
pwd

edit

This command opens a text file in the AlliedWare Plus™ text editor. Once opened you can use the editor to alter to the file.

If a filename is specified and it already exists, then the editor opens it in the text editor.

If no filename is specified, the editor prompts you for one when you exit it.

Before starting the editor make sure your terminal, terminal emulation program, or Telnet client is 100% compatible with a VT100 terminal. The editor uses VT100 control sequences to display text on the terminal.

For more information about using the editor, including control sequences, see "Using the editor" on page 6.6.

Syntax `edit [<filename>]`

Parameter	Description
<filename>	Name of a file in the local Flash filesystem.

Mode Privileged Exec

Examples To create and edit a new text file, use the command:

```
awplus# edit
```

To edit the existing configuration file `myconfig.cfg` stored on your device's Flash memory, use the command:

```
awplus# edit myconfig.cfg
```

Related Commands edit URL
show file

edit URL

This command opens a remote text file as read-only in the AlliedWare Plus™ text editor.

Before starting the editor make sure your terminal, terminal emulation program, or Telnet client is 100% compatible with a VT100 terminal. The editor uses VT100 control sequences to display text on the terminal.

Syntax `edit <url>`

Parameter	Description
<url>	The URL of the remote file. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.

Mode Privileged Exec

Example To view the file `bob.key` stored in the security directory of a TFTP server, use the command:

```
awplus# edit tftp://security/bob.key
```

Related Commands
edit
show file

erase startup-config

This command deletes the file that is set as the startup-config file, which is the configuration file that the system runs when it boots up.

At the next restart, the device loads the default configuration file, default.cfg. If default.cfg no longer exists, then the device loads with the factory default configuration. This provides a mechanism for you to return the device to the factory default settings.

Syntax `erase startup-config`

Mode Privileged Exec

Example To delete the file currently set as the startup-config, use the command:

```
awplus# erase startup-config
```

Related Commands
boot config-file
copy running-config
copy startup-config
show boot

license

This command enables the licensed software feature set.

Use the no variant of this command to disable the licensed software feature set.

For feature licenses, contact your authorized distributor or reseller. If a license key expires or a proper key is not installed, some software features will not be available.

Note

See the AlliedWare Plus™ datasheet for a list of current feature licenses available by product, and the AlliedWare Plus™ How To notes for information on obtaining them.

Syntax

```
license <name> <key>

no license [<name>|index <index-number>]
```

Parameter	Description
<name>	A unique user-defined name for the license. To determine names already in use, use the show license command.
<key>	The encrypted license key to enable this set of software features.
<index-number>	The index number of the software feature. To display the index number, use the show license command.

Mode

Privileged Exec

Usage

Default feature license names are issued along with encrypted license keys by email for you to apply using this command to enable features. These default feature license names can be changed, but must be 15 characters or less in length to be accepted with the issued key.

For example, you may want to change the license name '`AT-FL-SBX9-01`' to '`x900 L3 license`'. The license name and license index is displayed with the show license command.

In a stacked configuration, the license command will add a license to the active stack master only and the no license command will remove a license from the active stack master only. Using these commands in a stacked configuration could result in different members of the stack having different licenses enabled or disabled, possibly causing the stack to fail to operate correctly. A warning message is generated if you use this command in a stacked configuration. To maintain consistent behavior across the stack, use the license member command to enable or disable licensed features.

Examples

To enable the license `name1` with the key `12345678ABCDE123456789ABCDE`, use the command:

```
awplus# license name1 12345678ABCDE123456789ABCDE
```

To remove the license `name1`, use the command:

```
awplus# no license name1
```

Validation Command

show license

Related Commands license member
show license member

mkdir

This command makes a new directory.

Syntax `mkdir <url>`

Parameter	Description
<url>	URL of the directory that you are creating.

Mode Privileged Exec

Usage The keywords flash, nvs, card, tftp, scp, sftp and http are reserved for tab completion when using the copy, move, delete, cd and dir command. Keywords flash, nvs, card, tftp, scp, sftp and http cannot be applied as directory or subdirectory names when using a mkdir command.

Example To make a new directory called `images` in the current directory, use the command:

```
awplus# mkdir images
```

Related Commands
cd
dir
pwd

move

This command renames or moves a file.

Syntax `move <source-url> <destination-url>`

Parameter	Description
<source-url>	The URL of the source file. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.
<destination-url>	The URL of the destination file. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.

Mode Privileged Exec

Examples To rename the file `temp.cfg` to `startup.cfg`, use the command:

```
awplus# move temp.cfg startup.cfg
```

To move the file `temp.cfg` from the root of the Flash filesystem to the directory `myconfigs`, use the command:

```
awplus# move temp.cfg myconfigs/temp.cfg
```

Related Commands
delete
edit
show file
show file systems

move debug

This command moves a specified debug file to a destination debug file. Specify whether the destination is Flash or Card when saving the software to the local filesystem.

Syntax

```
move debug {<destination-url>|card|debug|flash|nvs}
   {<source-url>|card|debug|flash|nvs}
```

Parameter	Description
<destination-url>	The URL where you would like the debug output moved to. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.
<source-url>	The URL where the debug output originates. See "URL Syntax and Keyword Usage" on page 7.3 for valid URL syntax.

Mode Privileged Exec

Example To move debug output onto a SD (or SDHC) card with a filename `my-debug`, use the following command:

```
awplus# move debug card:my-debug
```

Output Figure 7-4: CLI prompt after entering the **move debug** command

```
Enter source file name []:
```

Related Commands

copy debug
delete debug

pwd

This command prints the current working directory.

Syntax `pwd`

Mode Privileged Exec

Example To print the current working directory, use the command:

```
awplus# pwd
```

Related Commands cd

rmdir

This command removes a directory. The directory must be empty for the command to work unless the optional force keyword is used to remove all subdirectories or files in a directory.

Syntax `rmdir [force] <url>`

Parameter	Description
`force`	Optional keyword that allows you to delete any directories that are not empty and may contain files or subdirectories.
`<url>`	The URL of the directory.

Mode Privileged Exec

Usage In a stacked environment you can use the CLI on a stack master to access filesystems that are located on another stack member. In this case, when you enter the command, specify the stack member's filesystem by using the following syntax:
<*hostname*>-<*member-id*>/
(for example, `awplus-1/` for a file or directory on stack member 1, `awplus-2/` for member 2 etc).

Examples To remove the directory `images` from the top level of the Flash filesystem, use the command:

```
awplus# rmdir flash:/images
```

To force the removal of directory `level1` containing subdirectory `level2`, use the command:

```
awplus# mkdir level1
awplus# mkdir level1/level2
awplus# rmdir force level1
```

To remove a directory called `test` from the top level of the Flash filesystem, in stack member 3, use the command:

```
awplus# rmdir awplus-3/flash:/test
```

Note that you must specify the filesystem, ("flash:" in this example).

Related Commands
cd
dir
mkdir
pwd

show autoboot

This command displays the Autoboot configuration and status.

Syntax `show autoboot`

Mode Privileged Exec

Example To show the Autoboot configuration and status, use the command:

```
awplus# show autoboot
```

Output Figure 7-5: Example output from the **show autoboot** command

```
awplus#show autoboot
Autoboot configuration
------------------------------------------------------------------------------
Autoboot status                    : enabled
SD Card file autoboot.txt exists : yes

Restore information on SD card
Autoboot enable in autoboot.txt  : yes
Restore release file             : x900-5.4.2.rel (file exists)
Restore configuration file       : network_1.cfg (file exists)
```

Figure 7-6: Example output from the **show autoboot** command when an external media source is not present

```
awplus#show autoboot
Autoboot configuration
------------------------------------------------------------------------------
Autoboot status                    : enabled
External media source              : SD card not found.
```

Related Commands autoboot enable
create autoboot
show boot

show boot

This command displays the current boot configuration.

Syntax `show boot`

Mode Privileged Exec

Example To show the current boot configuration, use the command:

```
awplus# show boot
```

Output Figure 7-7: Example output from the **show boot** command with current boot config set on a SD card

```
awplus#show boot
Boot configuration
-----------------------------------------------------------------
Current software   : x900-5.4.2.rel
Current boot image : card:/x900-5.4.2.rel
Backup  boot image : flash:/x900-5.4.2.rel
Default boot config: flash:/default.cfg
Current boot config: card:/my.cfg (file exists)
Backup  boot config: flash:/backup.cfg (file not found)
Autoboot status    : enabled
```

Table 7-1: Parameters in the output of the **show boot** command

Parameter	Description
`Current software`	The current software release that the device is using.
`Current boot image`	The boot image currently configured for use during the next boot cycle.
`Backup boot image`	The boot image to use during the next boot cycle if the device cannot load the main image.
`Default boot config`	The default startup configuration file. The device loads this configuration script if no file is set as the startup-config file.
`Current boot config`	The configuration file currently configured as the startup-config file. The device loads this configuration file during the next boot cycle if this file exists.
`Backup boot config`	The configuration file to use during the next boot cycle if the main configuration file cannot be loaded.
`Autoboot status`	The status of the Autoboot feature; either enabled or disabled.

Related Commands
autoboot enable
boot config-file
boot system
show autoboot

show file

This command displays the contents of a specified file.

Syntax `show file {<filename>|<url>}`

Parameter	Description
<filename>	Name of a file on the local Flash filesystem.
<url>	URL of a file.

Mode Privileged Exec

Example To display the contents of the file `oldconfig.cfg`, which is in the current directory, use the command:

```
awplus# show file oldconfig.cfg
```

Related Commands edit
edit URL
show file systems

show file systems

This command lists the filesystems and their utilization information where appropriate.

If this command is entered on the stack master, it will list the filesystems for all the stack members. A stack member heading is displayed to distinguish the different lists shown for each stack member. If it is entered on a specific stack member, as a host-directed command, it will list the filesystems for only that stack member.

Syntax `show file systems`

Mode Privileged Exec

Examples To display the filesystems for either a standalone device, or a complete stack, use the command:

```
awplus# show file systems
```

To list the filesystem for stack member 3, use the command:

```
awplus# remote-command 3 show file systems
```

Output Figure 7-8: Example output from the **show file systems** command

```
awplus#show file systems

STACK member 1:

 Size(B)  Free(B)  Type    Flags  Prefixes   S/D/V    Lcl/Ntwk  Avail
-----------------------------------------------------------------------
  30.0M     6.7M   flash     rw  flash:     static   local      Y
      -        -   system    rw  system:    virtual  local      -
 499.0k        0   nvs       rw  nvs:       static   local      Y
      -        -   sdcard    rw  card:      dynamic  local      N
      -        -   tftp      rw  tftp:      -        network    -
      -        -   scp       rw  scp:       -        network    -
      -        -   sftp      ro  sftp:      -        network    -
      -        -   http      ro  http:      -        network    -
-----------------------------------------------------------------------

STACK member 2:

 Size(B)  Free(B)  Type    Flags  Prefixes   S/D/V    Lcl/Ntwk  Avail
-----------------------------------------------------------------------
  30.0M     6.7M   flash     rw  flash:     static   local      Y
      -        -   system    rw  system:    virtual  local      -
 499.0k        0   nvs       rw  nvs:       static   local      Y
      -        -   sdcard    rw  card:      dynamic  local      N
      -        -   tftp      rw  tftp:      -        network    -
      -        -   scp       rw  scp:       -        network    -
      -        -   sftp      ro  sftp:      -        network    -
      -        -   http      ro  http:      -        network    -
.
.
.
```

Table 7-2: Parameters in the output of the **show file systems** command

Parameter	Description
`Size (B)` `Available`	The total memory available to this filesystem. The units are given after the value and are M for Megabytes or k for kilobytes.
`Free (B)`	The total memory free within this filesystem. The units are given after the value and are M for Megabytes or k for kilobytes.
`Type`	The memory type used for this filesystem: flash, system, nvs, sdcard, tftp, scp, sftp, or http.
`Flags`	The file setting options: rw (read write), ro (read only).
`Prefixes`	The prefixes used when entering commands to access the filesystems: flash, system, nvs, card, tftp, scp, sftp, or http.
`S/V/D`	The memory type: static, virtual, dynamic.
`Lcl / Ntwk`	Whether the memory is located locally or via a network connection.
`Avail`	Whether the memory is accessible: Y (yes), N (no), - (not appropriate)

Related Commands

edit
edit URL
show file

show license

This command displays information about a specific software license, or all enabled software feature licenses on the device.

In a stacked configuration, use the show license member command to display license information about either a specific licensed software feature, or all software feature licenses enabled on either a specific stack member or on all stack members.

Syntax `show license [<name>|index <index-number>] [brief]`

Parameter	Description
<name>	The license name of the software feature to show information about.
<index-number>	The index number of the software feature to display information about.
`brief`	Displays a brief summary of license information.

Mode User Exec and Privileged Exec

Examples To display a brief summary of information about all enabled licenses, use the command:

```
awplus# show license brief
```

To display full information about all enabled licenses, use the command:

```
awplus# show license
```

To display full information about the licenses with index number 1, use the command:

```
awplus# show license index 1
```

Output Figure 7-9: Example output from the **show license index** command

```
awplus#show license index 0
OEM Territory: ATKK
Software Feature Licenses
-----------------------------------------------------------------
Index                          : 0
License name                   : Base License
Customer name                  : Base License
Quantity of licenses           : 1
Type of license                : Full
License issue date             : 07-Jul-2000
License expiry date            : N/A
Features included              : OSPF-64, VRRP
```

Table 7-3: Parameters in the output of the **show license** command

Parameter	Description
Index	Index identifying entry.
License name	Name of the license key bundle (case-sensitive).
Customer name	Customer name.
Quantity of licenses	Quantity of licensed installations.
Type of license	Full or Temporary.
License issue date	Date the license was generated.
License expiry date	Expiry date for temporary license.
Features included	List of features included in the license.

Figure 7-10: Example output from the **show license brief** command

```
awplus#show license brief
OEM Territory: ATKK
Software Feature Licenses
-----------------------------------------------------------------
Index License name    Quantity     Customer name
      Type                        Period
-----------------------------------------------------------------
0     Base License    1            Base License
      Full                         N/A

Current enabled features for displayed licenses:
 OSPF-64, VRRP
```

Table 7-4: Parameters in the output of the **show license** command

Parameter	Description
Index	Index identifying entry.
License name	Name of the license key bundle (case-sensitive).
Quantity	Quantity of licensed installations.
Customer name	Customer name.
Type	Full or Temporary.
Period	Expiry date for temporary license.
Current enabled features for displayed licenses	List of features included in the license.

Related Commands

license
license member
show license member

show running-config

This command displays the current configuration of the device. The output includes all non-default configuration; default settings are not displayed.

You can control the output in any one of the following ways:

- To display only lines that contain a particular word, follow the command with | include word
- To start the display at the first line that contains a particular word, follow the command with | begin word
- To save the output to a file, follow the command with > filename

For more information, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config`

Mode Privileged Exec and Global Configuration

Example To display the current dynamic configuration of your device, use the command:

```
awplus# show running-config
```

Output Figure 7-11: Example output from the **show running-config** command

```
awplus#sho running-config
!
service password-encryption
!
username manager privilege 15 password 8 $1$bJoVec4D$JwOJGPr7YqoExA0GVasdE0
!
service telnet
!
no clock timezone
ip domain-lookup
!
spanning-tree mode rstp
no platform e2efc
!
interface port1.0.1-1.0.24
 switchport
 switchport mode access
!
!
service telnet
!
no clock timezone
!
!
stack virtual-mac
stack virtual-chassis-id 2111
!
!
ip domain-lookup
!
spanning-tree mode rstp
no platform e2efc
!
interface port1.0.1-1.0.24
 switchport
 switchport mode access
!
interface vlan2
 ip address 172.28.8.210/16
!
ip route 0.0.0.0/0 172.28.0.1
!
line con 0
line vty 0 4
!
end
```

Related Commands copy running-config
show running-config access-list

show running-config access-list

Use this command to show the running system status and configuration details for access-list.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config access-list`

Mode Privileged Exec and Global Configuration

Example To display the running system status and configuration details for access-list, use the command:

```
awplus# show running-config access-list
```

Output Figure 7-12: Example output from the **show running-config access-list** command

```
!
access-list abc remark annai
access-list abc deny any
access-list abd deny any
!
```

Related Commands copy running-config
show running-config

show running-config as-path access-list

Use this command to show the running system status and configuration details for as-path access-list.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config as-path access-list`

Mode Privileged Exec and Global Configuration

Example To display the running system status and configuration details for as-path access-list, use the command:

```
awplus# show running-config as-path access-list
```

Output Figure 7-13: Example output from the **show running-config as-path access-list** command

```
!
ip as-path access-list wer permit knsmk
!
```

Related Commands copy running-config
show running-config

show running-config bgp

Use this command to show the running system BGP related configuration.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config bgp`

Mode Privileged Exec and Global Configuration

Example To display the running system BGP related configuration, use the command:

```
awplus# show running-config bgp
```

Output Figure 7-14: Example output from the **show running-config bgp** command

```
!
bgp config-type standard
bgp rfc1771-path-select
bgp rfc1771-strict
bgp aggregate-nexthop-check
!
router bgp 1
no auto-summary
no synchronization
bgp router-id 1.2.3.4
!
```

Related Commands copy running-config
show running-config

show running-config community-list

Use this command to show the running system status and configuration details for community-lists.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config community-list`

Mode Privileged Exec and Global Configuration

Example To display the running system status and configuration details for community-lists use the command:

```
awplus# show running-config community-list
```

Output Figure 7-15: Example output from the **show running-config community list** command

```
!
ip community-list standard aspd permit internet
ip community-list expanded cspd deny ljj
ip community-list expanded cspd permit dcv
ip community-list expanded wde permit njhd
ip community-list expanded wer deny sde
```

Related Commands copy running-config
show running-config

show running-config dhcp

Use this command to display the running configuration for DHCP server, DHCP snooping, and DHCP relay.

Syntax `show running-config dhcp`

Mode Privileged Exec and Global Configuration

Example To display to display the running configuration for DHCP server, DHCP snooping, and DHCP relay:

```
awplus# show running-config dhcp
```

Output Figure 7-16: Example output from the **show running-config dhcp** command

```
!
#show running-config dhcp
no service dhcp-server
!
service dhcp-snooping
!
interface port1.0.1
 ip dhcp snooping trust
!
interface port1.0.21
 ip dhcp snooping max-bindings 25
 access-group dhcpsnooping
!
interface port2.0.21
 ip dhcp snooping max-bindings 25
 access-group dhcpsnooping
!
interface port2.0.44
 access-group dhcpsnooping
!
interface port3.0.1
 ip dhcp snooping trust
!
interface port3.0.21
 ip dhcp snooping max-bindings 25
!
interface port4.0.24
 access-group dhcpsnooping
!
interface po1
 ip dhcp snooping max-bindings 25
 arp security violation log
!
interface sa1
 ip dhcp snooping max-bindings 25
 access-group dhcpsnooping
 arp security violation log
!
interface vlan100
 ip dhcp snooping
 arp security
!
interface vlan200
 ip dhcp snooping
 arp security
!
```

Related Commands copy running-config
show running-config

show running-config full

Use this command to show the complete status and configuration of the running system.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config full`

Mode Privileged Exec and Global Configuration

Example To display the complete status and configuration of the running system, use the command:

```
awplus# show running-config full
```

Output Figure 7-17: Example output from the **show running-config full** command

```
awplus#show running-config full
!
no service password-encryption
!
interface lo
ip address 127.0.0.1/8
ipv6 address ::1/128
!
interface vlan1
ip address 10.92.0.16/24
ipv6 address fe80::202:b3ff:fea1:2159/64
!
interface vlan2
ip address 20.10.10.54/24
ipv6 address fe80::200:5eff:fe00:101/64
ipv6 address fe80::202:b3ff:fea1:1567/64
ipv6 address fe80::204:76ff:fee6:6c1c/64
ip rip authentication string abcdefghijklmnop
!
router ospf
ospf router-id 100.100.100.100
no capability opaque
redistribute static
network 10.10.10.0/24 area 3
network 10.10.11.0/24 area 1
network 10.10.16.0/24 area 2
network 192.168.0.0/24 area 1
!
router rip
network vlan2
distance 10
!
router ipv6 rip
!
ip route 5.5.5.0/24 10.10.16.2
!
line con 0
login
line vty 0 4
login
!
end
```

Related Commands copy running-config
show running-config

show running-config interface

This command displays the current configuration of one or more interfaces on the switch.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show running-config interface [<interface-list>]
   [dot1x|ip igmp|ip multicast|ip pim dense-mode|ip pim sparse-mode|
   ipv6 rip|lacp|mstp|ospf|rip|rstp|stp]
```

Parameter	Description
<interface-list>	The interfaces or ports to display information about. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.
`dot1x`	Displays running configuration for 802.1X port authentication for the specified interfaces.
`lacp`	Displays running configuration for LACP (Link Aggregation Control Protocol) for the specified interfaces.
`ip igmp`	Displays running configuration for IGMP (Internet Group Management Protocol) for the specified interfaces.
`ip multicast`	Displays running configuration for general multicast settings for the specified interfaces.
`ip pim sparse-mode`	Displays running configuration for PIM-SM (Protocol Independent Multicast - Sparse Mode) for the specified interfaces.
`ip pim dense-mode`	Displays running configuration for PIM-DM (Protocol Independent Multicasting - Dense Mode) for the specified interfaces.
`mstp`	Displays running configuration for MSTP (Multiple Spanning Tree Protocol) for the specified interfaces.
`ospf`	Displays running configuration for OSPF (Open Shortest Path First) for the specified interfaces.
`rip`	Displays running configuration for RIP (Routing Information Protocol) for the specified interfaces.
`ipv6 rip`	Displays running configuration for RIPng (RIP for IPv6) for the specified interfaces.

Parameter	Description
rstp	Displays running configuration for RSTP (Rapid Spanning Tree Protocol) for the specified interfaces.
stp	Displays running configuration for STP (Spanning Tree Protocol) for the specified interfaces.

Mode Privileged Exec and Global Configuration

Examples To display the current running configuration of your switch for ports 1 to 24, use the command:

```
awplus# show running-config interface port1.0.1-port1.0.24
```

To display the current running configuration of a switch for VLAN 1, use the command:

```
awplus# show running-config interface vlan1
```

To display the current running configuration of a switch for VLANs 1 and 3-5, use the command:

```
awplus# show running-config interface vlan1,vlan3-vlan5
```

To display the current OSPF configuration of your switch for ports 1 to 24, use the command:

```
awplus# show running-config interface port1.0.1-port1.0.24
        ospf
```

To display current IGMP configuration for ports 1 to 12 on XEM 1 and 3, use the command:

```
awplus# show running-config interface
        port1.0.1-1.0.12,port1.3.1-1.3.12 ip igmp
```

Output Figure 7-18: Example output from a **show running-config interface port1.0.2** command

```
awplus#sh running-config interface port1.0.2
!
interface port1.0.2
 switchport
 switchport mode access
!
```

Figure 7-19: Example output from the **show running-config interface** command

```
awplus#sh running-config interface
interface port1.0.1-1.0.24
 switchport
 switchport mode access
!
interface vlan1
 ip address 192.168.1.1/24
 ip rip authentication mode md5
 ip rip authentication string mykey
 ip irdp
!
interface vlan2
 ip address 192.168.2.2/24
 ip rip authentication mode md5
 ip rip authentication key-chain cars
!
```

Related Commands

copy running-config
show running-config

show running-config ip pim dense-mode

Use this command to show the running system status and configuration details for PIM-DM.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config ip pim dense-mode`

Mode Privileged Exec and Global Configuration

Example To display the running system status and configuration details for PIM-DM, use the command:

```
awplus# show running-config ip pim dense-mode
```

Output Figure 7-20: Example output from the **show running-config ip pim dense-mode** command

```
!
ip pim spt-threshold
ip pim accept-register list 1
!
```

Related Commands copy running-config
show running-config

show running-config ip pim sparse-mode

Use this command to show the running system status and configuration details for PIM-SM.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config ip pim sparse-mode`

Mode Privileged Exec and Global Configuration

Example To display the running system status and configuration details for PIM-SM, use the command:

```
awplus# show running-config ip pim sparse-mode
```

Output Figure 7-21: Example output from the **show running-config ip pim sparse-mode** command

```
!
ip pim spt-threshold
ip pim accept-register list 1
!
```

Related Commands copy running-config
show running-config

show running-config ip route

Use this command to show the running system static IPv4 route configuration.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show running-config ip route
```

Mode

Privileged Exec and Global Configuration

Example

To display the running system static IPv4 route configuration, use the command:

```
awplus# show running-config ip route
```

Output

Figure 7-22: Example output from the **show running-config ip route** command

```
!
ip route 3.3.3.3/32 vlan3
ip route 3.3.3.3/32 vlan2
!
```

Related Commands

copy running-config
show running-config

show running-config ipv6 access-list

Use this command to show the running system status and configuration for ipv6 access-list.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config ipv6 access-list`

Mode Privileged Exec and Global Configuration

Example To display the running system status and configuration for ipv6 access-list, use the command:

```
awplus# show running-config ipv6 access-list
```

Output Figure 7-23: Example output from the **show running-config ipv6 access-list** command

```
!
ipv6 access-list abc permit any
!
```

Related Commands copy running-config
show running-config

show running-config ipv6 mroute

Use this command to show the running system IPv6 multicast route configuration.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show running-config ipv6 mroute
```

Mode

Privileged Exec and Global Configuration

Example

To display he running system IPv6 multicast route configuration, use the command:

```
awplus# show running-config ipv6 mroute
```

Output

Figure 7-24: Example output from the **show running-config ipv6 mroute** command

```
!
ipv6 route 3e11::/64 lo
ipv6 route 3e11::/64 vlan2
ipv6 route fe80::/64 vlan3
!
```

Related Commands

copy running-config
show running-config

show running-config ipv6 prefix-list

Use this command to show the running system status and configuration details for ipv6 prefix-list.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config ipv6 prefix-list`

Mode Privileged Exec and Global Configuration

Example To display show the running system status and configuration details for ipv6 prefix-list, use the command:

```
awplus# show running-config ipv6 prefix-list
```

Output Figure 7-25: Example output from the **show running-config ipv6 prefix-list** command

```
!
ipv6 prefix-list sde seq 5 permit any
!
```

Related Commands copy running-config
show running-config

show running-config ipv6 route

Use this command to show the running system static IPv6 route configuration.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show running-config ipv6 route
```

Mode

Privileged Exec and Global Configuration

Example

To display the running system static IPv6 route configuration, use the command:

```
awplus# show running-config ipv6 route
```

Output

Figure 7-26: Example output from the **show running-config ipv6 route** command

```
!
ipv6 route 3e11::/64 lo
ipv6 route 3e11::/64 vlan2
ipv6 route fe80::/64 vlan3
!
```

Related Commands

copy running-config
show running-config

show running-config key chain

Use this command to show the running system key-chain related configuration.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config key chain`

Mode Privileged Exec and Global Configuration

Example To display the running system key-chain related configuration, use the command:

```
awplus# show running-config key chain
```

Output Figure 7-27: Example output from the **show running-config key chain** command

```
!
key chain 12
key 2
key-string 234
!
key chain 123
key 3
key-string 345
!
```

Related Commands copy running-config
show running-config

show running-config lldp

This command shows the current running configuration of LLDP.

Syntax `show running-config lldp`

Mode Privileged Exec and Global Configuration

Example To display the current configuration of LLDP, use the command:

```
awplus# show running-config lldp
```

Output Figure 7-28: Example output from the **show running-config lldp** command

```
awplus#show running-config lldp

lldp notification-interval 10
lldp timer 20
!
interface port1.0.1
 lldp notifications
 lldp tlv-select port-description
 lldp tlv-select system-name
 lldp tlv-select system-description
 lldp tlv-select management-address
 lldp transmit receive
```

Related Commands show lldp
show lldp interface

show running-config prefix-list

Use this command to show the running system status and configuration details for prefix-list.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config prefix-list`

Mode Privileged Exec and Global Configuration

Example To display the running system status and configuration details for prefix-list, use the command:

```
awplus# show running-config prefix-list
```

Output Figure 7-29: Example output from the **show running-config prefix-list** command

```
!
ip prefix-list abc seq 5 permit any
ip prefix-list as description annai
ip prefix-list wer seq 45 permit any
!
```

Related Commands copy running-config
show running-config

show running-config route-map

Use this command to show the running system status and configuration details for route-map.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config route-map`

Mode Privileged Exec and Global Configuration

Example To display the running system status and configuration details for route-map, use the command:

```
awplus# show running-config route-map
```

Output Figure 7-30: Example output from the **show running-config route-map** command

```
!
route-map abc deny 2
match community 2
!
route-map abc permit 3
match route-type external type-2
set metric-type type-1
!
```

Related Commands copy running-config
show running-config

show running-config router

Use the show running-config router command to display the current running configuration for a given router.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config router <protocol>`

Parameter	Description
<protocol>	bgp | ospf | rip |ipv6 rip | vrrp
`bgp`	Border Gateway Protocol (BGP)
`ospf`	Open Shortest Path First (OSPF)
`rip`	Routing Information Protocol (RIP)
`ipv6 rip`	rip IPv6 RIP
`vrrp`	Virtual Redundancy Routing Protocol (VRRP)

Mode Privileged Exec and Global Configuration

Example To display the current running configuration for a given router, use the command:

```
awplus# show running-config router ospf
```

Output Figure 7-31: Example output from the **show running-config router** command

```
!
router ospf
 network 192.168.1.0/24 area 0.0.0.0
 network 192.168.3.0/24 area 0.0.0.0
!
```

Related Commands copy running-config
show running-config

show running-config router-id

Use this command to show the running system global router ID configuration.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config router-id`

Mode Privileged Exec and Global Configuration

Example To display the running system global router ID configuration, use the command:

```
awplus# show running-config router-id
```

Output Figure 7-32: Example output from the **show running-config router-id** command

```
!
router-id 3.3.3.3
!
```

Related Commands copy running-config
show running-config

show running-config security-password

This command displays the configuration settings for the various security-password rules. If a default parameter is used for a security-password rule, therefore disabling that rule, no output is displayed for that feature.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show running-config security-password
```

Mode

Privileged Exec and Global Configuration

Example

To display the current security-password rule settings in the running-config, use the command:

```
awplus# show running-config security-password
```

Output

Figure 7-33: Example output from the **show running-config security-password** command

```
security-password minimum-length 8
security-password minimum-categories 3
security-password history 4
security-password lifetime 30
security-password warning 3
security-password forced-change
```

Related Commands

show security-password configuration
show security-password user

show running-config switch

Use this command to show the running system status and configuration details for a given switch.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config switch <switch-protocol>`

Parameter	Description
<switch-protocol>	dot1x | mstp | rstp | stp
`dot1x`	802.1X Port-Based Authentication
`mstp`	Multiple Spanning Tree Protocol (MSTP)
`rstp`	Rapid Spanning Tree Protocol (RSTP)
`stp`	Spanning Tree Protocol (RSTP)

Mode Privileged Exec and Global Configuration

Example To display the running system status and configuration details for a given switch, use the command:

```
awplus# show running-config switch stp
```

Output Figure 7-34: Example output from the **show running-config switch** command

```
!
bridge 6 ageing-time 45
bridge 6 priority 4096
bridge 6 max-age 7
```

Related Commands copy running-config
show running-config

show running-config switch lacp

Use this command to show the running system LACP related configuration.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config switch lacp`

Mode Privileged Exec and Global Configuration

Example To display the running system LACP related configuration, use the command:

```
awplus# show running-config switch lacp
```

Output Figure 7-35: Example output from the **show running-config switch lacp** command

```
!
lacp system-priority 23
!
```

Related Commands copy running-config
show running-config

show running-config switch radius-server

Use this command to show the running system RADIUS-server related configuration.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config switch radius-server`

Mode Privileged Exec and Global Configuration

Example To display the running system radius-server related configuration, use the command:

```
awplus# show running-config switch radius-server
```

Output Figure 7-36: Example output from the **show running-config switch radius-server** command

```
!
radius-server key abc
!
```

Related Commands copy running-config
show running-config

show running-config switch vlan

Use this command to show the running system VLAN related configuration.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config switch vlan`

Mode Privileged Exec and Global Configuration

Example To display the running system VLAN related configuration, use the command:

```
awplus# show running-config switch vlan
```

Output Figure 7-37: Example output from the **show running-config switch vlan** command

```
!
vlan database
vlan 4 bridge 2 name VLAN0004
vlan 4 bridge 2 state enable
```

Related Commands copy running-config
show running-config

show startup-config

This command displays the contents of the start-up configuration file, which is the file that the device runs on start-up.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show startup-config`

Mode Privileged Exec

Example To display the contents of the current start-up configuration file, use the command:

```
awplus# show startup-config
```

Output Figure 7-38: Example output from the **show startup-config** command

```
awplus#show startup-config
!
service password-encryption
!
username manager privilege 15 password 8 $1$bJoVec4D$JwOJGPr7YqoExA0GVasdE0
!
no service ssh
!
service telnet
!
service http
!
no clock timezone
!
platform jumboframe
platform routingratio ipv4andipv6
.
.
.
line con 0
line vty 0 4
!
end
```

Related Commands
boot config-file
copy running-config
copy startup-config
erase startup-config
show boot

show version

This command displays the version number and copyright details of the current AlliedWare Plus™ OS your device is running.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show version`

Mode User Exec and Privileged Exec

Example To display the version details of your currently installed software, use the command:

```
awplus# show version
```

Output Figure 7-39: Example output from the **show version** command

```
awplus#show version

AlliedWare Plus (TM) 5.4.1 12/08/10 12:13:19

Build name : x900-5.4.2.rel
Build date : Wed Dec 2 12:13:19 NZDT 2011
Build type : RELEASE
 NET-SNMP SNMP agent software
 (c) 1996, 1998-2000 The Regents of the University of California.
     All rights reserved;
 (c) 2001-2003, Networks Associates Technology, Inc. All rights reserved;
 (c) 2001-2003, Cambridge Broadband Ltd. All rights reserved;
 (c) 2003, Sun Microsystems, Inc. All rights reserved.
 RSA Data Security, Inc. MD5 Message-Digest Algorithm
 (c) 1991-2, RSA Data Security, Inc. Created 1991. All rights reserved.
 Libedit Library
 (c) 1992, 1993 The Regents of the University of California.
     All rights reserved.
 OpenSSL Library
 Copyright (c) 1998-2008 The OpenSSL Project. All rights reserved.
 Original SSLeay License
 Copyright (C) 1995-1998 Eric Young (eay@cryptsoft.com).
 sFlow(R) Agent Software
 Copyright (c) 2002-2006 InMon Corp.
 DHCP Library
 Copyright (c) 2004-2010 by Internet Systems Consortium, Inc;
 Copyright (c) 1995-2003 by Internet Software Consortium.
 Application Interface Specification Framework
 Copyright (c) 2002-2004 MontaVista Software, Inc;
 Copyright (c) 2005-2010 Red Hat, Inc.
 Hardware Platform Interface Library
 Copyright (c) 2003, Intel Corporation;
 Copyright (C) IBM Corp. 2003-2007.
 Corosync Cluster Engine
 Copyright (c) 2002-2004 MontaVista Software, Inc. All rights reserved.
 File Utility Library
 Copyright (c) Ian F. Darwin 1986-1987, 1989-1992, 1994-1995.
 Software written by Ian F. Darwin and others;
 maintained 1994- Christos Zoulas.

Portions of this product are covered by the GNU GPL, source code may be
downloaded from: http://www.alliedtelesis.co.nz/support/gpl/awp.html
```

Related Commands boot system
show boot

write file

This command copies the running-config into the file that is set as the current startup-config file. This command is a synonym of the write memory and copy running-config startup-config commands.

Syntax `write [file]`

Mode Privileged Exec

Example To write configuration data to the start-up configuration file, use the command:

```
awplus# write file
```

Related Commands copy running-config
write memory
show running-config

write memory

This command copies the running-config into the file that is set as the current startup-config file. This command is a synonym of the write file and copy running-config startup-config commands.

Syntax `write [memory]`

Mode Privileged Exec

Example To write configuration data to the start-up configuration file, use the command:

```
awplus# write memory
```

Related Commands copy running-config
write file
show running-config

write terminal

This command displays the current configuration of the device. This command is a synonym of the show running-config command.

Syntax `write terminal`

Mode Privileged Exec

Example To display the current configuration of your device, use the command:

```
awplus# write terminal
```

Related Commands show running-config

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Command List

This chapter provides an alphabetical reference of commands for configuring and monitoring the system.

banner exec

This command configures the User Exec mode banner that is displayed on the console after you login. The banner exec default command restores the User Exec banner to the default banner. Use the no banner exec command to disable the User Exec banner and remove the default User Exec banner.

Syntax

```
banner exec <banner-text>
banner exec default
no banner exec
```

Default By default, the AlliedWare Plus™ version and build date is displayed at console login, such as:

```
AlliedWare Plus (TM) 5.4.1 07/27/10 00:44:25
```

Mode Global Configuration

Examples To configure a User Exec mode banner after login, enter the following commands:

```
awplus#configure terminal
awplus(config)#banner exec enable to move to Priv Exec mode
awplus(config)#exit
awplus#exit

awplus login: manager
Password:
enable to move to Priv Exec mode
awplus>
```

To restore the default User Exec mode banner after login, enter the following commands:

```
awplus#configure terminal
awplus(config)#banner exec default
awplus(config)#exit
awplus#exit

awplus login: manager
Password:

AlliedWare Plus (TM) 5.4.1 11/14/10 13:03:59

awplus>
```

To remove the User Exec mode banner after login, enter the following commands:

```
awplus#configure terminal
awplus(config)#banner exec default
awplus(config)#exit
awplus#exit

awplus login: manager
Password:
awplus>
```

Related Commands banner login (system)
banner motd

banner login (system)

This command configures the login banner that is displayed on the console when you login. The login banner is displayed on all connected terminals. The login banner is displayed after the MOTD (Message-of-the-Day) banner and before the login username and password prompts.

Use the no banner login command to disable the login banner.

Syntax

```
banner login
no banner login
```

Default By default, no login banner is displayed at console login.

Mode Global Configuration

Examples To configure a login banner to be displayed when you login, enter the following commands:

```
awplus#configure terminal
awplus(config)#banner login
Type CNTL/D to finish.
authorised users only
awplus(config)#exit
awplus#exit

authorised users only
awplus login: manager
Password:

AlliedWare Plus (TM) 5.4.1 11/14/10 13:03:59

awplus>
```

To remove the login banner, enter the following commands:

```
awplus#configure terminal
awplus(config)#no banner login
awplus(config)#exit
awplus#exit

awplus login: manager
Password:

awplus>
```

Related Commands

banner exec
banner motd

banner motd

Use this command to change the text MOTD (Message-of-the-Day) banner displayed before login. The MOTD banner is displayed on all connected terminals. The MOTD banner is useful for sending messages that affect all network users, for example, any imminent system shutdowns.

Use the no variant of this command to not display a text MOTD (Message-of-the-Day) banner on login.

Syntax

```
banner motd <motd-text>
no banner motd
```

Default By default, the switch displays the AlliedWare Plus™ OS version and build date before login.

Mode Global Configuration

Examples To configure a MOTD banner to be displayed when you login, enter the following commands:

```
awplus>enable
awplus#configure terminal
awplus(config)#banner motd system shutdown at 6pm
awplus(config)#exit
awplus#exit

system shutdown at 6pm
awplus login: manager
Password:

AlliedWare Plus (TM) 5.4.1 11/14/10 13:03:59
```

To remove the login banner, enter the following commands:

```
awplus>enable
awplus#configure terminal
awplus(config)#no banner motd
awplus(config)#exit
awplus#exit

awplus login: manager
Password:

AlliedWare Plus (TM) 5.4.1 11/14/10 13:03:59

awplus>
```

Related Commands

banner exec
banner login (system)

clock set

This command sets the time and date for the system clock.

Syntax `clock set <hh:mm:ss> <day> <month> <year>`

Parameter	Description
<hh:mm:ss>	Local time in 24-hour format
<day>	Day of the current month <1-31>
<month>	The first three letters of the current month.
<year>	Current year <2000-2035>

Mode Privileged Exec

Usage Configure the timezone before setting the local time. Otherwise, when you change the timezone, the device applies the new offset to the local time.

Note If Network Time Protocol (NTP) is enabled, then you cannot change the time or date using this command. NTP maintains the clock automatically using an external time source. If you wish to manually alter the time or date, you must first disable NTP.

Example To set the time and date on your system to 2pm on the 2nd of April 2007, use the command:

```
awplus# clock set 14:00:00 2 apr 2007
```

Related Commands clock timezone

clock summer-time date

This command defines the start and end of summertime for a specific year only, and specifies summertime's offset value to Standard Time for that year.

The no variant of this command removes the device's summertime setting. This clears both specific summertime dates and recurring dates (set with the clock summer-time recurring command on page 8.10).

By default, the device has no summertime definitions set.

Syntax

```
clock summer-time <timezone-name> date <start-day> <start-month>
   <start-year> <start-time> <end-day> <end-month> <end-year>
   <end-time> <1-180>

no clock summer-time
```

Parameter	Description
<timezone-name>	A description of the summertime zone, up to 6 characters long.
date	Specifies that this is a date-based summertime setting for just the specified year.
<start-day>	Day that the summertime starts, in the range 1-31.
<start-month>	First three letters of the name of the month that the summertime starts.
<start-year>	Year that summertime starts, in the range 2000-2035.
<start-time>	Time of the day that summertime starts, in the 24-hour time format HH:MM.
<end-day>	Day that summertime ends, in the range 1-31.
<end-month>	First three letters of the name of the month that the summertime ends.
<end-year>	Year that summertime ends, in the range 2000-2035.
<end-time>	Time of the day that summertime ends, in the 24-hour time format HH:MM.
<1-180>	The offset in minutes.

Mode Global Configuration

Examples To set a summertime definition for New Zealand using NZST (UTC+12:00) as the standard time, and NZDT (UTC+13:00) as summertime, with the summertime set to begin on the 1st October 2007 and end on the 18th of March 2008:

```
awplus(config)# clock summer-time NZDT date 1 oct 2:00 2007 18
                mar 2:00 2008 60
```

To remove any summertime settings on the system, use the command:

```
awplus(config)# no clock summer-time
```

Related Commands clock summer-time recurring
clock timezone

clock summer-time recurring

This command defines the start and end of summertime for every year, and specifies summertime's offset value to Standard Time.

The no variant of this command removes the device's summertime setting. This clears both specific summertime dates (set with the clock summer-time date command on page 8.8) and recurring dates.

By default, the device has no summertime definitions set.

Syntax

```
clock summer-time <timezone-name> recurring <start-week> <start-day>
   <start-month> <start-time> <end-week> <end-day> <end-month>
   <end-time> <1-180>

no clock summer-time
```

Parameter	Description
<timezone-name>	A description of the summertime zone, up to 6 characters long.
`recurring`	Specifies that this summertime setting applies every year from now on.
<start-week>	Week of the month when summertime starts, in the range 1-5. The value 5 indicates the last week that has the specified day in it for the specified month. For example, to start summertime on the last Sunday of the month, enter 5 for *<start-week>* and sun for *<start-day>*.
<start-day>	Day of the week when summertime starts. Valid values are mon, tue, wed, thu, fri, sat or sun.
<start-month>	First three letters of the name of the month that summertime starts.
<start-time>	Time of the day that summertime starts, in the 24-hour time format HH:MM.
<end-week>	Week of the month when summertime ends, in the range 1-5. The value 5 indicates the last week that has the specified day in it for the specified month. For example, to end summertime on the last Sunday of the month, enter 5 for *<end-week>* and sun for *<end-day>*.
<end-day>	Day of the week when summertime ends. Valid values are mon, tue, wed, thu, fri, sat or sun.
<end-month>	First three letters of the name of the month that summertime ends.
<end-time>	Time of the day that summertime ends, in the 24-hour time format HH:MM.
<1-180>	The offset in minutes.

Mode Global Configuration

Examples To set a summertime definition for New Zealand using NZST (UTC+12:00) as the standard time, and NZDT (UTC+13:00) as summertime, with summertime set to start on the 1st Sunday in October, and end on the 3rd Sunday in March, use the command:

```
awplus(config)# clock summer-time NZDT recurring 1 sun oct 2:00
                3 sun mar 2:00 60
```

To remove any summertime settings on the system, use the command:

```
awplus(config)# no clock summer-time
```

Related Commands clock summer-time date
clock timezone

clock timezone

This command defines the device's clock timezone. The timezone is set as a offset to the UTC.

The no variant of this command resets the system time to UTC.

By default, the system time is set to UTC.

Syntax

```
clock timezone <timezone-name> {minus|plus} [<0-13>|<0-12>:<00-59>]
no clock timezone
```

Parameter	Description
<timezone-name>	A description of the timezone, up to 6 characters long.
minus or plus	The direction of offset from UTC. The minus option indicates that the timezone is behind UTC. The plus option indicates that the timezone is ahead of UTC.
<0-13>	The offset in hours or from UTC.
<0-12>:<00-59>	The offset in hours or from UTC.

Mode Global Configuration

Usage Configure the timezone before setting the local time. Otherwise, when you change the timezone, the device applies the new offset to the local time.

Examples To set the timezone to New Zealand Standard Time with an offset from UTC of +12 hours, use the command:

```
awplus(config)# clock timezone NZST plus 12
```

To set the timezone to Indian Standard Time with an offset from UTC of +5:30 hours, use the command:

```
awplus(config)# clock timezone NZST plus 5:30
```

To set the timezone back to UTC with no offsets, use the command:

```
awplus(config)# no clock timezone
```

Related Commands clock set
clock summer-time date
clock summer-time recurring

continuous-reboot-prevention

Use this command to enable and to configure the continuous reboot prevention feature. Continuous reboot prevention allows the user to configure the time period during which reboot events are counted, the maximum number of times the switch can reboot within the specified time period, referred to as the threshold, and the action to take if the threshold is exceeded.

Use the no variant of this command to disable the continuous reboot prevention feature or to return the period, threshold and action parameters to the defaults.

Syntax

```
continuous-reboot-prevention enable

continuous-reboot-prevention [period <0-604800>] [threshold <1-10>]
   [action [linkdown|logonly|stopreboot]]

no continuous-reboot-prevention enable

no continuous-reboot-prevention [period] [threshold] [action]}
```

Parameter	Description	
`enable`	Enable the continuous reboot prevention feature.	
`period`	Set the period of time in which reboot events are counted.	
	<0-604800>	Period value in seconds. The default is 600.
`threshold`	Set the maximum number of reboot events allowed in the specified period.	
	<1-10>	Threshold value. The default is 1.
`action`	Set the action taken if the threshold is exceeded.	
	`linkdown`	Reboot procedure continues and all switch ports and stack ports stay link down. The reboot event is logged. This is the default action.
	`logonly`	Reboot procedure continues normally and the reboot event is logged.
	`stopreboot`	Reboot procedure stops until the user enters the key ”c” via the CLI. Normal reboot procedure then continues and the reboot event is logged.

Default Continuous reboot prevention is disabled by default. The default `period` value is `600`, the default `threshold` value is `1` and the default `action` is `linkdown`.

Mode Global Configuration

Examples To enable continuous reboot prevention, use the commands:

```
awplus# configure terminal
awplus(config)# continuous-reboot-prevention enable
```

To set the `period` to `500` and `action` to `stopreboot`, use the commands:

```
awplus# configure terminal
awplus(config)# continuous-reboot-prevention period 500
action stopreboot
```

To return the `period` and `action` to the defaults and keep the continuous reboot prevention feature enabled, use the commands:

```
awplus# configure terminal
awplus(config)# no continuous-reboot-prevention period action
```

To disable continuous reboot prevention, use the commands:

```
awplus# configure terminal
awplus(config)# no continuous-reboot-prevention enable
```

Related Commands

show continuous-reboot-prevention
show reboot history
show tech-support

diagnostic monitor pcsping

Use this command to disable or configure the background PCS (Physical Coding Sublayer) ping monitoring feature to either output a log message or to power off a XEM when a background PCS ping check fails.

Use the no variant of this command to re-enable the PCS ping monitoring feature, or restore default behavior to output a log message and not power off a XEM.

The background PCS ping feature is enabled by default to output log messages.

Syntax

```
diagnostic monitor pcsping {disable|power-off}
no diagnostic monitor pcsping {disable|power-off}
```

Parameter	Description
`disable`	Select this required parameter to disable the background PCS (Physical Coding Sublayer) ping monitoring feature (not recommended). Negate a diagnostic monitor pcsping disable command to re-enable the background PCS ping feature.
`power-off`	Select this required parameter to power off a XEM if a background PCS (Physical Coding Sublayer) ping is not received on a XEM. Negate a diagnostic monitor pcsping power-off command to output a log message instead of powering off a XEM, restoring default behavior.

Default This feature is enabled by default to log a message when a background PCS ping check fails. Default behavior is restored by negating a diagnostic monitor pcsping power-off command.

Mode Global Configuration

Usage The background PCS ping feature implements background hardware monitoring to ensure the connections between the switch and the XEMs are working correctly, which is done by this feature periodically sending PCS pings to connected XEMs on a switch, by default.

A PCS ping is a small message that is sent across a switch link at the PHY layer. The PCS ping message contains data that identifies the source at one end of the link. If a PCS ping message is delivered then a XEM to switch link works.

To re-enable background PCS ping monitoring negate a diagnostic monitor pcsping disable command. A no diagnostic monitor pcsping disable command will re-enable the feature.

To log a message and not power off a XEM, negate a diagnostic monitor pcsping power-off command. A no diagnostic monitor pcsping power-off command will not power off a XEM.

Note We recommend that you do not disable the PCSping function, because this may conceal the existence of a faulty XEM module.

Examples To disable the background PCS ping monitoring feature, use the following commands:

```
awplus# configure terminal
awplus(config)# diagnostic monitor pcsping disable
```

Output Figure 8-1: Example output from a **show diagnostic monitor pcsping** command after issuing a **diagnostic monitor pcsping disable** command to disable the feature

```
awplus# configure terminal
awplus(config)# diagnostic monitor pcsping disable
awplus(config)# exit
awplus# show diagnostic monitor pcsping
Background PCS Ping Monitoring Information
Enabled: No
Power-off XEM if a PCS Ping fails: No
```

To re-enable the background PCS ping monitoring feature, use the following commands:

```
awplus# configure terminal
awplus(config)# no diagnostic monitor pcsping disable
```

Output Figure 8-2: Example output from a **show diagnostic monitor pcsping** command after issuing a **no diagnostic monitor pcsping disable** command to re-enable the feature

```
awplus# configure terminal
awplus(config)# no diagnostic monitor pcsping disable
awplus(config)# exit
awplus# show diagnostic monitor pcsping
Background PCS Ping Monitoring Information
Enabled: Yes
Power-off XEM if a PCS Ping fails: No
```

To power off a XEM when a background PCS ping check fails, use the following commands:

```
awplus# configure terminal
awplus(config)# diagnostic monitor pcsping power-off
```

Output Figure 8-3: Example output from a **show diagnostic monitor pcsping** command after issuing a **diagnostic monitor pcsping power-off** command to configure XEM power-off

```
awplus# configure terminal
awplus(config)# diagnostic monitor pcsping power-off
awplus(config)# exit
awplus# show diagnostic monitor pcsping
Background PCS Ping Monitoring Information
Enabled: Yes
Power-off XEM if a PCS Ping fails: Yes
```

To not power off a XEM, and only log a message, when a background PCS ping check fails, use the following commands:

```
awplus# configure terminal
awplus(config)# no diagnostic monitor pcsping power-off
```

Output Figure 8-4: Example output from a **show diagnostic monitor pcsping** command after issuing a **no diagnostic monitor pcsping power-off** command to restore log output

```
awplus# configure terminal
awplus(config)# no diagnostic monitor pcsping power-off
awplus(config)# exit
awplus# show diagnostic monitor pcsping
Background PCS Ping Monitoring Information
Enabled: Yes
Power-off XEM if a PCS Ping fails: No
```

Validation Commands show diagnostic monitor pcsping
show running-config

ecofriendly led

Use this command to enable the eco-friendly feature which turns off power to the port LEDs on XEMs installed in the switch, the stack ID LED on the XEM-STK and all port LEDs on the switch, except the eth0 port. On the switch, power to the fault, SD and PSU LEDs is not disabled, and in addition, on the SwitchBlade® x908 power to the stacking status LED is not disabled. On the XEM-1XP and XEM-2XP power to the XFP LED is not disabled.

Use the no variant of this command to disable the eco-friendly feature.

Syntax

```
ecofriendly led
no ecofriendly led
```

Default The eco-friendly feature is disabled by default.

Mode Global Configuration

Usage When the eco-friendly feature is enabled, a change in port status will not affect the display of the associated LED. When the eco-friendly feature is disabled and power is returned to port LEDs, the LEDs will correctly show the current state of the ports.

In a stack environment, enabling the eco-friendly feature on the stack master will apply the feature to every member of the stack.

For an example of how to configure a trigger to enable the eco-friendly feature, see "Turn Off Power to Port LEDs" on page 96.7.

Example To enable the eco-friendly feature which turns off power to all port LEDs, use the following commands:

```
awplus# configure terminal
awplus(config)# ecofriendly led
```

To disable the eco-friendly feature, use the following command:

```
awplus# configure terminal
awplus(config)# no ecofriendly led
```

Related Commands show ecofriendly

hostname

This command sets the name applied to the device as shown at the prompt. The hostname is:

- displayed in the output of the show system command
- displayed in the CLI prompt so you know which device you are configuring
- stored in the MIB object sysName

Use the no variant of this command to reset the hostname to the default (`awplus`).

On a stack, after the stack master is elected, the master will have a host name: `awplus` by default, and this also becomes the name of the stack. Individual stack members (excluding the master) will have a host name that is the stack name hyphenated with a numeric suffix. For example, `awplus-1`, `awplus-2` and so on.

The hostname command can then be used to change the stack name and the stack master's host name. For example, for the hostname `Lab` the stack master's host name will be `Lab` and the other stack members will have host names `Lab-1`, `Lab-2` and so on.

In case of stack master fail-over, or stack split, the new stack will use the previous stack name as its host name and the stack name, unless it is changed by executing hostname command on the new stack master.

Use the no variant of this command to revert the hostname setting to its default (`awplus`).

Syntax

```
hostname <hostname>
no hostname [<hostname>]
```

Parameter	Description
<hostname>	Specifies the network name of the system.

Default The default hostname is `awplus`.

Mode Global Configuration

Usage To specify or modify the host name, use the hostname global configuration command. The host name is used in prompts and default configuration filenames.

The name must also follow the rules for ARPANET host names. The name must start with a letter, end with a letter or digit, and use only letters, digits, and hyphens. Refer to RFC 1035.

Example To set the system name to `HQ-Sales`, use the command:

```
awplus# configure terminal
awplus(config)# hostname HQ-Sales
```

This changes the prompt to:

```
HQ-Sales(config)#
```

To revert to the default hostname `awplus`, use the command:

```
awplus# configure terminal
awplus(config)# no hostname
```

This changes the prompt to:

```
awplus(config)#
```

Related Commands show system

max-fib-routes

This command now enables you to control the maximum number of FIB routes configured. It operates by providing parameters that enable you to configure preset maximums and warning message thresholds. The operation of these parameters is explained in the Parameter / Descriptions table shown below.

Note

To set the max-fib-routes for a VRF Instance, use the max-fib-routes (VRF) command on page 46.12.

To set static routes, use the max-static-routes command on page 8.21.

Use the no variant of this command to set the maximum number of fib routes to the default of 4294967294 fib routes.

Syntax

```
max-fib-routes <1-4294967294>
no max-fib-routes
```

Syntax

```
max-fib-routes <1-4294967294> [<1-100>|warning-only]
no max-fib-routes
```

Parameter	Description
`max-fib-routes`	This is a the maximum number of routes that can be stored in Forwarding Information dataBase for a VRF instance. In practice, other practical system limits would prevent this maximum being reached.
<1-4294967294>	The allowable configurable range for setting maximum the number of FIB-routes.
<1-100>	This parameter enables you to optionally apply a percentage value. This percentage will be based on the maximum number of FIB routes you have specified. This will cause a warning message to appear when your routes reach your specified percentage value. Routes can continue to be added until your configured maximum value is reached.
`warning-only`	This parameter enables you to optionally apply a warning message. If you set this option a warning message will appear if your maximum configured value configured. Routes can continue to be added until your switch reaches either the maximum capacity value of 4294967294, or a practical system limit.

Default The default number of fib routes is the maximum number of fib routes (4294967294).

Mode Global Configuration

Examples To set the maximum number of dynamic routes to 2000 and warning threshold of 75%, use the following commands:

```
awplus# config terminal
awplus(config)# max-fib-routes 2000 75
```

Related Commands max-fib-routes (VRF)

max-static-routes

Use this command to set the maximum number of static routes, excluding FIB (Forwarding Information Base) routes. Note that FIB routes are set and reset using max-fib-routes.

Use the no variant of this command to set the maximum number of static routes to the default of 1000 static route.

Note To set the max-static-routes for a VRF Instance, use the max-fib-routes (VRF) command on page 46.12.

To set dynamic FIB routes, use the max-fib-routes command on page 8.20.

Syntax

```
max-static-routes <1-1000>

no max-static-routes
```

Default The default number of static routes is the maximum number of static routes (1000).

Mode Global Configuration

Example To reset the maximum number of static routes to the default maximum, use the command:

```
awplus# configure terminal

awplus(config)# no max-static-routes
```

Note Static routes are applied before adding routes to the RIB (Routing Information Base). Therefore, rejected static routes will not appear in the running config.

Related Commands max-fib-routes

no debug all

This command disables the debugging facility for all features on your device. This stops the device from generating any diagnostic debugging messages.

The debugging facility is disabled by default.

Syntax `no debug all [bgp|dot1x|ipv6|nsm|ospf|vrrp]`

Parameter	Description
`bgp`	Turns off all debugging for BGP (Border Gateway Protocol).
`dot1x`	Turns off all debugging for IEEE 802.1X port-based network access-control.
`ipv6`	Turns off all debugging for IPv6 (Internet Protocol version 6).
`nsm`	Turns off all debugging for the NSM (Network Services Module).
`ospf`	Turns off all debugging for OSPF (Open Path Shortest First).
`vrrp`	Turns off all debugging for VRRP (Virtual Router Redundancy Protocol).

Mode Global Configuration and Privileged Exec

Example To disable debugging for all features, use the command:

```
awplus# no debug all
```

To disable all bgp debugging, use the command:

```
awplus# no debug all
```

To disable all 802.1X debugging, use the command:

```
awplus# no debug all
```

To disable all IPv6 debugging, use the command:

```
awplus# no debug all
```

To disable all NSM debugging, use the command:

```
awplus# no debug all
```

To disable all OSPF debugging, use the command:

```
awplus# no debug all ospf
```

To disable all VRRP debugging, use the command:

```
awplus# no debug all vrrp
```

Related Commands undebug all

reboot

This command halts and performs a cold restart (also known as reboot or reload) on either a stand-alone device, a stack, or a specified stack member. It displays a confirmation request before restarting any devices.

Syntax

```
reboot [stack-member <1-8>]
reload [stack-member <1-8>]
```

Parameter	Description
`stack-member`	Restart the specified stack member.
<1-8>	The ID of the stack member to be restarted.

Mode Privileged Exec

Usage The reboot and reload commands perform the same action.

When restarting the whole stack, you can either use this reboot command to reboot all stack members immediately, or to minimize downtime, reboot the stack members in a rolling sequence by using the reboot rolling command on page 103.7.

Examples To restart the stand-alone device, use the command:

```
awplus# reboot
reboot system? (y/n): y
```

To restart all devices in the stack, use the command:

```
awplus# reboot
Are you sure you want to reboot the whole stack? (y/n): y
```

To restart stack member 3, use the command:

```
awplus# reboot stack-member 3
reboot stack-member 3 system? (y/n): y
```

If the specified stack member ID does not exist in the current stack, the command is rejected.

Related Commands

reboot rolling
reload rolling

reload

This command performs the same function as the reboot command on page 8.23.

show clock

This command displays the system's current configured local time and date. It also displays other clock related information such as timezone and summertime configuration.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show clock`

Mode User Exec and Privileged Exec

Example To display the system's current local time, use the command:

```
awplus# show clock
```

Output Figure 8-5: Example output from the **show clock** command for a switch using New Zealand time

```
Local Time: Mon,  6 Aug 2007 13:56:06 +1200
UTC Time:   Mon,  6 Aug 2007 01:56:06 +0000
Timezone: NZST
Timezone Offset: +12:00
Summer time zone: NZDT
Summer time starts: Last Sunday in September at 02:00:00
Summer time ends: First Sunday in April at 02:00:00
Summer time offset: 60 mins
Summer time recurring: Yes
```

Table 8-1: Parameters in the output of the **show clock** command

Parameter	Description
`Local Time`	Current local time.
`UTC Time`	Current UTC time.
`Timezone`	The current configured timezone name.
`Timezone Offset`	Number of hours offset to UTC.
`Summer time zone`	The current configured summertime zone name.
`Summer time starts`	Date and time set as the start of summer time.
`Summer time ends`	Date and time set as the end of summer time.
`Summer time offset`	Number of minutes that summer time is offset from the system's timezone.
`Summer time recurring`	Whether the device will apply the summer time settings every year or only once.

Related Commands
clock set
clock summer-time date
clock summer-time recurring
clock timezone

show continuous-reboot-prevention

This command displays the current continuous reboot prevention configuration.

Syntax `show continuous-reboot-prevention`

Mode User Exec and Privileged Exec

Examples To show the current continuous reboot prevention configuration, use the command:

```
awplus# show continuous-reboot-prevention
```

Output Figure 8-6: Example output from the **show continuous-reboot-prevention** command

```
-----------------------------------------------
Continuous reboot prevention
-----------------------------------------------
status=disabled
period=600
threshold=1
action=linkdown
-----------------------------------------------
```

Related Commands continuous-reboot-prevention
show reboot history

show cpu

This command displays a list of running processes with their CPU utilization.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show cpu [<1-8>] [sort {thrds|pri|sleep|runtime}]`

Parameter	Description	
<1-8>	The stack member to display output for.	
`sort`	Whether to sort the list by a specified field. If you do not specify this, then the list is sorted by percentage CPU utilization.	
	`thrds`	The list is sorted by the number of threads.
	`pri`	The list is sorted by the process priority.
	`sleep`	The list is sorted by the average time sleeping.
	`runtime`	The list is sorted by the runtime of the process.

Mode User Exec and Privileged Exec

Usage Entering this command on the stack master will display the information of all the stack members. A stack member heading will distinguish the different information for every stack member device.

Entering this command for a specific stack member (as a host-directed command) will display the information for that stack member.

Examples To show the CPU utilization of current processes, sorting them by the number of threads the processes are using, use the command:

```
awplus# show cpu sort thrds
```

Note that in a stack environment, executing this command on the stack master will show CPU utilization for all stack members.

To show CPU utilization for a specific stack member (in this case stack member 3), use the following command:

```
awplus# show cpu 3
```

Output Figure 8-7: Example output from the **show cpu** command

```
Stack member 1:

CPU averages:
 1 second: 5%, 20 seconds: 0%, 60 seconds: 0%
System load averages:
 1 minute: 0.00, 5 minutes: 0.00, 15 minutes: 0.00
Current CPU load:
 userspace: 4%, kernel: 1%, interrupts: 0% iowaits: 0%

user processes
==============
  pid name             thrds  cpu%   pri state sleep% runtime
 1532 hostd               1   1.9    20   run      0   103
 1113 exfx               18   0.9    20 sleep      0  3374
 1225 aisexec            44   0.9    -2 sleep      0  2290
 1630 mstpd               1   0.9    20 sleep      0    86
    1 init                1   0.0    20 sleep      0   799
 6149 sh                  1   0.0    20 sleep      0     0
 6150 corerotate          1   0.0    20 sleep      0     0
  801 syslog-ng           1   0.0    20 sleep      0   287
  807 klogd               1   0.0    20 sleep      0     1
  858 inetd               1   0.0    20 sleep      0    21
  868 portmap             1   0.0    20 sleep      0     0
  879 crond               1   0.0    20 sleep      0     1
 1038 openhpid           10   0.0    20 sleep      0   161
 1057 hpilogd             1   0.0    20 sleep      0     0
 1147 stackd              1   0.0    20 sleep      0    10
 1170 hsl                 1   0.0    20 sleep      0     1
 1258 rpc.statd           1   0.0    20 sleep      0     0
 1262 rpc.statd           1   0.0    20 sleep      0     0
 1268 rpc.mountd          1   0.0    20 sleep      0     0
 1361 automount           1   0.0    20 sleep      0    84
 1395 ntpd                1   0.0    20 sleep      0    18
 1440 authd               1   0.0    20 sleep      0    89
 1463 bgpd                1   0.0    20 sleep      0    88
 1483 cntrd               1   0.0    20 sleep      0    89
 1509 epsrd               1   0.0    20 sleep      0    90
 1560 imi                 1   0.0    20 sleep      0    87
 1581 irdpd               1   0.0    20 sleep      0    90
 1603 lacpd               1   0.0    20 sleep      0    86
 1653 nsm                 1   0.0    20 sleep      0   111
 1678 ospfd               1   0.0    20 sleep      0    89
 1700 pdmd                1   0.0    20 sleep      0    88
 1722 pimd                1   0.0    20 sleep      0    87
 1743 ripd                1   0.0    20 sleep      0    90
 1765 ripngd              1   0.0    20 sleep      0    88
 1786 rmond               1   0.0    20 sleep      0    91
 1798 sshd                1   0.0    20 sleep      0     0
 1905 atlgetty            1   0.0    20 sleep      0     0
 1906 getty               1   0.0    20 sleep      0     0

kernel threads
==============
  pid name             cpu%   pri state sleep% runtime
   87 aio/0            0.0     15 sleep      0     0
    5 events/0         0.0     15 sleep      0   575
  673 fsl-cpm-spi.1    0.0     15 sleep      0     0
   58 kblockd/0        0.0     15 sleep      0     0
    6 khelper          0.0     15 sleep      0     1
  667 kmmcd            0.0     15 sleep      0     0
    3 ksoftirqd/0      0.0     15 sleep      0    78
   86 kswapd0          0.0     15 sleep      0     0
    2 kthreadd         0.0     15 sleep      0     0
  989 loop0            0.0      0 sleep      0    16
  648 mtdblockd        0.0     15 sleep      0     5
   84 pdflush          0.0     20 sleep      0     0
  732 rpciod/0         0.0     15 sleep      0     0
  689 w1_control       0.0     15 sleep      0     2
    4 watchdog/0       0.0   -100 sleep      0     0
  768 jffs2_gcd_mtd0   0.0     30 sleep      0     5
 1264 lockd            0.0     20 sleep      0     0
 1265 nfsd             0.0     20 sleep      0   130
```

```
Stack member 3:

CPU averages:
 1 second: 12%, 20 seconds: 2%, 60 seconds: 2%
System load averages:
 1 minute: 0.03, 5 minutes: 0.02, 15 minutes: 0.00
Current CPU load:
 userspace: 6%, kernel: 4%, interrupts: 1% iowaits: 0%

user processes
==============
  pid name            thrds  cpu%   pri state sleep% runtime
 1544 hostd              1   2.8    20   run      0   120
 1166 exfx              17   1.8    20 sleep     0  3846
 1198 stackd             1   0.9    20 sleep     0   459
 1284 aisexec           44   0.9    -2 sleep     0  2606
    1 init               1   0.0    20 sleep     0   120
 9772 sh                 1   0.0    20 sleep     0     0
 9773 corerotate         1   0.0    20 sleep     0     0
  853 syslog-ng          1   0.0    20 sleep     0   356
  859 klogd              1   0.0    20 sleep     0     1
  910 inetd              1   0.0    20 sleep     0     3
  920 portmap            1   0.0    20 sleep     0     0
  931 crond              1   0.0    20 sleep     0     1
 1090 openhpid          11   0.0    20 sleep     0   233
 1111 hpilogd            1   0.0    20 sleep     0     0
 1240 hsl                1   0.0    20 sleep     0    79
 1453 authd              1   0.0    20 sleep     0    85
 1477 bgpd               1   0.0    20 sleep     0    40
 1497 cntrd              1   0.0    20 sleep     0     2
 1520 epsrd              1   0.0    20 sleep     0    56
 1571 imi                1   0.0    20 sleep     0   275
 1594 irdpd              1   0.0    20 sleep     0    23
 1617 lacpd              1   0.0    20 sleep     0    87
 1638 mstpd              1   0.0    20 sleep     0    75
 1662 nsm                1   0.0    20 sleep     0   163
 1685 ospfd              1   0.0    20 sleep     0    35
 1708 pdmd               1   0.0    20 sleep     0    23
 1729 pimd               1   0.0    20 sleep     0    32
 1751 ripd               1   0.0    20 sleep     0    33
 1775 ripngd             1   0.0    20 sleep     0    25
 1797 rmond              1   0.0    20 sleep     0    64
 1963 ntpd               1   0.0    20 sleep     0    15
 2102 atlgetty           1   0.0    20 sleep     0     0
 2712 rpc.statd          1   0.0    20 sleep     0     0
 2716 rpc.statd          1   0.0    20 sleep     0     0
 2722 rpc.mountd         1   0.0    20 sleep     0     0
 2821 automount          1   0.0    20 sleep     0    82
 2892 ntpd               1   0.0    20 sleep     0    17
 2912 sshd               1   0.0    20 sleep     0     0
 9774 login              1   0.0    20 sleep     0     2
12689 more               1   0.0    20 sleep     0     0

.
.
.
```

Table 8-2: Parameters in the output of the **show cpu** command

Parameter	Description
`STACK member`	The stack member output being displayed.
`CPU averages`	Average CPU utilization for the periods stated.
`System load averages`	The average number of processes waiting for CPU time for the periods stated.
`Current CPU load`	Current CPU utilization specified by load types.
`pid`	Identifier number of the process.
`name`	A shortened name for the process
`thrds`	Number of threads in the process.
`cpu%`	Percentage of CPU utilization that this process is consuming.
`pri`	Process priority state.
`state`	Process state; one of “run”, “sleep”, “zombie”, and “dead”.
`sleep%`	Percentage of time that the process is in the sleep state.
`runtime`	The time that the process has been running for, measured in jiffies. A jiffy is the duration of one tick of the system timer interrupt.

Related Commands

remote-command
show memory
show memory allocations
show memory history
show memory pools
show process

show cpu history

This command prints a graph showing the historical CPU utilization.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show [<1-8>]cpu history`

Parameter	Description
<1-8>	The stack member to display output for.

Mode User Exec and Privileged Exec

Usage This command's output displays three graphs of the percentage CPU utilization:

- per second for the last minute, then
- per minute for the last hour, then
- per 30 minutes for the last 30 hours.

If this command is entered on the stack master, it will print graphs for all the stack members. A stack member heading will be displayed to distinguish the different graphs for every stack member.

If the command is entered on a specific stack member, as a host-directed command, it will print the graph for that particular stack member.

Examples To display a graph showing the historical CPU utilization of the device, use the command:

```
awplus# show cpu history
```

To display the CPU utilization history graph for stack member 3, use the command:

```
awplus# show 3 cpu history
```

where 3 is the node id of the stack member.

Output Figure 8-8: Example output from the **show cpu history** command

```
Stack member 1:

Per second CPU load history

100
 90
 80
 70
 60
 50
 40
 30
 20
 10 ************************************************************
    |....|....|....|....|....|....|....|....|....|....|....|....
    Oldest                                                  Newest
        CPU load% per second (last 60 seconds)
              * = average CPU load%


Per minute CPU load history

100         *+
 90         +
 80
 70
 60
 50
 40
 30
 20                     +                   +
 10          ************************************************
    |....|....|....|....|....|....|....|....|....|....|....|....
    Oldest                                                  Newest
        CPU load% per minute (last 60 minutes)
              * = average CPU load%, + = maximum


Per (30) minute CPU load history

100                                                           +
 90
 80
 70
 60
 50
 40
 30
 20
 10                                                           **
    |....|....|....|....|....|....|....|....|....|....|....|....
    Oldest                                                  Newest
        CPU load% per 30 minutes (last 60 values / 30 hours)
              * = average, - = minimum, + = maximum
.
.
.
```

Related Commands

remote-command
show memory
show memory allocations
show memory pools
show process

show debugging

This command displays information for all debugging options.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show debugging`

Default This command runs all the show debugging commands in alphabetical order.

Mode User Exec and Privileged Exec

Usage This command displays all debugging information, similar to the way the show tech-support command displays all show output for use by Allied Telesis authorized service personnel only.

Example To display all debugging information, use the command:

```
awplus# show debugging
```

Output Figure 8-9: Example output from the **show debugging** command

```
awplus#show debugging
AAA debugging status:
  Authentication debugging is off
  Accounting debugging is off
% DHCP Snooping service is disabled
BGP debugging status:
  BGP debugging is off
  BGP nsm debugging is off
  BGP events debugging is off
  BGP keepalives debugging is off
  BGP updates debugging is off
  BGP fsm debugging is off
  BGP filter debugging is off
  BGP Route Flap Dampening debugging is off

802.1X debugging status:

EPSR debugging status:
 EPSR Info debugging is off
 EPSR Message debugging is off
 EPSR Packet debugging is off
 EPSR State debugging is off
IGMP Debugging status:
  IGMP Decoder debugging is off
  IGMP Encoder debugging is off
.
.
.
```

Related Commands
show debugging aaa
show debugging bgp
show debugging dot1x
show debugging epsr
show debugging igmp
show debugging ip dns forwarding
show debugging lacp
show debugging lldp
show debugging mstp

show debugging ospf
show debugging pim dense-mode
show debugging pim sparse-mode
show debugging radius
show debugging rip
show debugging snmp
show debugging stack
show debugging vrrp

show diagnostic monitor pcsping

Use this command to show the status of the background PCS (Physical Coding Sublayer) ping feature used to check the link status between a XEM and the switch. See the diagnostic monitor pcsping command on page 8.14 for further information about the feature. The background PCS ping feature is enabled by default to output log messages.

Syntax `show diagnostic monitor pcsping`

Mode User Exec and Privileged Exec

Example To monitor the status of the background PCS ping feature, use the following command:

```
awplus# show diagnostic monitor pcsping
```

Output Figure 8-10: Example output from a **show diagnostic monitor pcsping** command showing default behaviour (enabled with log message output) for the background PCS ping feature

```
awplus# show diagnostic monitor pcsping
Background PCS Ping Monitoring Information
Enabled: Yes
Power-off XEM if a PCS Ping fails: No
```

Figure 8-11: Example output from a **show diagnostic monitor pcsping** command showing the background PCS ping feature disabled

```
awplus# show diagnostic monitor pcsping
Background PCS Ping Monitoring Information
Enabled: No
Power-off XEM if a PCS Ping fails: No
```

Figure 8-12: Example output from a **show diagnostic monitor pcsping** command showing the background PCS ping feature configured to power off a XEM if PCS ping fails

```
awplus# show diagnostic monitor pcsping
Background PCS Ping Monitoring Information
Enabled: Yes
Power-off XEM if a PCS Ping fails: Yes
```

Validation Commands show running-config

Related Commands diagnostic monitor pcsping

show ecofriendly

This command displays the switch's eco-friendly configuration status.

Syntax `show ecofriendly`

Mode Privileged Exec

Example To display the switch's eco-friendly configuration status, use the following command:

```
awplus# show ecofriendly
```

Output Figure 8-13: Example output from the **show ecofriendly** command

```
awplus#show ecofriendly
Front panel port LEDs          normal
```

Table 8-3: Parameters in the output of the **show ecofriendly** command

Parameter	Description
`normal`	The eco-friendly feature is disabled and port LEDs show the current state of the ports. This is the default setting.
`off`	The eco-friendly feature is enabled and power to the port LEDs is disabled.

Related Commands ecofriendly led

show interface memory

This command displays the shared memory used by either all interfaces, or the specified interface or interfaces. The output is useful for diagnostic purposes by Allied Telesis authorized service personnel.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show interface memory
show interface <port-list> memory
```

Parameter	Description
<port-list>	The ports to display information about. The port list can be: ■ a switch port (e.g. `port1.0.12`) a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po3`) ■ a continuous range of ports separated by a hyphen, e.g. `port1.0.1-1.0.24`, or `sa1-2`, or `po1-4` ■ a comma-separated list of ports and port ranges, e.g. `port1.0.1,port1.0.4-1.2.24`. Do not mix switch ports, static channel groups, and dynamic (LACP) channel groups in the same list

Mode User Exec and Privileged Exec

Example To display the shared memory used by all interfaces, use the command:

```
awplus# show interface memory
```

To display the shared memory used by `port1.0.1` and `port1.0.5 to port1.0.8`, use the command:

```
awplus# show interface port1.0.1,port1.0.5-1.0.8 memory
```

Output Figure 8-14: Example output from the **show interface <port-list> memory** command

```
awplus#show interface port1.0.1,port1.0.5-1.0.8 memory
Vlan blocking state shared memory usage
---------------------------------------------
Interface     shmid        Bytes Used     nattch     Status
port1.0.1     393228       512            1
port1.0.5     491535       512            1
port1.0.6     557073       512            1
port1.0.7     327690       512            1
port1.0.8     655380       512            1
```

Figure 8-15: Example output from the **show interface memory** command

```
awplus#show interface memory
Vlan blocking state shared memory usage
---------------------------------------------
Interface     shmid        Bytes Used     nattch     Status
port1.0.1     393228       512            1
port1.0.2     458766       512            1
port1.0.3     360459       512            1
port1.0.4     524304       512            1
port1.0.5     491535       512            1
port1.0.6     557073       512            1
port1.0.7     327690       512            1
port1.0.8     655380       512            1
port1.0.9     622611       512            1
.
.
port1.0.21    950301       512            1
port1.0.22    1048608      512            1
port1.0.23    1015839      512            1
port1.0.24    1081377      512            1
lo            425997       512            1
po1           1179684      512            1
po2           1212453      512            1
sa3           1245222      512            1
```

Related Commands

show interface brief
show interface status
show interface switchport

show memory

This command displays the memory used by each process that is currently running

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show memory [<1-8>] [sort {size|peak|stk}]`

Parameter	Description
`<1-8>`	Specify the stack member number.
`sort`	Changes the sorting order for the list of processes. If you do not specify this, then the list is sorted by percentage memory utilization.
`size`	Sorts the list by the amount of memory the process is currently using.
`peak`	Sorts the list by the peak amount of memory the process has ever used.
`stk`	Sorts the list by the stack size of the process.

Mode User Exec and Privileged Exec

Usage If this command is entered on the stack master, it will display corresponding memory utilization information for all the stack members. A stack member heading will be displayed to distinguish the different lists for every stack member.

If it is entered on a specific stack member, as host-directed commands, it will display corresponding memory utilization information for that stack member.

Example To display the memory used by the current running processes, use the command:

```
awplus# show memory
```

Output Figure 8-16: Example output from the **show memory** command

```
awplus#show memory

Stack member 1:

RAM total: 514920 kB; free: 382716; buffers: 16368 kB

user processes
==============
pid name             mem%   size   peak   data   stk
962 pss                 6  33112  36260  27696   244
1   init                0    348   1092    288    84
797 syslog-ng           0    816   2152    752    84
803 klogd               0    184   1244    124    84
843 inetd               0    256   1256    136    84
```

Table 8-4: Parameters in the output of the **show memory** command

Parameter	Description
`STACK member`	The stack member output being displayed.
`RAM total`	Total amount of RAM memory free.
`free`	Available memory size.
`buffers`	Memory allocated kernel buffers.
`pid`	Identifier number for the process.
`name`	Short name used to describe the process.
`mem%`	Percentage of memory utilization the process is currently using.
`size`	Amount of memory currently used by the process.
`peak`	Greatest amount of memory ever used by the process.
`data`	Amount of memory used for data.
`stk`	The stack size.

Related Commands

show memory allocations
show memory history
show memory pools
show memory shared

show memory allocations

This command displays the memory allocations used by processes.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show memory allocations [<process>]`

Parameter	Description
<process>	Displays the memory allocation used by the specified process.

Mode User Exec and Privileged Exec

Usage If entered on the stack master, this command will display corresponding memory utilization information for all the stack members. A stack member heading will be displayed to distinguish the different lists for every stack member.

If it is entered on a specific stack member, as host-directed commands, it will display corresponding memory utilization information for that stack member.

Examples To display the memory allocations used by all processes on your device, use the command:

```
awplus# show memory allocations
```

To display the memory allocations used by BGP, use the command:

```
awplus# show memory allocations bgp
```

Output Figure 8-17: Example output from the **show memory allocations** command

```
awplus#show memory allocations
Memory allocations for imi
----------------------------

Current 15093760 (peak 15093760)

Statically allocated memory:
 - binary/exe                 :    1675264
 - libraries                  :    8916992
 - bss/global data            :    2985984
 - stack                      :     139264

Dynamically allocated memory (heap):
 - total allocated            :    1351680
   - in use                   :    1282440
   - non-mmapped              :    1351680
 - maximum total allocated    :    1351680
 - total free space           :      69240
   - releasable               :      68968
   - space in freed fastbins  :         16

Context
           filename:line   allocated      freed
 +            lib.c:749          484
.
.
.
```

Figure 8-18: Example output from the **show memory allocations bgp** command

```
awplus#show memory allocations bgp
Memory allocations for BGP
---------------------------
name bgpd; pid 1155; size 2860; peak 8988; data 2360; stack 84
LDP Id
filename:line   allocated         freed
+               lib.c:614           296
=============
296
Memory diagnostics
filename:line   allocated         freed
+         gmem_diag.c:149          1820
+         gmem_diag.c:199          3024
=============
4860
```

Table 8-5: Parameters in the output from the **show memory allocations** command

Parameter	Description
`name`	Short name used to describe the process.
`pid`	Identifier number for the process.
`size`	Amount of memory in kB used by the process.
`peak`	The peak amount of memory in kB ever used by the process.
`data`	Amount of memory used for data.
`stack`	The stack size.

Related Commands

show memory
show memory history
show memory pools
show memory shared
show tech-support

show memory history

This command prints a graph showing the historical memory usage.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show memory history [<1-8>]`

Parameter	Description
<1-8>	Specify the stack member number.

Mode User Exec and Privileged Exec

Usage This command's output displays three graphs of the percentage memory utilization:

- per second for the last minute, then
- per minute for the last hour, then
- per 30 minutes for the last 30 hours.

If entered on the stack master, this command will display corresponding memory utilization information for all the stack members. A stack member heading will be displayed to distinguish the different lists for every stack member.

If it is entered on a specific stack member, as host-directed commands, it will display corresponding memory utilization information for that stack member.

Examples To show a graph displaying the historical memory usage for either a single unstacked device, or a complete stack, use the command:

```
awplus# show memory history
```

To show a graph displaying the historical memory usage for a single device (device 3 in this example) within a stack, use the command:

```
awplus# show memory history 3
```

Output Figure 8-19: Example output from the **show memory history** command

```
STACK member 1:

Per minute memory utilization history

100
 90
 80
 70
 60
 50
 40
************************************************************
 30
 20
 10
    |....|....|....|....|....|....|....|....|....|....|....|....
    Oldest                                                  Newest
        Memory utilization% per minute (last 60 minutes)
              * = average memory utilisation%.
.
.
.
------------------------------------------------------------------

STACK member 2:

Per minute memory utilization history

100
 90
 80
 70
 60
 50
 40
************************************************************
 30
 20
 10
    |....|....|....|....|....|....|....|....|....|....|....|....
    Oldest                                                  Newest
        Memory utilization% per minute (last 60 minutes)
              * = average memory utilisation%.
.
.
.
```

Related Commands

show memory allocations
show memory pools
show memory shared
show tech-support

show memory pools

This command shows the memory pools used by processes.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show memory pools [<process>]`

Parameter	Description
<process>	Displays the memory pools used by the specified process.

Mode User Exec and Privileged Exec

Example To shows the memory pools used by processes, use the command:

```
awplus# show memory pools
```

To shows the memory pools used by BGP, use the command:

```
awplus# show memory pools bgp
```

Output Figure 8-20: Example output from the **show memory pools** command

```
awplus#show memory pools
Memory pools for imi
----------------------

Current 15290368 (peak 15290368)

Statically allocated memory:
 - binary/exe                 :    1675264
 - libraries                  :    8916992
 - bss/global data            :    2985984
 - stack                      :     139264

Dynamically allocated memory (heap):
 - total allocated            :    1548288
   - in use                   :    1479816
   - non-mmapped              :    1548288
 - maximum total allocated    :    1548288
 - total free space           :      68472
   - releasable               :      68200
   - space in freed fastbins  :         16
.
.
.
```

Figure 8-21: Example output from the **show memory pools bgp** command

```
awplus#show memory pools bgp
Memory pools for BGP
----------------------

name bgpd; pid 1207; size 1996; peak 8640; data 2012; stack 84
pool                                allocated
----                                ---------
LDP Id                               296
Memory diagnostics                   2508
Message of The Day                   96
Host config                          8
Link list                            320
Rmap                                 64
Temporary memory                     113440
Vector                               21992
.
.
.
Application Total (kb)               283
```

Table 8-6: Parameters in the output from the **show memory pools** command

Parameter	Description
name	Short name used to describe the process.
pid	Identifier for the process.
size	Amount of memory in kB used by the process.
peak	Peak amount of memory in kB ever used by the process.
data	Amount of memory in kB used for data.
stack	The stack size in kB.

Related Commands

show memory allocations
show memory history
show tech-support

show memory shared

This command displays shared memory allocation information. The output is useful for diagnostic purposes by Allied Telesis authorized service personnel.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show memory shared`

Mode User Exec and Privileged Exec

Example To display information about the shared memory allocation used on the switch, use the command:

```
awplus# show memory shared
```

Output Figure 8-22: Example output from the **show memory shared** command

```
awplus#show memory shared
Shared Memory Status
----------------------------
Segment allocated  = 39
Pages allocated    = 39
Pages resident     = 11

Shared Memory Limits
----------------------------
Maximum number of segments          = 4096
Maximum segment size (kbytes)       = 32768
Maximum total shared memory (pages) = 2097152
Minimum segment size (bytes)        = 1
```

Related Commands
show memory allocations
show memory history
show memory sort

show process

This command lists a summary of the current running processes.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show process [<1-8>] [sort {cpu|mem}]`

Parameter	Description	
<1-8>	The stack member to display output for.	
`sort`	Changes the sorting order for the list of processes.	
	`cpu`	Sorts the list by the percentage of CPU utilization.
	`mem`	Sorts the list by the percentage of memory utilization.

Mode User Exec and Privileged Exec

Usage For a stacked configuration, if this command is entered on the stack master, it will display the information for all the stack members. A stack member heading will be displayed to distinguish the different information for every stack member.

If it is entered on a specific stack member, as a host-directed command, it will display the information for that stack member.

Example To display a summary of the current running processes on stack member 3, use the command:

```
awplus# show process 3
```

Output Figure 8-23: Example output from the **show process** command

```
STACK member 3:

CPU load for 1 minute: 0%; 5 minutes: 3%; 15 minutes: 0%
RAM total: 514920 kB; free: 382600 kB; buffers: 16368 kB

user processes
==============
pid name          thrds  cpu%  mem%   pri  state  sleep%
962 pss              12     0     6    25  sleep       5
1   init              1     0     0    25  sleep       0
797 syslog-ng         1     0     0    16  sleep      88


kernel threads
==============
pid name          cpu%  pri  state  sleep%
71  aio/0         0     20   sleep  0
3   events/0      0     10   sleep  98
.
.
.
```

Table 8-7: Parameters in the output from the **show process** command

Parameter	Description
`STACK member`	The stack member output being displayed.
`CPU load`	Average CPU load for the given period.
`RAM total`	Total memory size.
`free`	Available memory.
`buffers`	Memory allocated to kernel buffers.
`pid`	Identifier for the process.
`name`	Short name to describe the process.
`thrds`	Number of threads in the process.
`cpu%`	Percentage of CPU utilization that this process is consuming.
`mem%`	Percentage of memory utilization that this process is consuming.
`pri`	Process priority.
`state`	Process state; one of “run”, “sleep”, “stop”, “zombie”, or “dead”.
`sleep%`	Percentage of time the process is in the sleep state.

Related Commands

remote-command
show cpu
show cpu history

show reboot history

Use this command to display the switch's reboot history.

Syntax `show reboot history`

Mode User Exec and Privileged Exec

Examples To show the reboot history, use the command:

```
awplus# show reboot history
```

Output Figure 8-24: Example output from the **show reboot history** command

```
------------------------
     Reboot History
------------------------
2010-08-29 20:40:23 (Unexpected) System reboot
2010-08-29 08:26:26 (Unexpected) Rebooting due to critical process (network/nsm)
failure!
2010-08-29 08:01:56 (Unexpected) System reboot
2010-08-25 22:00:17 (Expected)   CLI(user request)
2010-08-25 20:46:40 (Unexpected) Rebooting due to VCS duplicate member-ID
2010-08-25 20:45:23 (Expected)   CLI(user request)
2010-08-25 20:36:06 (Unexpected) Rebooting due to VCS duplicate master (Continuous
reboot prevention)
2010-08-25 20:30:50 (Expected)   CLI(user request)
2010-08-25 20:28:04 (Unexpected) System reboot
```

Table 8-8: Parameters in the output from the **show reboot history** command

Parameter	Description
`Unexpected`	Reboot is counted by the continuous reboot prevention feature if the reboot event occurs in the time period specified for continuous reboot prevention.
`Expected`	Reboot is not counted by continuous reboot prevention feature.
`Continuous reboot prevention`	A continuous reboot prevention event has occurred. The action taken is configured with the continuous-reboot-prevention command. The next time period during which reboot events are counted begins from this event.
`user request`	User initiated reboot via the CLI.

Related Commands show continuous-reboot-prevention
show tech-support

show router-id

Use this command to show the Router ID of the current system.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show router-id`

Mode User Exec and Privileged Exec

Example To display the Router ID of the current system, use the command:

```
awplus# show router-id
```

Output Figure 8-25: Example output from the **show router-id** command

```
awplus>show router-id
Router ID: 10.55.0.2 (automatic)
```

show system

This command displays general system information about the device, including the hardware installed, memory, and software versions loaded. It also displays location and contact details when these have been set.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show system`

Mode User Exec and Privileged Exec

Usage For a stacked configuration, if this command is entered on the stack master, it will display the information for all the stack members. A stack member heading will be displayed to distinguish the different information for every stack member.

If it is entered on a specific stack member, as a host-directed command, it will display the information for that stack member.

Examples To display the system information for a single switch, or a whole stack, use the command:

```
awplus# show system
```

To display the system information of stack member 3, use the command:

```
awplus# remote-command 3 show system
```

Output Figure 8-26: Example output from the **show system** command

```
awplus#show system
Switch System Status                                    Wed Dec 19 08:42:16 2007

Board       ID  Bay   Board Name                              Rev  Serial number
-------------------------------------------------------------------------------
Base       219        x900-24XT                               A-0  61556953
-------------------------------------------------------------------------------
Memory:   DRAM: 255196 kB   Flash: 30.0MB Used: 26.4MB Available: 3.6MB
-------------------------------------------------------------------------------
Environment Status : Normal
Uptime             : 25 days 11:41:58
Bootloader version : 1.0.9


Current software   : x900-5.4.2.rel
Software version   : 5.4.2
Build date         : Thu Oct 11 02:41:04 NZDT 2011

Current boot config: flash:/default.cfg (file exists)
User Configured Territory: usa

System Name

System Contact

System Location
```

Figure 8-27: Example output from the **show system** command for a stacked configuration

```
Stack System Status                                    Tue Aug  7 05:25:09 2007

Stack member 1:

Board        ID  Bay   Board Name                                Rev  Serial number
-------------------------------------------------------------------------------
Base         270       x900-24XT                                 B-0  41FY68006
Expansion    272  Bay1  XEM-1XP                                   B-0  41AR65001
Expansion    285  Bay2  XEM-STK                                   A-0  M1L174004
PSU          212  PSU1  AT-PWR01-AC                               F-1  66354904
Fan module   214  PSU2  AT-FAN01                                  F-1  66098695
-------------------------------------------------------------------------------
Memory:   DRAM: 514460 kB   Flash: 31.0MB Used: 25.1MB Available: 5.9MB
-------------------------------------------------------------------------------
Environment Status: Normal
Uptime: 0 days 04:26:02


Stack member 2:

Board        ID  Bay   Board Name                                Rev  Serial number
-------------------------------------------------------------------------------
Base         271       x900-24XS                                 A-2  41HF6900U
Expansion    272  Bay1  XEM-1XP                                   A-0  41AR5B003
Expansion    285  Bay2  XEM-STK                                   (nul M1L17400T
PSU          212  PSU1  AT-PWR01-AC                               F-1  66354904
Fan module   214  PSU2  AT-FAN01                                  F-1  66098695
-------------------------------------------------------------------------------
Memory:   DRAM: 514460 kB   Flash: 31.0MB Used: 25.2MB Available: 5.8MB
-------------------------------------------------------------------------------
Environment Status: Normal
Uptime: 0 days 00:01:14


Bootloader version : 1.0.9
Current software   : x900-5.4.2.rel
Software version   : 5.4.2
Build date         : Tue Nov 7 09:27:05 NZST 2011

Current boot config: flash:/default.cfg (file exists)
User Configured Territory: usa

System Name

System Contact

System Location
```

Related Commands remote-command
show system environment

show system environment

This command displays the current environmental status of your device and any attached PSU, XEM, or other expansion option. The environmental status covers information about temperatures, fans, and voltage.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show system environment`

Mode User Exec and Privileged Exec

Usage For a stacked configuration, if this command is entered on the stack master, it will display the information for all the stack members. A stack member heading will be displayed to distinguish the different information for every stack member.

If it is entered on a specific stack member, as a host-directed command, it will display the information for that stack member.

Example To display the system's environmental status, use the command:

```
awplus# show system environment
```

Output Figure 8-28: Example output from the **show system environment** command

```
awplus#show system environment
Environment Monitoring Status
Overall Status: ***Fault***

Resource ID: 1   Name: PSU bay 1
ID Sensor (Units)                          Reading  Low Limit High Limit Status
1  Device Present                                0          -          -  FAULT
2  PSU Overtemp                                  0          -          -     Ok
3  PSU Fan Fail                                  0          -          -     Ok
4  PSU Power Good                                0          -          -     Ok

Resource ID: 2 Name: PSU bay 2
ID Sensor (Units)                          Reading  Low Limit High Limit Status
1 Device Present                                 1          -          -     Ok
2 PSU Overtemp                                   0          -          -     Ok
3 PSU Fan Fail                                   0          -          -     Ok
4 PSU Power Good                                 1          -          -     Ok

Resource ID: 3 Name: x900-24XS
ID Sensor (Units)                          Reading  Low Limit High Limit Status
1 Voltage: 2.5V (Volts)                      2.578      0.000      3.320     Ok
2 Voltage: 1.65V (Volts)                     1.629      0.000      2.988     Ok
3 Voltage: 3.3V (Volts)                      3.369      0.000      4.383     Ok
4 Voltage: 1.8V (Volts)                      1.771      0.000      6.641     Ok
5 Voltage: 1.2V (Volts)                     12.000      0.000     15.938     Ok
6 Temp: Ambient (Degrees C)                     30       -127        100     Ok
7 Temp: Sensor chip (Degrees C)                 46       -127         85     Ok
8 Temp: Internal (Degrees C)                    43       -127        127     Ok

Resource ID: 4 Name: XEM-12S
ID Sensor (Units)                          Reading  Low Limit High Limit Status
1 Fan: XEM Fan 1 (Rpm)                        5153       3516          -     Ok
2 Voltage: 2.5V (Volts)                      2.539      2.344      2.865     Ok
3 Voltage: 1.65V (Volts)                     1.603      1.491      1.814     Ok
4 Voltage: 3.3V (Volts)                      3.334      2.973      3.627     Ok
5 Voltage: 5V (Volts)                        4.948      4.505      5.495     Ok
6 Voltage: 12V (Volts)                      11.563     10.813     13.188     Ok
7 Voltage: 1.8V (Volts)                      1.828      1.617      1.983     Ok
8 Temp: Internal (Degrees C)                    42    70(Hyst)         85     Ok
```

Related Commands show system

show system interrupts

Use this command to display the number of interrupts for each IRQ (Interrupt Request) used to interrupt input lines on a PIC (Programmable Interrupt Controller) on your switch.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show system interrupts`

Mode User Exec and Privileged Exec

Example To display information about the number of interrupts for each IRQ in your device, use the command:

```
awplus# show system interrupts
```

Output Figure 8-29: Example output from the **show system interrupts** command

```
awplus>show system interrupts
           CPU0
  1:          2   CPM2 SIU  Level Enabled   0     i2c-mpc
  2:        145   CPM2 SIU  Level Enabled   0     spi-mpc
 77:          0   OpenPIC   Level Enabled   0     enet_tx
 78:          2   OpenPIC   Level Enabled   0     enet_rx
 82:          0   OpenPIC   Level Enabled   0     enet_error
 90:       5849   OpenPIC   Level Enabled   0     serial
 91:    2066672   OpenPIC   Level Enabled   0     i2c-mpc
 94:        147   OpenPIC   Level Enabled   0     cpm2_cascade
112:          5   OpenPIC   Edge  Enabled   0     phy_interrupt
114:     398714   OpenPIC   Level Enabled   0     mvPP
115:      26247   OpenPIC   Level Enabled   0     mvPP
119:          0   OpenPIC   Edge  Enabled   0     Power supply status
120:          0   OpenPIC   Edge  Enabled   0     Plugin XEM
BAD:          0
```

Related Commands show system environment

show system pci device

Use this command to display the PCI devices on your switch.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show system pci device Mode`

User Exec and Privileged Exec

Example To display information about the PCI devices on your switch, use the command:

```
awplus# show system pci device
```

Output Figure 8-30: Example output from the **show system pci device** command

```
awplus>show system pci device
00:0c.0 Class 0200: 11ab:00d1 (rev 01)
        Flags: bus master, 66Mhz, medium devsel, latency 128, IRQ 113
        Memory at 5ffff000 (32-bit, non-prefetchable) [size=4K]
        Memory at 58000000 (32-bit, non-prefetchable) [size=64M]

00:0d.0 Class 0200: 11ab:00d1 (rev 01)
        Flags: bus master, 66Mhz, medium devsel, latency 128, IRQ 116
        Memory at 57fff000 (32-bit, non-prefetchable) [size=4K]
        Memory at 50000000 (32-bit, non-prefetchable) [size=64M]
```

Related Commands show system environment
show system pci tree

show system pci tree

Use this command to display the PCI tree on your switch.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show system pci tree`

Mode User Exec and Privileged Exec

Example To display information about the PCI tree on your switch, use the command:

```
awplus# show system pci tree
```

Output Figure 8-31: Example output from the **show system pci tree** command

```
awplus>show system pci tree
-[00]-+-0c.0  11ab:00d1
      \-0d.0  11ab:00d1
```

Related Commands show system environment
show system pci device

show system pluggable

This command displays brief pluggable transceiver information showing the pluggable type, the pluggable serial number, and the pluggable port on the switch. Different types of pluggable transceivers, such as SFPs or XFPs, are supported in different models of switch. See your Allied Telesis dealer for more information about the models of pluggables that your switch supports.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show system pluggable [<port-list>]`

Parameter	Description
<port-list>	The ports to display information about. The port list can be: ■ a switch port (e.g. `port1.0.12`) ■ a continuous range of ports separated by a hyphen, e.g. `port1.0.1-1.0.24` ■ a comma-separated list of ports and port ranges, e.g. `port1.0.1,port1.0.4-1.2.24`.

Mode User Exec and Privileged Exec

Usage For a stacked configuration, if this command is entered on the stack master, it will display information about the pluggable transceivers for all the stack members. A stack member heading will be displayed to distinguish different pluggable transceiver information for every stack member.

If it is entered on a specific stack member, as a host-directed command, it will display information about the pluggable transceiver for that stack member.

Example To display brief information about pluggable transceivers installed in `port1.0.21` through `port1.0.24`, use the command:

```
awplus# show system pluggable port1.0.21-1.0.24
```

Output Figure 8-32: Example output from the **show system pluggable port1.0.21-1.0.24** command

```
System Pluggable Information
Port   Manufacturer     Device           Serial Number    Datecode Type
-------------------------------------------------------------------------------
1.0.21 AGILENT          HFBR-5710L       0401312315461272 040131   1000BASE-SX
1.0.22 AGILENT          QBCU-5730R       AK0614GKF7       060408   1000BASE-T
1.0.23 AGILENT          HFBR-5710L       0305130112182696 030513   1000BASE-SX
1.0.24 AGILENT          HBCU-5710R       AK051300SM       050402   1000BASE-T
-------------------------------------------------------------------------------
```

Example To display information about the pluggable transceiver installed in `port1.0.21`, use the command:

```
awplus# show system pluggable port1.0.21
```

Output Figure 8-33: Example output from the **show system pluggable port1.0.21** command

```
System Pluggable Information
Port   Manufacturer     Device           Serial Number    Datecode Type
-------------------------------------------------------------------------------
1.0.21 AGILENT          HFBR-5710L       0401312315461272 040131   1000BASE-SX
-------------------------------------------------------------------------------
```

Table 8-9: Parameters in the output from the **show system pluggables** command

Parameter	Description
`Port`	Specifies the vendor's name for the installed XFP or SFP.
`Manufacturer`	Specifies the device name for the installed XFP or SFP.
`Device`	Specifies the device type for the installed XFP or SFP, such as 1000BASE-LX for an SFP.
`Serial Number`	Specifies the serial number for the installed XFP or SFP.
`Datecode`	Specifies the manufacturing datecode for the installed XFP or SFP. Checking the manufacturing datecode with the vendor may be useful when determining Laser Diode aging issues. See the Trouble-shoot fiber and pluggable issues section in the System Configuration and Monitoring Commands chapter.
`Type`	Specifies the laser wavelength of the installed pluggable transceiver.

Related Commands
show system environment
show system pluggable detail
show system pluggable diagnostics

show system pluggable detail

This command displays detailed pluggable transceiver information showing the pluggable type, the pluggable serial number, and the pluggable port on the switch. Different types of pluggable transceivers, such as SFPs or XFPs, are supported in different models of switch. See your Allied Telesis dealer for more information about the models of pluggables that your switch supports.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show system pluggable [<port-list>] detail`

Parameter	Description
<port-list>	The ports to display information about. The port list can be: ■ a switch port (e.g. `port1.0.12`) ■ a continuous range of ports separated by a hyphen, e.g. `port1.0.1-1.0.24` ■ a comma-separated list of ports and port ranges, e.g. `port1.0.1,port1.0.4-1.2.24`.

Mode User Exec and Privileged Exec

Usage For a stacked configuration, if this command is entered on the stack master, it will display detailed information about the pluggable transceivers for all the stack members. A stack member heading will be displayed to distinguish the different pluggable transceiver information for every stack member.

If it is entered on a specific stack member, as a host-directed command, it will display detailed information about the pluggable transceiver for that stack member.

In addition to the information about pluggable transceivers displayed using the show system pluggable command (port, manufacturer, serial number, manufacturing datecode, and type information), the show system pluggable detail command displays the following information:

- SFP Laser Wavelength: Specifies the laser wavelength of the installed pluggable transceiver
- Single mode Fiber: Specifies the link length supported by the pluggable transceiver using single mode fiber
- OM1 (62.5µm) Fiber: Specifies the link length (in µm - micron) supported by the pluggable transceiver using 62.5 micron multi-mode fiber.
- OM2 (50 µm) Fiber: Specifies the link length (in µm - micron) supported by the pluggable transceiver using 50 micron multi-mode fiber.
- Diagnostic Calibration: Specifies whether the SFP or XFP pluggable supports DDM or DOM Internal or External Calibration.
  - « Internal is displayed if the SFP or XFP pluggable supports DDM or DOM Internal Calibration.
  - « External is displayed if the SFP or XFP pluggable support DDM or DOM External Calibration.
  - « - is displayed if SFP DDM or XFP DOM Internal Calibration or External Calibration is not supported.
- Power Monitoring: Displays the received power measurement type, which can be either OMA (Optical Module Amplitude) or Avg (Average Power) measured in µW.

- FEC BER support: Specifies whether FEC (Forward Error Correction) coder can generate a BER (Bit Error Rate) signal that is used as feedback to tune an XFP if DOM is supported.

Note

For parameters that are not supported or not specified, a hyphen is displayed instead. FEC BER support may be available on an XFP if the XFP supports DOM. FEC BER support is not available on an SFP or an SFP+ even if the SFP or the SFP+ supports DDM. FEC BER support is applicable to XFPs that support DOM only.

Example To display detailed information about the pluggable transceivers installed on a standalone switch, use the command:

```
awplus# show system pluggable port1.0.24 detail
```

Output Figure 8-34: Example output from the **show system pluggable detail** command on a switch

```
awplus#show system pluggable port1.0.24 detail
System Pluggable Information Detail

Port1.0.24
==========
Vendor Name:               AGILENT
Device Name:               HFCT-5710L
Device Type:               1000BASE-LX
Serial Number:             0402142241184360
Manufacturing Datecode:    040214
SFP Laser Wavelength:      -
Link Length Supported
 Single Mode Fiber :      10Km
 OM1 (62.5um) Fiber:      550m
 OM2 (50um) Fiber  :      550m
Diagnostic Calibration:    Internal
Power Monitoring:          Avg
FEC BER support:           -
```

Example To display detailed information about the pluggable transceivers installed on a stack, use the command:

```
awplus# show system pluggable detail
```

Output Figure 8-35: Example output from the **show system pluggable detail** command on a stack

```
awplus#show system pluggable detail
System Pluggable Information Detail

Stack member 1:

Port1.0.24
==========
Vendor Name:               AGILENT
Device Name:               HFCT-5710L
Device Type:               1000BASE-LX
Serial Number:             0402142241184360
Manufacturing Datecode:    040214
SFP Laser Wavelength:      -
Link Length Supported
 Single Mode Fiber :      10Km
 OM1 (62.5um) Fiber:      550m
 OM2 (50um) Fiber  :      550m
Diagnostic Calibration:    Internal
Power Monitoring:          Avg
FEC BER support:           -

Stack member 2:

Port2.0.24
==========
Vendor Name:               FINISAR CORP.
Device Name:               FTRJ-8519-7D-CSC
Device Type:               1000BASE-SX
Serial Number:             P430KGY
Manufacturing Datecode:    030718
SFP Laser Wavelength:      850nm
Link Length Supported
  Single Mode Fiber :      -
  OM1 (62.5um) Fiber:      300m
  OM2 (50um) Fiber  :      550m
Diagnostic Calibration:    Internal
Power Monitoring:          OMA
FEC BER support:           Yes
```

Table 8-10: Parameters in the output from the **show system pluggables detail** command:

Parameter	Description
`Stack member`	The stack member output being displayed.
`Port`	Specifies the port the XFP or SFP is installed in.
`Vendor Name:`	Specifies the vendor's name for the installed XFP or SFP.
`Device Name:`	Specifies the device name for the installed XFP or SFP.
`Device Type:`	Specifies the device type for the installed XFP or SFP, such as 1000BASE-LX for an SFP.
`Serial Number:`	Specifies the serial number for the installed XFP of SFP.
`Manufacturing Datecode:`	Specifies the manufacturing datecode for the installed XFP or SFP. Checking the manufacturing datecode with the vendor may be useful when determining Laser Diode aging issues. See the Trouble-shoot fiber and pluggable issues section in the System Configuration and Monitoring Commands chapter.
`SFP Laser Wavelength:`	Specifies the laser wavelength of the installed pluggable transceiver.
`Single Mode Fiber:`	Specifies the link length supported by the pluggable transceiver using single mode fiber.
`OM1 (62.5um) Fiber:`	Specifies the link length (in µm - micron) supported by the pluggable transceiver using 62.5 micron multi-mode fiber.
`OM2 (50um) Fiber:`	Specifies the link length (in µm - micron) supported by the pluggable transceiver using 50 micron multi-mode fiber.
`Diagnostic Calibration:`	Specifies whether the SFP or XFP pluggable supports DDM or DOM Internal or External Calibration: Internal is displayed if the SFP or XFP pluggable supports DDM or DOM Internal Calibration. External is displayed if the SFP or XFP pluggable support DDM or DOM External Calibration. - is displayed if SFP DDM or XFP DOM Internal Calibration or External Calibration is not supported.
`Power Monitoring:`	Displays the received power measurement type, which can be either OMA (Optical Module Amplitude) or Avg (Average Power) measured in µW.
`FEC BER support:`	Specifies whether FEC (Forward Error Correction) coder can generate a BER (Bit Error Rate) signal that is used as feedback to tune an XFP if DOM is supported.

Related Commands

show system environment
show system pluggable
show system pluggable diagnostics

show system pluggable diagnostics

This command displays diagnostic information about pluggable transceivers, such as SFPs and XFPs, which support Digital Diagnostic Monitoring (DDM) for SFPs or Digital Optical Monitoring (DOM) for XFPs that are installed in your switch. Different types of pluggable transceivers, such as SFPs or XFPs, are supported in different models of switch. See your Allied Telesis dealer for more information about the models of pluggables that your switch supports.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show system pluggable [<port-list>] diagnostics`

Parameter	Description
<port-list>	The ports to display information about. The port list can be: ■ a switch port (e.g. `port1.0.12`) ■ a continuous range of ports separated by a hyphen, e.g. `port1.0.1-1.0.24` ■ a comma-separated list of ports and port ranges, e.g. `port1.0.1,port1.0.4-1.2.24`.

Mode User Exec and Privileged Exec

Usage For a stacked configuration, if this command is entered on the stack master, it will display information about the pluggable transceivers for all the stack members. A stack member heading will be displayed to distinguish different pluggable transceiver information for every stack member.

If it is entered on a specific stack member, as a host-directed command, it will display information about the pluggable transceiver for that stack member.

Modern optical SFP transceivers support Digital Diagnostics Monitoring (DDM) functions. Modern optical XFP transceivers support Digital Optical Monitoring (DOM) functions.

Diagnostic monitoring features allow you to monitor real-time parameters of the SFP or XFP, such as optical output power, optical input power, temperature, laser bias current, and transceiver supply voltage. Additionally, RX LOS (Loss of Signal) is shown when the received optical level is below a preset threshold. Monitoring these parameters to check on the health of all SFP and XFP transceivers, selected SFP and XFP transceivers or a specific SFP or XFP transceiver installed in a switch.

Example To display detailed information about all pluggable transceivers installed on a standalone switch, use the command:

```
awplus# show system pluggable diagnostics
```

Output Figure 8-36: Example output from the **show system pluggable diagnostics** command on a switch

```
awplus#show system pluggable diagnostics
System Pluggable Information Diagnostics

Port1.0.21           Status              Alarms                    Warnings
Reading   Alarm      Max      Min    Warning      Max      Min
Temp: (Degrees C)   29.387        -   100.00   -40.00          -   85.000   -10.00
Vcc: (Volts)         3.339        -    3.465    3.135          -    3.400    3.200
Tx Bias: (mA)       10.192        -   37.020    3.260          -   34.520    5.760
Tx Power: (mW)      17.872        -   35.643    8.953          -   28.313   11.271
Rx Power: (mW)       0.006      Low   15.849    0.025        Low   12.589    0.040
Rx LOS:            Rx Down

Port1.0.22           Status              Alarms                    Warnings
Reading   Alarm      Max      Min    Warning      Max      Min
Temp: (Degrees C)   29.387        -   100.00   -40.00          -   85.000   -10.00
Vcc: (Volts)         3.378        -    3.630    2.970          -    3.465    3.135
Tx Bias: (mA)        2.802        -    6.000    1.000          -    5.000    1.000
Tx Power: (mW)       2.900        -   11.000    0.600          -   10.000    0.850
Rx Power: (mW)       1.739        -   18.000    0.000          -   10.000    0.200
Rx LOS:              Rx Up
```

Example To display detailed information about the pluggable transceiver installed in `port1.0.22` on a standalone switch, use the command:

```
awplus# show system pluggable diagnostics port1.0.22
```

Output Figure 8-37: Example output from the **show system pluggable diagnostics port1.0.22** command on a switch

```
awplus#show system pluggable port1.0.22 diagnostics
System Pluggable Information Diagnostics

Port1.0.22           Status              Alarms                    Warnings
Reading   Alarm      Max      Min    Warning      Max      Min
Temp: (Degrees C)   29.387        -   100.00   -40.00          -   85.000   -10.00
Vcc: (Volts)         3.378        -    3.630    2.970          -    3.465    3.135
Tx Bias: (mA)        2.802        -    6.000    1.000          -    5.000    1.000
Tx Power: (mW)       2.900        -   11.000    0.600          -   10.000    0.850
Rx Power: (mW)       1.739        -   18.000    0.000          -   10.000    0.200
Rx LOS:              Rx Up
```

Table 8-11: Parameters in the output from the **show system pluggables diagnostics** command:

Parameter	Description
`Temp: (Degrees C)`	Shows the temperature inside the XFP, SFP or SFP+ transceiver.
`Vcc: (Volts)`	Shows voltage supplied to the XFP, SFP or SFP+ transceiver.
`Tx Bias: (mA)`	Shows current to the Laser Diode in the XFP, SFP or SFP+ transceiver.
`Tx Power: (mW)`	Shows the amount of light transmitted from the XFP, SFP or SFP+ transceiver.
`Rx Power: (mW)`	Shows the amount of light received in the XFP, SFP or SFP+ transceiver.
`Rx LOS:`	Shows when the received optical level falls below a preset threshold.

Related Commands

show system environment
show system pluggable
show system pluggable detail

show system psu

This command shows the PSU (Power Supply Unit) status information for the x908 series PSUs only. This command returns a console error message when run on other x900 switches.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show system psu`

Mode User Exec and Privileged Exec

Usage Running this command on switches other than an x908 results in an error message as shown:

```
awplus#show system psu
% This command is not applicable to this device.
```

Example To display the PSU status information, use the command:

```
awplus# show system psu
```

Output Figure 8-38: Example output from the **show system psu** command on an x908 switch

```
awplus#show system psu
System PSU Status

Resource ID: 4  Name: AT-PWR05-AC   Bay: 1
Part Number     : FNP600-12G
Serial Number   : 070252-001DB
Revision        : AD
Mfg. date       : 2007-02-05
Manufacturer    : POWER-ONE
Mfg. location   : 02

Device Ratings:
Output rail 1   : 12000 mV, 51000 mA
Output rail 2   : 12000 mV, 500 mA
Ouput Power     : 600 W
Min AC input    : 85 V
Max AC input    : 264 V

Dynamic Data:
Fault Bytes     : 00 00 00 00
Fan Speed       : 13300 RPM
Time in service : 41 hours
Measured rail 1 : 12224 mV, 7304 mA
Measured rail 2 : 0 mV, 0 mA

Resource ID: 5  Name: AT-PWR05-AC   Bay: 2
Part Number     : FNP600-12G
Serial Number   : 070252-001D1
Revision        : AD
Mfg. date       : 2007-02-05
Manufacturer    : POWER-ONE
Mfg. location   : 02

Device Ratings:
Output rail 1   : 12000 mV, 51000 mA
Output rail 2   : 12000 mV, 500 mA
Ouput Power     : 600 W
Min AC input    : 85 V
Max AC input    : 264 V

Dynamic Data:
Dynamic data invalid. PSU may be powered off.
awplus#
```

show system serialnumber

This command shows the serial number information for the switch.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show system serialnumber`

Mode User Exec and Privileged Exec

Example To display the serial number information for the switch, use the command:

```
awplus# show system serialnumber
```

Output Figure 8-39: Example output from the **show system serialnumber** command

```
awplus#show system serialnumber
45AX5300X
```

show tech-support

The show tech-support command generates system and debugging information for the switch and saves it to a file. You can optionally limit it to display only information for a given protocol.

The command generates a large amount of output and the output is saved into a file. The output file name can be specified by the outfile option. If the output file already exists, a new file name is generated with the current time stamp. Since output files may be too large for Flash on the switch we recommend saving files to an SD card whenever possible to avoid switch lockup.

If all is specified the command captures the full list of information of the device. If bgp is specified the command captures information specific to BGP, and so on. If system is specified the command captures general system information of the device.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show tech-support [all] [outfile <filename>]

show tech-support {[bgp] [dhcpsn] [epsr] [igmp] [ip] [ipv6] [ospf]
    [pim] [rip] [rinpng] [mld] [stack] [stp] [system]}
    [outfile <filename>]
```

Parameter	Description
`all`	Output full troubleshooting information for all protocols and the device.
`bgp`	Output only BGP protocol specific troubleshooting information.
`dhcpsn`	Output only DHCP snooping specific troubleshooting information.
`epsr`	Output only EPSR protocol specific troubleshooting information.
`igmp`	Output only IGMP protocol specific troubleshooting information.
`ip`	Output only IP protocol specific troubleshooting information.
`ipv6`	Output only IPv6 protocol specific troubleshooting information.
`ospf`	Output only OSPF protocol specific troubleshooting information.
`pim`	Output only PIM protocol specific troubleshooting information.
`rip`	Output only RIP protocol specific troubleshooting information.
`ripng`	Output only RIPng protocol specific troubleshooting information.
`mld`	Output only MLD protocol specific troubleshooting information.
`stack`	Output only stacking device specific troubleshooting information.
`stp`	Output only STP protocol specific troubleshooting information.
`system`	Output general system (not protocol) troubleshooting information.
`outfile`	Keyword used to specify the file name for the output file.
<filename>	Placeholder used to specify the file name for the output file.

Default The show tech-support command by default captures all information for the switch.

By default the output is saved to the file 'tech-support.txt.gz' in the current directory. If this file already exists in the current directory then a new file is generated with the time stamp appended to the file name, for example 'tech-support20080109.txt.gz', so the last saved file is retained.

Mode Privileged Exec

Usage The show tech-support command is useful for collecting a large amount of information about all protocols or specific protocols on your switch for troubleshooting purposes. The output of this command can be provided to technical support representatives when reporting a problem.

Examples To capture the full set of show output for the technical support, use the command:

```
awplus# show tech-support
```

To capture show output related to IP module and save it to a file named support-ip.txt.gz on the SD card, use the below command:

```
awplus# show tech-support ip outfile card:support-ip.txt.gz
```

To capture the system technical support information, use the below command:

```
awplus# show tech-support system
```

Output The output of this command may include the result of the following commands:

show arp
show arp security
show arp security interface
show arp security statistics
show boot
show counter dhcp-client
show counter dhcp-relay
show counter dhcp-server
show counter log
show counter mail
show counter ntp
show counter ping-poll
show counter snmp-server
show counter stack
show cpu
show cpu history
show diagnostic channel-group
show etherchannel
show etherchannel detail
show exception log
show interface
show interface brief
show ip bgp
show ip bgp neighbors
show ip bgp paths
show ip bgp summary
show ip dhcp snooping
show ip dhcp snooping acl
show ip dhcp snooping binding
show ip dhcp snooping interface

show ip dhcp snooping statistics
show ip igmp groups
show ip igmp interface
show ip igmp snooping mrouter vlan1 (see the show ip igmp snooping mrouter command)
show ip interface
show ip ospf
show ip ospf database
show ip ospf interface
show ip ospf neighbor
show ip ospf route
show ip pim sparse-mode bsr-router
show ip pim sparse-mode interface detail
show ip pim sparse-mode mroute detail
show ip pim sparse-mode neighbor
show ip pim sparse-mode nexthop
show ip pim sparse-mode rp mapping
show ip route
show ip source binding
show lacp-counter
show lacp sys-id
show license
show log
show log permanent
show memory
show memory allocations
show memory history
show memory pools
show ntp associations
show ntp status
show platform
show platform port
show reboot history
show running-config
show spanning-tree
show stack
show stack detail (see the show stack command)
show startup-config
show static-channel-group
show system
show system environment
show system pluggable
show users
show vlan brief (see the show vlan command)
show vrrp

speed (asyn)

This command changes the console speed from the switch. Note that a change in console speed is applied for subsequent console sessions. Exit the current session to enable the console speed change using the clear line console command.

Syntax `speed <console-speed-in-bps>`

Parameter	Description
<*console-speed-in-bps*>	Console speed Baud rate in bps (bits per second).
1200	1200 Baud
1800	1800 Baud
2400	2400 Baud
9600	9600 Baud
19200	19200 Baud
38400	38400 Baud
57600	57600 Baud
115200	115200 Baud

Default The default console speed baud rate is 9600 bps.

Mode Line Configuration

Usage This command is used to change the console (asyn) port speed. Set the console speed to match the transmission rate of the device connected to the console (asyn) port on your switch.

Example To set the terminal console (asyn0) port speed from the switch to 115200 bps, then exit the session, and log in again to enable the change, use the commands:

```
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# speed 115200
awplus(config-line)# exit
awplus(config)# exit
awplus# exit
```

The new console speed of 115200 bps is applied after exiting the session and before login.

```
awplus login:
Password:

awplus>
```

Related Commands
line
clear line console
show running-config
show startup-config
speed

system territory

This command sets the territory of the system.

Use the no variant of this command to return the territory to its default setting of `japan`.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
system territory {australia|nz|europe|japan|usa|china|korea}
no system territory
```

Parameter	Description
`australia`	Australia
`nz`	New Zealand
`europe`	Europe
`japan`	Japan
`usa`	USA
`china`	China
`korea`	Korea

Mode Global Configuration

Example To set the territory to USA, enter the command:

```
awplus(config)# system territory usa
```

Validation Commands show system

terminal monitor

Use this command to display debugging output on a terminal.

To display the cursor after a line of debugging output, press the Enter key.

Use the command terminal no monitor to stop displaying debugging output on the terminal, or use the timeout option to stop displaying debugging output on the terminal after a set time.

Syntax

```
terminal monitor [<1-60>]
terminal no monitor
```

Parameter	Description
<1-60>	Set a timeout between 1 and 60 seconds for terminal output.

Default Disabled

Mode Privileged Exec

Examples To display debugging output on a terminal, enter the command:

```
awplus# terminal monitor
```

To specify timeout of debugging output after 60 seconds, enter the command:

```
awplus# terminal monitor 60
```

To stop displaying debugging output on the terminal, use the command:

```
awplus# terminal no monitor
```

Related Commands All debug commands

undebug all

This command applies the functionality of the no debug all command.

Chapter 9: Debugging and Logging

Introduction 9.2
Debugging 9.2
Logging to terminal 9.2
Turning off debugging 9.2
Logging 9.3
Log Outputs 9.3

Introduction

AlliedWare Plus™ has a comprehensive debugging and logging facility in various protocols and components. This chapter describes how to start/stop debugging and logging. For detailed descriptions of the commands used to configure logging, see Chapter 10, Logging Commands.

Debugging

Many protocols have debug commands. Debug commands, when used with the parameters, log protocol-specific information. For example, using the debug mstp protocol command, results in the device writing all debugging messages generated by the MSTP algorithm to the logging system.

On using a debug command, the protocol continues to generate output until the no parameter is used with the command. To specify where logging output is sent, and the level of events to log, use the log commands in Chapter 10, Logging Commands.

Logging to terminal

To start debugging to the terminal:

Step 1: Turn on the debug options by using the relevant debug command.

Step 2: Run the terminal monitor command.

```
awplus> enable
awplus# configure terminal
awplus(config)# debug <protocol> (parameter)
awplus(config)# exit
awplus# terminal monitor
```

Sample Output This is a sample output of the debug rsvp events command displayed on the terminal:

```
awplus#terminal monitor
Dec  2 16:41:49 localhost RSVP[6518]: RSVP: RSVP message sent to
10.10.23.60/32 via interface vlan2
Dec  2 16:41:57 localhost RSVP[6518]: RSVP: Received an RSVP message
of type RSVP Reservation from 192.168.0.60 via interface vlan2
Dec  2 16:41:57 localhost RSVP[6518]: RSVP: Received a RESV message
from 10.10.23.60/32
```

Turning off debugging

To turn off debugging, use the `no debug` or `undebug` command. When a protocol is specified with the `no debug` or `undebug` commands, debugging is stopped for the specified protocol. To stop all debugging, use the `all` parameter with these commands.

```
awplus(config)# no debug bgp events
```

or

```
awplus#undebug all
```

Logging

Protocols generate important debugging messages by default, and send them to the logging system. Additional more detailed messages can be generated by enabling debugging ("Debugging" on page 9.2).

Messages can be filtered based on: the program that generated the message, the severity level of the message, the type of facility that generated the message, substrings within the message text. The severity levels in order are:

- emergencies
- alerts
- critical
- errors
- warnings
- notifications
- informational
- debugging

The facility categories are:

- auth Security/authorization messages
- authpriv Security/authorization messages (private)
- cron Clock daemon
- daemon System daemons
- ftp FTP daemon
- kern Kernel messages
- lpr Line printer subsystem
- mail Mail system
- news Network news subsystem
- syslog Messages generated internally by syslogd
- user Random user-level messages
- uucp UUCP subsystem

Log Outputs

The following types of logging output are available:

- buffered
- permanent
- terminal
- console
- host
- email

Buffered log

The buffered log is a file stored in RAM on the device. Because it is stored in RAM its content does not survive a reboot of the device. A device can only have one instance of the buffered log. The buffered log is enabled by default and has a filter to include messages with a severity level of 'notifications' and above. The buffered log can be enabled or disabled using the commands:

```
awplus# configure terminal
awplus(config)# log buffered
awplus(config)# no log buffered
```

Additional filters can be added and removed using the commands described in log buffered (filter) command on page 10.9:

```
awplus(config)# log buffered {facility|level|msgtext|program}
awplus(config)# no log buffered {facility|level|msgtext|
program}
```

The following log buffered commands are available:

`show log`	Displays the entire contents of the buffered log
`show log tail`	Displays the 10 most recent entries in the buffered log.
`show log tail <10-250>`	Displays a specified number of the most recent entries in the buffered log.
`show log config`	Displays the configuration of all log outputs
`log buffered size`	Specify the amount of memory the buffered log may use.
`clear log`	Remove the contents of the buffered log (and permanent log if it exists)
`clear log buffered`	Remove the contents of the buffered log only
`default log buffered`	Restore the buffered log to its default configuration

Permanent log

The permanent log is a file stored in NVS on the device. This output type is only available on devices that have NVS. The contents on the permanent log is retained over a reboot. A device can only have one instance of the permanent log. The permanent log is enabled by default and has a filter to include messages with a severity level of 'warning' and above. The permanent log can be disabled using the command:

```
awplus# configure terminal
awplus(config)# no log permanent
```

Additional filters can be added and removed using the commands described in log permanent (filter):

```
awplus# configure terminal
awplus(config)# log permanent {facility|level|msgtext|
program}
awplus(config)# no log permanent {facility|level|msgtext|
program}
```

Table 9-1: Permanent log commands

Command	Description
`show log permanent`	Display the entire contents of the permanent log
`show log permanent tail`	Display the 10 most recent entries in the permanent log
`show log permanent tail <10-250>`	Display a specified number of the most recent entries in the permanent log
`show log config`	Display the configuration of all log outputs
`log permanent size`	Specify the amount of memory the permanent log may use
`clear log`	Remove the contents of the buffered log and permanent log
`clear log permanent`	Remove the contents of the permanent log only
`default log permanent`	Restore the permanent log to its default configuration

Host log

A host log sends log messages to a remote syslog server. A device may have many syslog hosts configured. To configure or remove a host use the commands:

```
awplus# configure terminal
awplus(config)# log host <ip-addr>9
awplus(config)# no log host <ip-addr>9
```

where `<ip-addr>` is the IP address of the remote syslog server.

There are no default filters associated with host outputs when they are created. Filters can be added and removed with the log host (filter) command on page 10.24.

It is not possible to view the log messages sent to this type of output as they are not retained on the device. They must be viewed on the remote device. The other host log commands are:

`show log config`	Displays the configuration of all log outputs
`log host time`	Adjust the time information in messages to a time zone other than the one configured on this device
`default log host <ip-address>`	Restores the device default settings for log sent to a remote syslog server.

Email log

An email log sends log messages to an email address. A device may have many email logs configured. To configure or remove an email log use the commands:

```
awplus# configure terminal
awplus(config)# log email <email-address>
awplus(config)# no log email <email-address>
```

where `<email-address>` is the destination email address.

There are no default filters associated with email outputs when they are created. Filters can be added and removed with the commands described in log email (filter):

```
awplus# configure terminal
awplus(config)# log email <email-address> {facility|level|
msgtext|program}
awplus(config)# no log email <email-address> {facility|
level|msgtext|program}
```

It is not possible to view the log messages sent to this type of output as they are not retained on the device. They must be viewed by the email recipient.

The other email log commands are:

`show log config`	Displays the configuration of all log outputs
`log email time`	Adjust the time information in messages to a time zone other than the one configured on this device
`default log email`	Restores the device default settings for log messages sent to an email address.

Note

An email server and “from” address must be configured on the device in order for email logs to work:

- mail from <*email-address*>
- mail smtpserver <*ip-address*>

where the <*email-address*> is the ‘From:’ field on the sent email, and the <*ip-address*> is the email’s destination SMTP server.

Email logs are sent in batches of approximately 20 messages and have the subject line “Log messages”

Chapter 10: Logging Commands

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Command List

This chapter provides an alphabetical reference of commands used to configure logging.

clear exception log

This command resets the contents of the exception log, but does not remove the associated core files.

Note When this command is used within a virtual chassis stack (VCS), it will remove the contents of the exception logs in all stack members.

Syntax `clear exception log`

Mode Privileged Exec

Example

```
awplus# clear exception log
```

clear log

This command removes the contents of the buffered and permanent logs.

Note When this command is used within a virtual chassis stack (VCS), it will remove the contents of the buffered and permanent logs in all stack members.

Syntax `clear log`

Mode Privileged Exec

Example To delete the contents of the buffered and permanent log use the command:

```
awplus# clear log
```

Validation Commands show log

Related Commands clear log buffered
clear log permanent

clear log buffered

This command removes the contents of the buffered log.

Note When this command is used within a virtual chassis stack (VCS), it will remove the contents of the buffered logs in all stack members.

Syntax `clear log buffered`

Mode Privileged Exec

Example To delete the contents of the buffered log use the following commands:

```
awplus# clear log buffered
```

Validation Commands show log

Related Commands clear log
clear log permanent

clear log permanent

This command removes the contents of the permanent log.

Note When this command is used within a virtual chassis stack (VCS), it will remove the contents of the buffered logs in all stack members.

Syntax `clear log permanent`

Mode Privileged Exec

Example To delete the contents of the permanent log use the following commands:

```
awplus# clear log permanent
```

Validation Commands show log

Related Commands clear log
clear log buffered

default log buffered

This command restores the default settings for the buffered log stored in RAM. By default the size of the buffered log is 50 kB and it accepts messages with the severity level of “warnings” and above.

Syntax `default log buffered`

Default The buffered log is enabled by default.

Mode Global Configuration

Example To restore the buffered log to its default settings use the following commands:

```
awplus# configure terminal
awplus(config)# default log buffered
```

Validation Commands show log config

Related Commands log buffered
log buffered size

default log console

This command restores the default settings for log messages sent to the terminal when a log console command is issued. By default all messages are sent to the console when a log console command is issued.

Syntax `default log console`

Mode Global Configuration

Example To restore the log console to its default settings use the following commands:

```
awplus# configure terminal
awplus(config)# default log console
```

Validation Commands show log config

Related Commands log console
log console (filter)

default log email

This command restores the default settings for log messages sent to an email address. By default no filters are defined for email addresses. Filters must be defined before messages will be sent. This command also restores the remote syslog server time offset value to local (no offset).

Syntax `default log email <email-address>`

Parameter	Description
<email-address>	The email address to send log messages to

Mode Global Configuration

Example To restore the default settings for log messages sent to the email address `admin@alliedtelesis.com` use the following commands:

```
awplus# configure terminal
awplus(config)# default log email admin@alliedtelesis.com
```

Related Commands show log config

default log host

This command restores the default settings for log sent to a remote syslog server. By default no filters are defined for remote syslog servers. Filters must be defined before messages will be sent. This command also restores the remote syslog server time offset value to local (no offset).

Syntax `default log host <ip-addr>`

Parameter	Description
<ip-addr>	The IP address of a remote syslog server

Mode Global Configuration

Example To restore the default settings for messages sent to the remote syslog server with IP address `10.32.16.21` use the following commands:

```
awplus# configure terminal
awplus(config)# default log host 10.32.16.21
```

Validation Commands show log config

Related Commands log email

default log monitor

This command restores the default settings for log messages sent to the terminal when a terminal monitor command is used.

Syntax `default log monitor`

Default All messages are sent to the terminal when a terminal monitor command is used.

Mode Global Configuration

Example To restore the log monitor to its default settings use the following commands:

```
awplus# configure terminal
awplus(config)# default log monitor
```

Related Commands log monitor (filter)
show log config

default log permanent

This command restores the default settings for the permanent log stored in NVS. By default, the size of the permanent log is 50 kB and it accepts messages with the severity level of `warnings` and above.

Syntax `default log permanent`

Default The permanent log is enabled by default.

Mode Global Configuration

Example To restore the permanent log to its default settings use the following commands:

```
awplus# configure terminal
awplus(config)# default log permanent
```

Related Commands log permanent
log permanent size
show log config

exception coredump size

This command sets the size of core files, and can also be used to stop core files being created.

Use the no variant of this command to restore the core file size to its default (unlimited).

This setting only applies to processes created after this command has been executed, to ensure this is applied to all processes the system will need to be restarted.

Syntax

```
exception coredump size {none|small|medium|large|unlimited}
no exception coredump size
```

Parameter	Description
`none`	Don't create corefiles
`small`	Create small corefiles
`medium`	Create medium corefiles
`large`	Create large corefiles (default)
`unlimited`	Create corefiles as large as necessary

Default Unlimited

Mode Global Configuration

Usage Core files are generated when a process crashes. The size of a core file can vary, its upper limit is controlled by this command. Files larger than this limit will be truncated by reducing the amount of stack and variable information stored.

Truncated core files may make debugging the failure difficult if not impossible. Reducing the amount of data stored in a core file is not recommended, however the facility is provided to reduce the amount of flash used.

Examples To restrict the size of the core file created, use the command:

```
awplus# configure terminal
awplus(config)# exception coredump size small
```

To restore the size of the core files created to the default of `unlimited`, use the command:

```
awplus# configure terminal
awplus(config)# no exception coredump size
```

log buffered

This command configures the device to store log messages in RAM. Messages stored in RAM are not retained on the device over a restart. Once the buffered log reaches its configured maximum allowable size old messages will be deleted to make way for new ones.

Syntax

```
log buffered
no log buffered
```

Default The buffered log is configured by default.

Mode Global Configuration

Examples To configured the device to store log messages in RAM use the following commands:

```
awplus# configure terminal
awplus(config)# log buffered
```

To configure the device to not store log messages in a RAM buffer use the following commands:

```
awplus# configure terminal
awplus(config)# no log buffered
```

Validation Commands show log config

Related Commands default log buffered
log buffered (filter)
log buffered size

log buffered (filter)

Use this command to create a filter to select messages to be sent to the buffered log. Selection can be based on the priority/ severity of the message, the program that generated the message, the logging facility used, a sub-string within the message or a combination of some or all of these.

The no variant of this command removes the corresponding filter, so that the specified messages are no longer sent to the buffered log.

Syntax

```
log buffered [level <level>] [program <program-name>]
   [facility <facility>] [msgtext <text-string>]

no log buffered [level <level>] [program <program-name>]
   [facility <facility>] [msgtext <text-string>]
```

Parameter	Description
`level`	Filter messages to the buffered log by severity level.
<level>	The minimum severity of message to send to the buffered log. The level can be specified as one of the following numbers or level names, where 0 is the highest severity and 7 is the lowest severity: 0 emergencies: System is unusable 1 alerts Action must be taken immediately 2 critical Critical conditions 3 errors Error conditions 4 warnings Warning conditions 5 notices Normal, but significant, conditions 6 informational Informational messages 7 debugging Debug-level messages
`program`	Filter messages to the buffered log by program. Include messages from a specified program in the buffered log.

Parameter	Description
<program-name>	The name of a program to log messages from, either one of the following predefined program names (not case-sensitive), or another program name (case-sensitive) that you find in the log output. rip Routing Information Protocol (RIP) ripng Routing Information Protocol - next generation (RIPng) ospf Open Shortest Path First (OSPF) ospfv3 Open Shortest Path First (OSPF) version 3 (OSPFv3) bgp Border Gateway Protocol (BGP) rsvp Resource Reservation Protocol (RSVP) pim-dm Protocol Independent Multicast - Dense Mode (PIM-DM) pim-sm Protocol Independent Multicast - Sparse Mode (PIM-SM) dot1x IEEE 802.1X Port-Based Access Control lacp Link Aggregation Control Protocol (LACP) stp Spanning Tree Protocol (STP) rstp Rapid Spanning Tree Protocol (RSTP) mstp Multiple Spanning Tree Protocol (MSTP) imi Integrated Management Interface (IMI) imish Integrated Management Interface Shell (IMISH) epsr Ethernet Protection Switched Rings (EPSR) irdp ICMP Router Discovery Protocol (IRDP) rmon Remote Monitoring loopprot Loop Protection dhcpsn DHCP snooping (DHCPSN)
`facility`	Filter messages to the buffered log by syslog facility.
<facility>	Specify one of the following syslog facilities to include messages from in the buffered log: kern Kernel messages user Random user-level messages mail Mail system daemon System daemons auth Security/authorization messages syslog Messages generated internally by syslogd lpr Line printer subsystem news Network news subsystem uucp UUCP subsystem cron Clock daemon authpriv Security/authorization messages (private) ftp FTP daemon
`msgtext`	Select messages containing a certain text string (maximum 128 characters).
<text-string>	A text string to match (maximum 128 characters). This is case sensitive, and must be the last text on the command line.

Default By default the buffered log has a filter to select messages whose severity level is “notices (5)” or higher. This filter may be removed using the no variant of this command.

Mode Global Configuration

Examples To add a filter to send all messages generated by BGP that have a severity of `notices` or higher to the buffered log use the following commands:

```
awplus# configure terminal
awplus(config)# log buffered level notices program bgp
```

To add a filter to send all messages containing the text "`Bridging initialization`", to the buffered log use the following commands:

```
awplus# configure terminal
awplus(config)# log buffered msgtext Bridging initialization
```

To remove a filter that sends all messages generated by BGP that have a severity of `notices` or higher to the buffered log use the following commands:

```
awplus# configure terminal
awplus(config)# no log buffered level notices program bgp
```

To remove a filter that sends all messages containing the text "`Bridging initialization`", to the buffered log use the following commands:

```
awplus# configure terminal
awplus(config)# no log buffered msgtext Bridging initialization
```

Validation Commands show log config

Related Commands default log buffered
log buffered
log buffered size

log buffered size

This command configures the amount of memory that the buffered log is permitted to use. Once this memory allocation has been filled old messages will be deleted to make room for new messages.

Syntax

```
log buffered size <50-250>
```

Parameter	Description
<50-250>	Size of the RAM log in kilobytes

Mode Global Configuration

Example To allow the buffered log to use up to 100 kB of RAM use the following commands:

```
awplus# configure terminal
awplus(config)# log buffered size 100
```

Validation Commands show log config

Related Commands default log buffered
log buffered

log console

This command configures the device to send log messages to consoles. The console log is configured by default to send messages to the devices main console port.

Use the no variant of this command to configure the device not to send log messages to consoles.

Syntax

```
log console
no log console
```

Mode Global Configuration

Examples To configure the device to send log messages use the following commands:

```
awplus# configure terminal
awplus(config)# log console
```

To configure the device not to send log messages in all consoles use the following commands:

```
awplus# configure terminal
awplus(config)# no log console
```

Validation Commands show log config

Related Commands log console (filter)

log console (filter)

This command creates a filter to select messages to be sent to all consoles when the log console command is given. Selection can be based on the priority/severity of the message, the program that generated the message, the logging facility used, a sub-string within the message or a combination of some or all of these.

Syntax

```
log console [level <level>] [program <program-name>]
    [facility <facility>] [msgtext <text-string>]

no log console [level <level>] [program <program-name>]
    [facility <facility>] [msgtext <text-string>]
```

Parameter	Description
`level`	Filter messages by severity level.
<level>	The minimum severity of message to send. The level can be specified as one of the following numbers or level names, where 0 is the highest severity and 7 is the lowest severity: 0 emergencies: System is unusable 1|alerts Action must be taken immediately 2|critical Critical conditions 3|errors Error conditions 4|warnings Warning conditions 5|notices Normal, but significant, conditions 6|informational Informational messages 7|debugging Debug-level messages
`program`	Filter messages by program. Include messages from a specified program.

Parameter	Description
<program-name>	The name of a program to log messages from, either one of the following predefined program names (not case-sensitive), or another program name (case-sensitive) that you find in the log output. rip Routing Information Protocol (RIP) ripng Routing Information Protocol - next generation (RIPng) ospf Open Shortest Path First (OSPF) ospfv3 Open Shortest Path First (OSPF) version 3 (OSPFv3) bgp Border Gateway Protocol (BGP) rsvp Resource Reservation Protocol (RSVP) pim-dm Protocol Independent Multicast - Dense Mode (PIM-DM) pim-sm Protocol Independent Multicast - Sparse Mode (PIM-SM) dot1x IEEE 802.1X Port-Based Access Control lacp Link Aggregation Control Protocol (LACP) stp Spanning Tree Protocol (STP) rstp Rapid Spanning Tree Protocol (RSTP) mstp Multiple Spanning Tree Protocol (MSTP) imi Integrated Management Interface (IMI) imish Integrated Management Interface Shell (IMISH) epsr Ethernet Protection Switched Rings (EPSR) irdp ICMP Router Discovery Protocol (IRDP) rmon Remote Monitoring loopprot Loop Protection dhcpsn DHCP snooping (DHCPSN)
`facility`	Filter messages to the buffered log by syslog facility.
<facility>	Specify one of the following syslog facilities to include messages from: kern Kernel messages user Random user-level messages mail Mail system daemon System daemons auth Security/authorization messages syslog Messages generated internally by syslogd lpr Line printer subsystem news Network news subsystem uucp UUCP subsystem cron Clock daemon authpriv Security/authorization messages (private) ftp FTP daemon
`msgtext`	Select messages containing a certain text string
<text-string>	A text string to match. This is case sensitive, and must be the last text on the command line.

Default By default the buffered log has a filter to select messages whose severity level is `critical` or higher. This filter may be removed using the no variant of this command. This filter may be removed and replaced by filters that are more selective.

Mode Global Configuration

Examples To create a filter to send all messages generated by MSTP that have a severity of `info` or higher to console instances where the log console command has been given, remove the default filter that includes everything use the following commands:

```
awplus# configure terminal
awplus(config)# log console level info program mstp
```

and then use the command:

```
awplus(config)# log console level info program mstp
```

To create a filter to send all messages containing the text "`Bridging initialization`" to console instances where the log console command has been given use the following commands:

```
awplus# configure terminal
awplus(config)# log console msgtext "Bridging initialization"
```

To remove a filter that sends all messages generated by BGP that have a severity of `notices` or higher to consoles use the following commands:

```
awplus# configure terminal
awplus(config)# no log console level notices program bgp
```

To remove a default filter that includes sending `critical`, `alert` and `emergency` level messages to the console use the following commands:

```
awplus# configure terminal
awplus(config)# no log console level critical
```

Validation Commands show log config

Related Commands log console

log email

This command configures the device to send log messages to an email address. The email address is specified in this command.

Syntax `log email <email-address>`

Parameter	Description
<email-address>	The email address to send log messages to

Default By default no filters are defined for email log targets. Filters must be defined before messages will be sent.

Mode Global Configuration

Example To have log messages emailed to the email address `admin@alliedtelesis.com` use the following commands:

```
awplus# configure terminal
awplus(config)# log email admin@alliedtelesis.com
```

Validation Commands show log config

Related Commands default log email
log email

log email (filter)

This command creates a filter to select messages to be sent to an email address. Selection can be based on the priority/ severity of the message, the program that generated the message, the logging facility used, a sub-string within the message or a combination of some or all of these.

The no variant of this command configures the device to no longer send log messages to a specified email address. All configuration relating to this log target will be removed.

Syntax

```
log email <email-address> [level <level>] [program <program-name>]
   [facility <facility>] [msgtext <text-string>]

no log email <email-address> [level <level>] [program <program-name>]
   [facility <facility>] [msgtext <text-string>]
```

Parameter	Description
<email-address>	The email address to send logging messages to
`level`	Filter messages by severity level.
<level>	The minimum severity of messages to send. The level can be specified as one of the following numbers or level names, where 0 is the highest severity and 7 is the lowest severity: 0 emergencies: System is unusable 1 alerts Action must be taken immediately 2 critical Critical conditions 3 errors Error conditions 4 warnings Warning conditions 5 notices Normal, but significant, conditions 6 informational Informational messages 7 debugging Debug-level messages
`program`	Filter messages by program. Include messages from a specified program in the log.

Parameter	Description
<program-name>	The name of a program to log messages from, either one of the following predefined program names (not case-sensitive), or another program name (case -sensitive) that you find in the log output. rip Routing Information Protocol (RIP) ripng Routing Information Protocol - next generation (RIPng) ospf Open Shortest Path First (OSPF) ospfv3 Open Shortest Path First (OSPF) version 3 (OSPFv3) bgp Border Gateway Protocol (BGP) rsvp Resource Reservation Protocol (RSVP) pim-dm Protocol Independent Multicast - Dense Mode (PIM-DM) pim-sm Protocol Independent Multicast - Sparse Mode (PIM-SM) dot1x IEEE 802.1X Port-Based Access Control lacp Link Aggregation Control Protocol (LACP) stp Spanning Tree Protocol (STP) rstp Rapid Spanning Tree Protocol (RSTP) mstp Multiple Spanning Tree Protocol (MSTP) imi Integrated Management Interface (IMI) imish Integrated Management Interface Shell (IMISH) epsr Ethernet Protection Switched Rings (EPSR) irdp ICMP Router Discovery Protocol (IRDP) rmon Remote Monitoring loopprot Loop Protection dhcpsn DHCP snooping (DHCPSN)
`facility`	Filter messages to the log by syslog facility.
<facility>	Specify one of the following syslog facilities to include messages from in the log: kern Kernel messages user Random user-level messages mail Mail system daemon System daemons auth Security/authorization messages syslog Messages generated internally by syslogd lpr Line printer subsystem news Network news subsystem uucp UUCP subsystem cron Clock daemon authpriv Security/authorization messages (private) ftp FTP daemon
`msgtext`	Select messages containing a certain text string
<text-string>	A text string to match. This is case sensitive, and must be the last text on the command line.

Mode Global Configuration

Examples To create a filter to send all messages generated by BGP that have a severity of `notices` or higher to the email address `admin@homebase.com` use the following commands:

```
awplus# configure terminal
awplus(config)# log email admin@homebase.com level notices
program bgp
```

To create a filter to send all messages containing the text "`Bridging initialization`", to the email address `admin@homebase.com` use the following commands:

```
awplus# configure terminal
awplus(config)# log email admin@homebase.com msgtext
"Bridging initialization"
```

To create a filter to send messages with a severity level of `informational` and above to the email address `admin@alliedtelesis.com` use the following commands:

```
awplus# configure terminal
awplus(config)# log email admin@alliedtelesis.com level
informational
```

To stop the device emailing log messages emailed to the email address `admin@alliedtelesis.com` use the following commands:

```
awplus# configure terminal
awplus(config)# no log email admin@homebase.com
```

To remove a filter that sends all messages generated by BGP that have a severity of `notices` or higher to the email address `admin@homebase.com` use the following commands:

```
awplus# configure terminal
awplus(config)# no log email admin@homebase.com level
notices program bgp
```

To remove a filter that sends messages with a severity level of `informational` and above to the email address `admin@alliedtelesis.com` use the following commands:

```
awplus# configure terminal
awplus(config)# no log email admin@alliedtelesis.com level
informational
```

Related Commands default log email
log email
show log config

log email time

This command configures the time used in messages sent to an email address. If the syslog server is in a different time zone to your switch then the time offset can be configured using either the utc-offset parameter option keyword or the local-offset parameter option keyword, where utc-offset is the time difference from UTC (Universal Time, Coordinated) and local-offset is the difference from local time.

Syntax

```
log email <email-address> time {local|local-offset|utc-offset
   {plus|minus}<0-24>}
```

Parameter	Description
<email-address>	The email address to send log messages to
`time`	Specify the time difference between the email recipient and the switch you are configuring.
`local`	The switch is in the same time zone as the email recipient
`local-offset`	The switch is in a different time zone to the email recipient. Use the plus or minus keywords and specify the difference (offset) from local time of the switch to the email recipient in hours.
`utc-offset`	The switch is in a different time zone to the email recipient. Use the plus or minus keywords and specify the difference (offset) from UTC time of the switch to the email recipient in hours.
`plus`	Negative offset (difference) from the switch to the email recipient.
`minus`	Positive offset (difference) from the switch to the email recipient.
<0-24>	World Time zone offset in hours

Default The default is local time.

Mode Global Configuration

Usage Use the local option if the email recipient is in the same time zone as this device. Messages will display the time as on the local device when the message was generated.

Use the offset option if the email recipient is in a different time zone to this device. Specify the time offset of the email recipient in hours. Messages will display the time they were generated on this device but converted to the time zone of the email recipient.

Examples To send messages to the email address `test@home.com` in the same time zone as the switch's local time zone, use the following commands:

```
awplus# configure terminal
awplus(config)# log email admin@base.com time local 0
```

To send messages to the email address `admin@base.com` with the time information converted to the time zone of the email recipient, which is 3 hours ahead of the switch's local time zone, use the following commands:

```
awplus# configure terminal
awplus(config)# log email admin@base.com time local-offset
                plus 3
```

To send messages to the email address `user@remote.com` with the time information converted to the time zone of the email recipient, which is 3 hours behind the switch's UTC time zone, use the following commands:

```
awplus# configure terminal

awplus(config)# log email user@remote.com time utc-offset
minus 3
```

Validation Commands show log config

Related Commands default log buffered

log host

This command configures the device to send log messages to a remote syslog server via UDP port 514. The IP address of the remote server must be specified. By default no filters are defined for remote syslog servers. Filters must be defined before messages will be sent.

Syntax

```
log host <ip-addr>
no log host <ip-addr>
```

Parameter	Description
<ip-addr>	The IP address of a remote syslog server in dotted decimal format A.B.C.D

Mode Global Configuration

Examples To configure the device to send log messages to a remote syslog server with IP address `10.32.16.99` use the following commands:

```
awplus# configure terminal
awplus(config)# log host 10.32.16.99
```

To stop the device from sending log messages to the remote syslog server with IP address `10.32.16.99` use the following commands:

```
awplus# configure terminal
awplus(config)# no log host 10.32.16.99
```

Validation Commands show log config

Related Commands default log host

log host (filter)

This command creates a filter to select messages to be sent to a remote syslog server. Selection can be based on the priority/severity of the message, the program that generated the message, the logging facility used, a substring within the message or a combination of some or all of these.

The no variant of this command configures the device to no longer send log messages to a remote syslog server. The IP address of the syslog server must be specified. All configuration relating to this log target will be removed.

Syntax

```
log host <ip-addr> [level <level>] [program <program-name>]
    [facility <facility>] [msgtext <text-string>]

no log host <ip-addr> [level <level>] [program <program-name>]
    [facility <facility>] [msgtext <text-string>]
```

Parameter	Description
`<ip-addr>`	The IP address of a remote syslog server
`level`	Filter messages by severity level.
`<level>`	The minimum severity of messages to send. The level can be specified as one of the following numbers or level names, where 0 is the highest severity and 7 is the lowest severity: 0|emergencies: System is unusable 1|alerts Action must be taken immediately 2|critical Critical conditions 3|errors Error conditions 4|warnings Warning conditions 5|notices Normal, but significant, conditions 6|informational Informational messages 7|debugging Debug-level messages
`program`	Filter messages by program. Include messages from a specified program in the log.
`<program-name>`	The name of a program to log messages from, either one of the following predefined program names (not case-sensitive), or another program name (case -sensitive) that you find in the log output. rip Routing Information Protocol (RIP) ripng Routing Information Protocol - next generation (RIPng) ospf Open Shortest Path First (OSPF) ospfv3 Open Shortest Path First (OSPF) version 3 (OSPFv3) bgp Border Gateway Protocol (BGP) rsvp Resource Reservation Protocol (RSVP) pim-dm Protocol Independent Multicast - Dense Mode (PIM-DM) pim-sm Protocol Independent Multicast - Sparse Mode (PIM-SM) dot1x IEEE 802.1X Port-Based Access Control

Parameter	Description	
<program-name> (cont.)	lacp	Link Aggregation Control Protocol (LACP)
	stp	Spanning Tree Protocol (STP)
	rstp	Rapid Spanning Tree Protocol (RSTP)
	mstp	Multiple Spanning Tree Protocol (MSTP)
	imi	Integrated Management Interface (IMI)
	imish	Integrated Management Interface Shell (IMISH)
	epsr	Ethernet Protection Switched Rings (EPSR)
	irdp	ICMP Router Discovery Protocol (IRDP)
	rmon	Remote Monitoring
	loopprot	Loop Protection
	dhcpsn	DHCP snooping (DHCPSN)
`facility`	Filter messages to the log by syslog facility.	
<facility>	Specify one of the following syslog facilities to include messages from in the log:	
	kern	Kernel messages
	user	Random user-level messages
	mail	Mail system
	daemon	System daemons
	auth	Security/authorization messages
	syslog	Messages generated internally by syslogd
	lpr	Line printer subsystem
	news	Network news subsystem
	uucp	UUCP subsystem
	cron	Clock daemon
	authpriv	Security/authorization messages (private)
	ftp	FTP daemon
`msgtext`	Select messages containing a certain text string	
<text-string>	A text string to match. This is case sensitive, and must be the last text on the command line.	

Mode Global Configuration

Examples To create a filter to send all messages generated by BGP that have a severity of `notices` or higher to a remote syslog server with IP address `10.32.16.21` use the following commands:

```
awplus# configure terminal
awplus(config)# log host 10.32.16.21 level notices program bgp
```

To create a filter to send all messages containing the text "`Bridging initialization`", to a remote syslog server with IP address `10.32.16.21` use the following commands:

```
awplus# configure terminal
awplus(config)# log host 10.32.16.21 msgtext "Bridging
initialization"
```

To create a filter to send messages with a severity level of `informational` and above to the syslog server with IP address `10.32.16.21` use the following commands:

```
awplus# configure terminal
awplus(config)# log host 10.32.16.21 level informational
```

To remove a filter that sends all messages generated by BGP that have a severity of `notices` or higher to a remote syslog server with IP address `10.32.16.21` use the following commands:

```
awplus# configure terminal
awplus(config)# no log host 10.32.16.21 level notices program
bgp
```

To remove a filter that sends all messages containing the text "`Bridging initialization`", to a remote syslog server with IP address `10.32.16.21` use the following commands:

```
awplus# configure terminal
awplus(config)# no log host 10.32.16.21 msgtext "Bridging
initialization"
```

To remove a filter that sends messages with a severity level of `informational` and above to the syslog server with IP address `10.32.16.21` use the following commands:

```
awplusawpluls# configure terminal
awplus(config)# no log host 10.32.16.21 level informational
```

Related Commands default log host
show log config

log host time

This command configures the time used in messages sent to a remote syslog server. If the syslog server is in a different time zone to your switch then the time offset can be configured using either the utc-offset parameter option keyword or the local-offset parameter option keyword, where utc-offset is the time difference from UTC (Universal Time, Coordinated) and local-offset is the difference from local time.

Syntax

```
log host <email-address> time {local|local-offset|utc-offset
   {plus|minus} <0-24>}
```

Parameter	Description
<email-address>	The email address to send log messages to
`time`	Specify the time difference between the email recipient and the switch you are configuring.
`local`	The switch is in the same time zone as the email recipient
`local-offset`	The switch is in a different time zone to the email recipient. Use the plus or minus keywords and specify the difference (offset) from local time of the switch to the email recipient in hours.
`utc-offset`	The switch is in a different time zone to the email recipient. Use the plus or minus keywords and specify the difference (offset) from UTC time of the switch to the email recipient in hours.
`plus`	Negative offset (difference) from the switch to the syslog server.
`minus`	Positive offset (difference) from the switch to the syslog server.
<0-24>	World Time zone offset in hours

Default The default is local time.

Mode Global Configuration

Usage Use the local option if the remote syslog server is in the same time zone as the switch. Messages will display the time as on the local device when the message was generated.

Use the offset option if the email recipient is in a different time zone to this device. Specify the time offset of the remote syslog server in hours. Messages will display the time they were generated on this device but converted to the time zone of the remote syslog server.

Examples To send messages to the remote syslog server with the IP address `10.32.16.21` in the same time zone as the switch's local time zone, use the following commands:

```
awplus# configure terminal
awplus(config)# log host 10.32.16.21 time local 0
```

To send messages to the remote syslog server with the IP address `10.32.16.12` with the time information converted to the time zone of the remote syslog server, which is 3 hours ahead of the switch's local time zone, use the following commands:

```
awplus# configure terminal
awplus(config)# log host 10.32.16.12 time local-offset plus 3
```

To send messages to the remote syslog server with the IP address `10.32.16.02` with the time information converted to the time zone of the email recipient, which is 3 hours behind the switch's UTC time zone, use the following commands:

```
awplus# configure terminal
awplus(config)# log host 10.32.16.02 time utc-offset minus 3
```

Validation Commands show log config

Related Commands default log buffered

log monitor (filter)

This command creates a filter to select messages to be sent to the terminal when the terminal monitor command is given. Selection can be based on the priority/severity of the message, the program that generated the message, the logging facility used, a sub-string within the message or a combination of some or all of these.

Syntax

```
log monitor [level <level>] [program <program-name>]
   [facility <facility>] [msgtext <text-string>]

no log monitor [level <level>] [program <program-name>]
   [facility <facility>] [msgtext <text-string>]
```

Parameter	Description
`level`	Filter messages to the permanent log by severity level.
<level>	The minimum severity of message to send to the log. The level can be specified as one of the following numbers or level names, where 0 is the highest severity and 7 is the lowest severity: 0|emergencies: System is unusable 1|alerts Action must be taken immediately 2|critical Critical conditions 3|errors Error conditions 4|warnings Warning conditions 5|notices Normal, but significant, conditions 6|informational Informational messages 7|debugging Debug-level messages
`program`	Filter messages to the permanent log by program. Include messages from a specified program in the log.
<program-name>	The name of a program to log messages from, either one of the following predefined program names (not case-sensitive), or another program name (case -sensitive) that you find in the log output. rip Routing Information Protocol (RIP) ripng Routing Information Protocol - next generation (RIPng) ospf Open Shortest Path First (OSPF) ospfv3 Open Shortest Path First (OSPF) version 3 (OSPFv3) bgp Border Gateway Protocol (BGP) rsvp Resource Reservation Protocol (RSVP) pim-dm Protocol Independent Multicast - Dense Mode (PIM-DM) pim-sm Protocol Independent Multicast - Sparse Mode (PIM-SM) dot1x IEEE 802.1X Port-Based Access Control lacp Link Aggregation Control Protocol (LACP) stp Spanning Tree Protocol (STP) rstp Rapid Spanning Tree Protocol (RSTP) mstp Multiple Spanning Tree Protocol (MSTP) imi Integrated Management Interface (IMI)

Parameter	Description	
<program-name> (cont.)	imish	Integrated Management Interface Shell (IMISH)
	epsr	Ethernet Protection Switched Rings (EPSR)
	irdp	ICMP Router Discovery Protocol (IRDP)
	rmon	Remote Monitoring
	loopprot	Loop Protection
	dhcpsn	DHCP snooping (DHCPSN)
`facility`	Filter messages to the permanent log by syslog facility.	
<facility>	Specify one of the following syslog facilities to include messages from in the log:	
	kern	Kernel messages
	user	Random user-level messages
	mail	Mail system
	daemon	System daemons
	auth	Security/authorization messages
	syslog	Messages generated internally by syslogd
	lpr	Line printer subsystem
	news	Network news subsystem
	uucp	UUCP subsystem
	cron	Clock daemon
	authpriv	Security/authorization messages (private)
	ftp	FTP daemon
`msgtext`	Select messages containing a certain text string	
<text-string>	A text string to match. This is case sensitive, and must be the last text on the command line.	

Default By default there is a filter to select all messages. This filter may be removed and replaced by filters that are more selective.

Mode Global Configuration

Examples To create a filter to send all messages generated by MSTP that have a severity of `info` or higher to terminal instances where the terminal monitor command has been given use the following commands:

```
awplus# configure terminal
awplus(config)# log monitor level info program mstp
```

To remove a filter that sends all messages generated by BGP that have a severity of `notices` or higher to the terminal use the following commands:

```
awplus# configure terminal
awplus(config)# no log monitor level notices program bgp
```

To remove a default filter that includes sending everything to the terminal use the following commands:

```
awplus# configure terminal
awplus(config)# no log monitor level debugging
```

Validation Commands show log config

Related Commands terminal monitor

log permanent

This command configures the device to send log messages to non-volatile storage (NVS) on the device. Log messages sent to NVS are retained on the device over a restart, that is they are permanent. Once the permanent log reaches its configured maximum allowable size old messages will be deleted to make way for new ones.

The no variant of this command configures the device not to send any messages to the permanent log. Log messages will not be retained over a restart.

Syntax

```
log permanent
no log permanent
```

Mode Global Configuration

Examples To enable permanent logging use the following commands:

```
awplus# configure terminal
awplus(config)# log permanent
```

To disable permanent logging use the following commands:

```
awplus# configure terminal
awplus(config)# no log permanent
```

Validation Commands show log config

Related Commands default log permanent
log permanent (filter)
log permanent size
show log permanent

log permanent (filter)

This command creates a filter to select messages to be sent to the permanent log. Selection can be based on the priority/ severity of the message, the program that generated the message, the logging facility used, a sub-string within the message or a combination of some or all of these.

The no variant of this command removes the corresponding filter, so that the specified messages are no longer sent to the permanent log.

Syntax

```
log permanent [level <level>] [program <program-name>]
   [facility <facility>] [msgtext <text-string>]

no log permanent [level <level>] [program <program-name>]
   [facility <facility>] [msgtext <text-string>]
```

Parameter	Description
`level`	Filter messages to the permanent log by severity level.
<level>	The minimum severity of message to send to the log. The level can be specified as one of the following numbers or level names, where 0 is the highest severity and 7 is the lowest severity: 0|emergencies: System is unusable 1|alerts Action must be taken immediately 2|critical Critical conditions 3|errors Error conditions 4|warnings Warning conditions 5|notices Normal, but significant, conditions 6|informational Informational messages 7|debugging Debug-level messages
`program`	Filter messages to the permanent log by program. Include messages from a specified program in the log.

Parameter	Description	
<program-name>	The name of a program to log messages from, either one of the following predefined program names (not case-sensitive), or another program name (case -sensitive) that you find in the log output.	
	rip	Routing Information Protocol (RIP)
	ripng	Routing Information Protocol - next generation (RIPng)
	ospf	Open Shortest Path First (OSPF)
	ospfv3	Open Shortest Path First (OSPF) version 3 (OSPFv3)
	bgp	Border Gateway Protocol (BGP)
	rsvp	Resource Reservation Protocol (RSVP)
	pim-dm	Protocol Independent Multicast - Dense Mode (PIM-DM)
	pim-sm	Protocol Independent Multicast - Sparse Mode (PIM-SM)
	dot1x	IEEE 802.1X Port-Based Access Control
	lacp	Link Aggregation Control Protocol (LACP)
	stp	Spanning Tree Protocol (STP)
	rstp	Rapid Spanning Tree Protocol (RSTP)
	mstp	Multiple Spanning Tree Protocol (MSTP)
	imi	Integrated Management Interface (IMI)
	imish	Integrated Management Interface Shell (IMISH)
	epsr	Ethernet Protection Switched Rings (EPSR)
	irdp	ICMP Router Discovery Protocol (IRDP)
	rmon	Remote Monitoring
	loopprot	Loop Protection
	dhcpsn	DHCP snooping (DHCPSN)
`facility`	Filter messages to the permanent log by syslog facility.	
<facility>	Specify one of the following syslog facilities to include messages from in the log:	
	kern	Kernel messages
	user	Random user-level messages
	mail	Mail system
	daemon	System daemons
	auth	Security/authorization messages
	syslog	Messages generated internally by syslogd
	lpr	Line printer subsystem
	news	Network news subsystem
	uucp	UUCP subsystem
	cron	Clock daemon
	authpriv	Security/authorization messages (private)
	ftp	FTP daemon
`msgtext`	Select messages containing a certain text string	
<text-string>	A text string to match. This is case sensitive, and must be the last text on the command line.	

Default By default the buffered log has a filter to select messages whose severity level is `notices (5)` or higher. This filter may be removed using the no variant of this command.

Mode Global Configuration

Examples To create a filter to send all messages generated by BGP that have a severity of `notices` or higher to the permanent log use the following commands:

```
awplus# configure terminal
awplus(config)# log permanent level notices program bgp
```

To create a filter to send all messages containing the text "`Bridging initialization`", to the permanent log use the following commands:

```
awplus# configure terminal
awplus(config)# log permanent msgtext Bridging initialization
```

Validation Commands show log config

Related Commands default log permanent
log permanent
log permanent size
show log permanent

log permanent size

This command configures the amount of memory that the permanent log is permitted to use. Once this memory allocation has been filled old messages will be deleted to make room for new messages.

Syntax

```
log permanent size <50-250>
```

Parameter	Description
<50-250>	Size of the permanent log in kilobytes

Mode Global Configuration

Example To allow the permanent log to use up to 100 kB of NVS use the following commands:

```
awplus# configure terminal
awplus(config)# log permanent size 100
```

Validation Commands show log config

Related Commands default log permanent
log permanent

log-rate-limit nsm

This command limits the number of log messages generated by the switch for a given interval.

Use the no variant of this command to revert to the default number of log messages generated by the switch of up to 200 log messages per second.

Syntax

```
log-rate-limit nsm messages <message-limit> interval <time-interval>
no log-rate-limit nsm
```

Parameter	Description
<message-limit>	<1-65535> The number of log messages generated by the switch.
<time-interval>	<0-65535> The time period for log message generation in 1/100 seconds. If an interval of 0 is specified then no log message rate limiting is applied.

Default By default, the switch will allow 200 log messages to be generated per second.

Mode Global Configuration

Usage Previously, if the switch received a continuous stream of IGMP packets with errors, such as when a packet storm occurs because of a network loop, then the switch generates a lot of log messages using more and more memory, which may ultimately cause the switch to shutdown. This log rate limiting feature constrains the rate that log messages are generated by the switch.

Note that if within the given time interval, the number of log messages exceeds the limit, then any excess log messages are discarded. At the end of the time interval, a single log message is generated indicating that log messages were discarded due to the log rate limit being exceeded.

Thus if the expectation is that there will be a lot of discarded log messages due to log rate limiting, then it is advisable to set the time interval to no less than 100, which means that there would only be one log message, indicating log excessive log messages have been discarded.

Examples To limit the switch to generate up to 300 log messages per second, use the following commands:

```
awplus# configure terminal
awplus(config)# log-rate-limit nsm messages 300 interval 100
```

To return the switch the default setting, to generate up to 200 log messages per second, use the following commands:

```
awplus# configure terminal
awplus(config)# no log-rate-limit nsm
```

show counter log

This command displays log counter information.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show counter log`

Mode User Exec and Privileged Exec

Example To display the log counter information, use the command:

```
awplus# show counter log
```

Output Figure 10-1: Example output from the **show counter log** command

```
Log counters
Total Received         ......... 2328
Total Received P0      ......... 0
Total Received P1      ......... 0
Total Received P2      ......... 1
Total Received P3      ......... 9
Total Received P4      ......... 32
Total Received P5      ......... 312
Total Received P6      ......... 1602
Total Received P7      ......... 372
```

Table 10-1: Parameters in output of the **show counter log** command

Parameter	Description
`Total Received`	Total number of messages received by the log
`Total Received P0`	Total number of Priority 0 (Emergency) messages received
`Total Received P1`	Total number of Priority 1 (Alert) messages received
`Total Received P2`	Total number of Priority 2 (Critical) messages received
`Total Received P3`	Total number of Priority 3 (Error) messages received
`Total Received P4`	Total number of Priority 4 (Warning) messages received
`Total Received P5`	Total number of Priority 5 (Notice) messages received
`Total Received P6`	Total number of Priority 6 (Info) messages received
`Total Received P7`	Total number of Priority 7 (Debug) messages received

Related Commands show log config

show exception log

This command displays the contents of the exception log. When used within a virtual chassis stack (VCS), this command will display the contents of the exception log for all the stack members.

Syntax `show exception log`

Mode User Exec and Privileged Exec

Example To display the exception log, use the command:

```
awplus# show exception log
```

Output Figure 10-2: Example output from the **show exception log** command

```
awplus#show exception log

Stack member 1:

<date> <time> <facility>.<severity> <program[<pid>]>: <message>
------------------------------------------------------------------------
2008 May 29 04:08:46 local7.debug awplus corehandler: Process imish (PID:2200) s
ignal 5, core dumped to /flash/imish-r1-main-xinz-1212034124-2200.tgz
2008 May 29 04:10:21 local7.debug awplus corehandler: Process stackd (PID:1136)
signal 5, core dumped to /flash/stackd-r1-main-xinz-1212034216-1136.tgz
------------------------------------------------------------------------
Stack member 2:

<date> <time> <facility>.<severity> <program[<pid>]>: <message>
------------------------------------------------------------------------
2008 Mar 28 03:15:32 local7.debug awplus corehandler: Process imish (PID:2253) s
ignal 5, core dumped to /flash/imish-r1-main-xinz-7442130-2253.tgz
2008 Mar 28 03:16:06 local7.debug awplus corehandler: Process imish (PID:2416) s
ignal 5, core dumped to /flash/imish-r1-main-xinz-7442165-2416.tgz
2008 Mar 28 03:17:33 local7.debug awplus corehandler: Process aisexec (PID:1786)
 signal 5, core dumped to /flash/aisexec-r1-main-xinz-7442251-1786.tgz
------------------------------------------------------------------------
```

show log

This command displays the contents of the buffered log.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show log [tail [<10-250>]]`

Parameter	Description
`tail`	Display only the latest log entries.
<10-250>	Specify the number of log entries to display.

Default By default the entire contents of the buffered log is displayed.

Mode User Exec, Privileged Exec and Global Configuration

Usage If the optional tail parameter is specified only the latest 10 messages in the buffered log are displayed. A numerical value can be specified after the tail parameter to select how many of the latest messages should be displayed.

Examples To display the contents of the buffered log use the command:

```
awplus# show log
```

To display the 10 latest entries in the buffered log use the command:

```
awplus# show log tail 10
```

Output Figure 10-3: Example output from the **show log** command

```
awplus#show log

<date> <time> <facility>.<severity> <program[<pid>]>: <message>
------------------------------------------------------------------------
2011 Aug 29 07:55:22 kern.notice awplus kernel: Linux version 2.6.32.12-at1 (mak
er@awpmaker03-dl) (gcc version 4.3.3 (Gentoo 4.3.3-r3 p1.2, pie-10.1.5) ) #1 Wed
 Dec 8 11:53:40 NZDT 2010
2011 Aug 29 07:55:22 kern.warning awplus kernel: No pci config register base in
dev tree, using default
2011 Aug 29 07:55:23 kern.notice awplus kernel: Kernel command line: console=tty
S0,9600 releasefile=x900-5.4.2.rel ramdisk=14688 bootversion=1.1.0-rc12 loglevel=1
 extraflash=00000000
2011 Aug 29 07:55:25 kern.notice awplus kernel: RAMDISK: squashfs filesystem fou
nd at block 0
2011 Aug 29 07:55:28 kern.warning awplus kernel: ipifwd: module license 'Proprie
tary' taints kernel.
.
.
.
```

Figure 10-4: Example output from the **show log tail** command

```
awplus#show log tail

<date> <time> <facility>.<severity> <program[<pid>]>: <message>
------------------------------------------------------------------
2006 Nov 10 13:30:01 cron.notice crond[116]: USER manager pid 469 cmd logrotate /
etc/logrotate.conf
2006 Nov 10 13:30:01 cron.notice crond[116]: USER manager pid 471 cmd nbqueue --
wipe
2006 Nov 10 13:35:01 cron.notice crond[116]: USER manager pid 472 cmd nbqueue --
wipe
2006 Nov 10 13:40:01 cron.notice crond[116]: USER manager pid 477 cmd nbqueue --
wipe
2006 Nov 10 13:44:36 syslog.notice syslog-ng[67]: Log statistics;
processed=\'center(queued)=70\', processed=\'2006 Nov 10 13:45:01 cron.notice
crond[116]: USER manager pid 478 cmd logrotate /etc/logrotate.conf
2006 Nov 10 13:45:01 cron.notice crond[116]: USER manager pid 480 cmd nbqueue --
wipe
2006 Nov 10 13:49:32 syslog.notice syslog-ng[67]: SIGHUP received, reloading
configuration;
2006 Nov 10 13:50:01 cron.notice crond[116]: USER manager pid 482 cmd nbqueue --
wipe
2006 Nov 10 13:55:01 cron.notice crond[116]: USER manager pid 483 cmd nbqueue --
wipe
.
.
.
```

Related Commands show log config
show log permanent

show log config

This command displays information about the logging system. This includes the configuration of the various log destinations, buffered, permanent, syslog servers (hosts) and email addresses. This also displays the latest status information for each of these destinations.

Syntax `show log config`

Mode User Exec, Privileged Exec and Global Configuration

Example To display the logging configuration use the command:

```
awplus# show log config
```

Output Figure 10-5: Example output from the **show log config** command

```
Buffered log:
Status ......... enabled
  Maximum size ... 100kb
  Filters:
 *1 Level ........ notices
    Program ...... any
    Facility ..... any
    Message text . any
  2 Level ........ informational
    Program ...... mstp
    Facility ..... daemon
    Message text . any
  Statistics ..... 1327 messages received, 821 accepted by filter (2006 Dec 11
10:36:16)
Permanent log:
  Status ......... enabled
  Maximum size ... 60kb
  Filters:
  1 Level ........ error
    Program ...... any
    Facility ..... any
    Message text . any
 *2 Level ........ warnings
    Program ...... dhcp
    Facility ..... any
    Message text . "pool exhausted"
  Statistics ..... 1327 messages received, 12 accepted by filter (2006 Dec 11
10:36:16)
Host 10.32.16.21:
  Time offset .... +2:00
  Offset type .... UTC
  Filters:
  1 Level ........ critical
    Program ...... any
    Facility ..... any
    Message text . any
  Statistics ..... 1327 messages received, 1 accepted by filter (2006 Dec 11
10:36:16)
Email admin@alliedtelesis.com:
  Time offset .... +0:00
  Offset type .... Local
  Filters:
  1 Level ........ emergencies
    Program ...... any
    Facility ..... any
    Message text . any
  Statistics ..... 1327 messages received, 0 accepted by filter (2006 Dec 11
10:36:16)
Monitor log:
  Filters:
 *1   Level ...... debugging
      Program .... any
      Facility ... any
      Msg text ... any
  Statistics ..... Not available
Console log:
  Status ......... enabled
  List of consoles:
  1 .............. ttyS0
  Filters:
 *1   Level ...... critical
      Program .... any
      Facility ... any
      Msg text ... any
  Statistics ..... 1327 messages received, 1 accepted by filter (2006 Dec 11
10:36:16)
```

In the above example the '*' next to filter 1 in the buffered log configuration indicates that this is the default filter. The permanent log has had its default filter removed, so none of the filters are marked with ''*'.

Note Statistics are updated periodically not in real time. Whenever logging configuration commands are issued the statistics are reset. Whenever automatic log rotation occurs the statistics are reset

Note Terminal log and console log cannot be set at the same time. If console logging is enabled then the terminal logging is turned off.

Related Commands

show counter log
show log
show log permanent

show log permanent

This command displays the contents of the permanent log.

When used within a virtual chassis stack (VCS), this command will display the contents of the permanent log for all the stack members.

Syntax `show log permanent [tail [<10-250>]]`

Parameter	Description
`tail`	Display only the latest log entries
<10-250>	Specify the number of log entries to display

Default If the optional tail parameter is specified only the latest 10 messages in the permanent log are displayed. A numerical value can be specified after the tail parameter to select how many of the latest messages should be displayed.

Mode User Exec, Privileged Exec and Global Configuration

Example To display the permanent log, use the command:

```
awplus# show log permanent
```

To display the 10 latest entries in the permanent log, use the command:

```
awplus# show log permanent tail
```

Output Figure 10-6: Example output from the **show log permanent** command

```
<date> <time> <facility>.<severity> <program[<pid>]>: <message>
-------------------------------------------------------------------------
2006 Nov 10 09:30:09 syslog.notice syslog-ng[67]: syslog-ng starting up;
version=\'2.0rc3\'
2006 Nov 10 09:30:09 auth.warning portmap[106]: user rpc not found, reverting to
user bin
2006 Nov 10 09:30:09 cron.notice crond[116]: crond 2.3.2 dillon, started, log
level 8
2006 Nov 10 09:30:14 daemon.err snmpd[181]: /flash/.configs/snmpd.conf: line 20:
Error: bad SUBTREE object 2006 Nov 10 09:30:14 user.info HSL[192]: HSL: INFO:
Registering port port1.0.1
.
.
.
```

Figure 10-7: Example output from the **show log permanent tail** command

```
awplus>show log permanent tail

<date> <time> <facility>.<severity> <program[<pid>]>: <message>
------------------------------------------------------------------------
2006 Nov 10 13:30:01 cron.notice crond[116]: USER manager pid 469 cmd logrotate /
etc/logrotate.conf
2006 Nov 10 13:30:01 cron.notice crond[116]: USER manager pid 471 cmd nbqueue --
wipe
2006 Nov 10 13:35:01 cron.notice crond[116]: USER manager pid 472 cmd nbqueue --
wipe
2006 Nov 10 13:40:01 cron.notice crond[116]: USER manager pid 477 cmd nbqueue --
wipe
2006 Nov 10 13:44:36 syslog.notice syslog-ng[67]: Log statistics;
processed=\'center(queued)=70\', processed=\'2006 Nov 10 13:45:01 cron.notice
crond[116]: USER manager pid 478 cmd logrotate /etc/logrotate.conf
2006 Nov 10 13:45:01 cron.notice crond[116]: USER manager pid 480 cmd nbqueue --
wipe
2006 Nov 10 13:49:32 syslog.notice syslog-ng[67]: SIGHUP received, reloading
configuration;
2006 Nov 10 13:50:01 cron.notice crond[116]: USER manager pid 482 cmd nbqueue --
wipe
2006 Nov 10 13:55:01 cron.notice crond[116]: USER manager pid 483 cmd nbqueue --
wipe
------------------------------------------------------------------------
.
.
.
```

Figure 10-8: Example output from the **show log permanent** command for a stack

```
Stack member 1:

<date> <time> <facility>.<severity> <program[<pid>]>: <message>
------------------------------------------------------------------------
2008 May 28 23:11:21 user.crit awplus-2 VCS[1190]: Member 2 (00-00-cd-24-ff-57)
has become the Active Master
2008 May 28 23:11:21 daemon.warning awplus-2 rpc.statd[1300]: gethostbyname erro
r for awplus-2
2008 May 28 23:11:21 daemon.warning awplus-2 rpc.statd[1304]: gethostbyname erro
r for awplus-2
2008 May 28 23:11:53 user.err awplus NSM[1950]: VRRP Error: Can't set pktinfo
2008 May 29 03:54:40 user.alert awplus corerotate[26733]: Exception information
saved to flash:/imish-r1-main-xinz-7441248-19868.tgz
2008 May 29 03:55:47 user.crit awplus-1 VCS[1143]: Contact with the Active Maste
r has been lost
2008 May 29 03:55:47 user.crit awplus-1 VCS[1143]: Member 1 (00-09-41-fb-c3-0f)
has become the Disabled Master
2008 May 29 03:55:47 daemon.err awplus-1 mountd[1282]: Caught signal 15, un-regi
stering and exiting.
2008 May 29 03:55:47 user.warning awplus-1 kernel: nfsd: last server has exited
2008 May 29 03:55:47 user.warning awplus-1 kernel: nfsd: unexporting all filesys
tems


Stack member 2:

<date> <time> <facility>.<severity> <program[<pid>]>: <message>
------------------------------------------------------------------------
1970 Mar 27 22:17:33 user.crit awplus-1 VCS[1143]: Member 2 (00-00-cd-24-ff-57)
has become the Active Master
1970 Mar 27 22:17:33 user.alert awplus-1 VCS[1143]: Slave Boot from non-default
location, SW version auto synchronization does not support.
1970 Mar 27 22:17:38 daemon.warning awplus-1 rpc.statd[1271]: gethostbyname erro
r for awplus-1
1970 Mar 27 22:17:38 daemon.warning awplus-1 rpc.statd[1276]: gethostbyname erro
r for awplus-1
1970 Mar 28 03:00:52 user.alert awplus corerotate[26733]: Exception information
saved to flash:/imish-r1-main-xinz-7441248-19868.tgz
1970 Mar 28 03:01:59 user.warning awplus NSM[1950]: imi_client_send_xem_removal
port1.0.1
1970 Mar 28 03:01:59 user.warning awplus NSM[1950]: imi_client_send_xem_removal
port1.2.1
1970 Mar 28 03:15:34 user.alert awplus corerotate[2380]: Exception information s
aved to flash:/imish-r1-main-xinz-7442130-2253.tgz
1970 Mar 28 03:16:08 user.alert awplus corerotate[2495]: Exception information s
aved to flash:/imish-r1-main-xinz-7442165-2416.tgz
1970 Mar 28 03:17:31 user.err awplus VCS[1200]: HA event handling failed with re
sult 9
1970 Mar 28 03:17:31 user.err awplus HSL[1246]: connection to aisexec lost (9)
1970 Mar 28 03:17:31 user.err awplus 802.1X[1451]: connection to aisexec lost (9
```

Related Commands remote-command
show log

show running-config log

This command displays the current running configuration of the Log utility.

Syntax `show running-config log`

Mode Privileged Exec

Example To display the current configuration of the log utility, use the command:

```
awplus# show running-config log
```

Related Commands show log
show log config

Chapter 11: Interface Commands

Command List 11.2
description (interface) 11.2
interface (to configure) 11.3
mtu 11.5
show interface 11.7
show interface brief 11.10
show interface status 11.11
shutdown 11.13

Command List

This chapter provides an alphabetical reference of commands used to configure and display interfaces.

description (interface)

Use this command to add a description to a specific port or interface.

Syntax `description <description>`

Parameter	Description
<description>	Text describing the specific interface.

Mode Interface Configuration

Example The following example uses this command to describe the device that a switch port is connected to.

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# description Boardroom PC
```

interface (to configure)

Use this command to select one or more interfaces to configure.

Syntax

```
interface <interface-list>
interface lo
```

Parameter	Description
<interface-list>	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.
`lo`	The local loopback interface.

Usage

A local loopback interface is one that is always available for higher layer protocols to use and advertise to the network. Although a local loopback interface is assigned an IP address, it does not have the usual requirement of connecting to a lower layer physical entity. This lack of physical attachment creates the perception of a local loopback interface always being accessible via the network.

Local loopback interfaces can be utilized by a number of protocols for various purposes. They can be used to improve access to the switch and also increase its reliability, security, scalability and protection. In addition, local loopback interfaces can add flexibility and simplify management, information gathering and filtering.

One example of this increased reliability is for OSPF to advertise a local loopback interface as an interface-route into the network irrespective of the physical links that may be “up” or “down” at the time. This provides a higher probability that the routing traffic will be received and subsequently forwarded.

Mode

Global Configuration

Example

The following example shows how to enter Interface mode to configure `vlan1`. Note how the prompt changes.

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)#
```

The following example shows how to enter Interface mode to configure the local loopback interface.

```
awplus# configure terminal
awplus(config)# interface lo
awplus(config-if)#
```

Related Commands

ip address
show interface
show interface brief

mtu

Use this command to set the Maximum Transmission Unit (MTU) size for VLANs, where MTU is the maximum packet size that VLANs can transmit. The MTU size setting is applied to both IPv4 and IPv6 packet transmission.

Use the no variant of this command to remove a previously specified Maximum Transmission Unit (MTU) size for VLANs, and restore the default MTU size (1500 bytes) for VLANs.

Syntax

```
mtu <mtu-size>
no mtu
```

Parameter	Description
<mtu-size>	<68-1500> Specifies the Maximum Transmission Unit (MTU) size in bytes, where 1500 bytes is the default Ethernet MTU size for an interface.

Default The default MTU size is 1500 bytes for VLAN interfaces.

Mode Interface Configuration for VLAN interfaces.

Usage If a switch receives an IPv4 packet for Layer 3 switching to another VLAN with an MTU size smaller than the packet size, and if the packet has the 'don't fragment' bit set, then the switch will send an ICMP 'destination unreachable' (3) packet type and a 'fragmentation needed and DF set' (4) code back to the source. For IPv6 packets bigger than the MTU size of the transmitting VLAN interface, an ICMP 'packet too big' (ICMP type 2 code 0) message is sent to the source.

Note that show interface output will only show MTU size for VLAN interfaces.

Examples To configure an MTU size of 1500 bytes on interface `vlan2`, use the commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# mtu 1500
```

To configure an MTU size of 1500 bytes on interfaces `vlan2` to `vlan4`, use the commands:

```
awplus# configure terminal
awplus(config)# interface vlan2-vlan4
awplus(config-if)# mtu 1500
```

To restore the MTU size to the default MTU size of 1500 bytes on `vlan2`, use the commands

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no mtu
```

To restore the MTU size to the default MTU size of 1500 bytes on `vlan2` and `vlan4`, use the commands

```
awplus# configure terminal
awplus(config)# interface vlan2-vlan4
awplus(config-if)# no mtu
```

Related Commands show interface

show interface

Use this command to display interface configuration and status.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show interface [<interface-list>]
show interface lo
```

Parameter	Description
<interface-list>	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.
`lo`	The local loopback interface.

Mode User Exec and Privileged Exec

Usage Note that the output displayed with this command will show MTU (Maximum Transmission Unit) size for VLAN interfaces, and MRU (Maximum Received Unit) size for switch ports.

Example To display configuration and status information for interfaces `port1.0.1` and `port1.0.4`, use the command:

```
awplus# show interface port1.0.1,port1.0.4
```

Figure 11-1: Example output from the **show interface** command

```
Interface port1.0.1
  Scope: both
  Link is UP, administrative state is UP
  Thrash-limiting
  Status Not Detected, Action link-down, Timeout 60(s)
  Hardware is Ethernet, address is 0000.cd24.daeb
  index 5001 metric 1 mru 1500
  <UP,BROADCAST,RUNNING,MULTICAST>
  VRF Binding: Not bound
  SNMP link-status traps: Sending (Suppressed after 20 traps in 60 sec.)
    input packets 2396, bytes 324820, dropped 0, multicast packets 2370
    output packets 73235, bytes 406566, multicast packets 7321 broadcast packets 7
  Time since last state change: 0 days 16:35:52
Interface port1.0.2
  Scope: both
  Link is DOWN, administrative state is UP
  Thrash-limiting
  Status Unknown, Action learn-disable, Timeout 1(s)
  Hardware is Provisioned, address is 0000.0000.0000
  index 8001 metric 1 mru 1500
  <BROADCAST,MULTICAST>
  VRF Binding: Not bound
  SNMP link-status traps: Disabled
    input packets 0, bytes 0, dropped 0, multicast packets 0
    output packets 0, bytes 0, multicast packets 0 broadcast packets 0
  Time since last state change: 0 days 16:35:52
.
.
Interface eth0
  Scope: both
  Link is UP, administrative state is UP
  Hardware is Ethernet, address is 0000.cd24.daa7
  index 2 metric 1
  current duplex half, current speed 10
  configured duplex auto, configured speed auto, configured polarity auto
  <UP,BROADCAST,RUNNING,MULTICAST>
  VRF Binding: Not bound
  SNMP link-status traps: Disabled
  Bandwidth 1g
    input packets 36, bytes 6193, dropped 0, multicast packets 0
    output packets 0, bytes 0, multicast packets 0 broadcast packets 0
  Time since last state change: 0 days 16:35:52
Interface lo
  Scope: both
  Link is UP, administrative state is UP
  Hardware is Loopback
  index 1 metric 1
  <UP,LOOPBACK,RUNNING>
  VRF Binding: Not bound
  SNMP link-status traps: Disabled
    input packets 0, bytes 0, dropped 0, multicast packets 0
    output packets 0, bytes 0, multicast packets 0 broadcast packets 0
  Time since last state change: 0 days 16:35:52
Interface vlan1
  Scope: both
  Link is DOWN, administrative state is UP
  Hardware is VLAN, address is 0000.cd24.daa8
  index 201 metric 1 mtu 1500
  arp ageing timeout 300
  <UP,BROADCAST,MULTICAST>
  VRF Binding: Not bound
  SNMP link-status traps: Disabled
  Bandwidth 1g
    input packets 0, bytes 0, dropped 0, multicast packets 0
    output packets 29, bytes 1334, multicast packets 0 broadcast packets 0
  Time since last state change: 0 days 05:36:40
```

To display configuration and status information for interface `lo`, use the command:

```
awplus# show interface lo
```

Figure 11-2: Example output from the **show interface lo** command

```
Interface lo
  Scope: both
  Link is UP, administrative state is UP
  Hardware is Loopback
  index 1 metric 1
  <UP,LOOPBACK,RUNNING>
  VRF Binding: Not bound
  SNMP link-status traps: Disabled
    input packets 0, bytes 0, dropped 0, multicast packets 0
    output packets 0, bytes 0, multicast packets 0 broadcast packets 0
  Time since last state change: 69 days 01:28:47
```

To display configuration and status information for interfaces `vlan1` and `vlan2`, use the command:

```
awplus# show interface vlan1,vlan2
```

Figure 11-3: Example output from the **show interface vlan1,vlan2** command

```
Interface vlan1
  Scope: both
  Link is UP, administrative state is UP
  Hardware is VLAN, address is 0015.77e9.5c50
  IPv4 address 192.168.1.1/24 broadcast 192.168.1.255
  index 201 metric 1 mtu 1500
  arp ageing timeout 300
  <UP,BROADCAST,RUNNING,MULTICAST>
  VRF Binding: Not bound
  SNMP link-status traps: Disabled
  Bandwidth 1g
    input packets 295606, bytes 56993106, dropped 5, multicast packets 156
    output packets 299172, bytes 67379392, multicast packets 0 broadcast packets 0
  Time since last state change: 0 days 14:22:39
Interface vlan2
  Scope: both
  Link is DOWN, administrative state is UP
  Hardware is VLAN, address is 0015.77e9.5c50
  IPv4 address 192.168.2.1/24 broadcast 192.168.2.255
  Description: ip_phone_vlan
  index 202 metric 1 mtu 1500
  arp ageing timeout 300
  <UP,BROADCAST,MULTICAST>
  VRF Binding: Not bound
  SNMP link-status traps: Disabled
  Bandwidth 1g
    input packets 0, bytes 0, dropped 0, multicast packets 0
    output packets 90, bytes 4244, multicast packets 0 broadcast packets 0
  Time since last state change: 0 days 14:22:39
```

Related Commands mtu
show interface brief

show interface brief

Use this command to display brief interface, configuration, and status information, including provisioning information.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show interface brief`

Mode User Exec and Privileged Exec

Output Figure 11-4: Example output from the **show interface brief** command

```
awplus#show int brief
Interface              Status          Protocol
port1.0.1              admin up        down
port1.0.2              admin up        down
port1.0.3              admin up        down
port1.0.4              admin up        down
.
.
port1.0.23             admin up        down
port1.0.24             admin up        running
lo                     admin up        running
vlan1                  admin up        down
vlan2                  admin up        down
```

Table 11-1: Parameters in the output of the **show interface brief** command

Parameter	Description
`Interface`	The name or type of interface.
`Status`	The administrative state. This can be either admin up or admin down
`Protocol`	The link state. This can be either down, running, or provisioned

Related Commands show interface
show interface memory

show interface status

Use this command to display the status of the specified interface or interfaces. Note that when no interface or interfaces are specified then the status of all interfaces on the switch are shown.

Syntax `show interface [<port-list>] status`

Parameter	Description
`<port-list>`	The ports to display information about. The port list can be: ■ a switch port (e.g. `port1.0.12`) a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po3`) ■ a continuous range of ports separated by a hyphen, e.g. `port1.0.1-1.0.24`, or `sa1-2`, or `po1-4` ■ a comma-separated list of ports and port ranges, e.g. `port1.0.1,port1.0.4-1.2.24`. Do not mix switch ports, static channel groups, and dynamic (LACP) channel groups in the same list

Examples To display the status of ports 1.0.1 to 1.0.5, use the commands:

```
awplus# show interface port1.0.1-1.0.5 status
```

Figure 11-5: Example output from the **show interface <port-list> status** command

```
awplus#show interface port1.0.1 -1.0.5 status
Port       Name               Status            Vlan Duplex   Speed Type
port1.0.1                     notconnect           1 auto      auto 1000BASE-T
port1.0.2                     notconnect           1 auto      auto 1000BASE-T
port1.0.3                     notconnect           1 auto      auto 1000BASE-T
port1.0.4                     notconnect           1 auto      auto 1000BASE-T
port1.0.5                     notconnect           1 auto      auto 1000BASE-T
```

To display the status of all ports, use the commands:

```
awplus# show interface status
```

Figure 11-6: Example output from the **show interface status** command

```
awplus#sho int status
Port      Name               Status             Vlan Duplex   Speed Type
port1.0.1 Trunk_Net          connected         trunk a-full  a-1000 1000BaseTX
port1.0.2 Access_Net1        connected             5 full     100 1000BaseTX
port1.0.3 Access_Net1        disabled              5 auto      auto 1000BaseTX
port1.0.4 Access_Net2        connected             6 a-half   a-100 1000BaseTX
port1.0.5 Private_Prom       connected            10 a-full   a-100 1000BaseTX
port1.0.6 Private_Net1       connected         10,11 a-full   a-100 1000BaseTX
port1.0.7 Private_Net2       connected         10,12 a-full   a-100 1000BaseTX
port1.0.8                    notconnect            1 auto      auto 1000BaseTX
.
.
port1.0.23                   disabled              1 auto      auto not present
port1.0.24                   notconnect            1 auto      auto unknown
sa1                          notconnect        trunk auto      auto
```

Table 11-2: Parameters in the output from the **show interface status** command

Parameter	Description
`Port`	Name/Type of the interface.
`Name`	Description of the interface.
`Status`	The administrative and operational status of the interface; one of: ■ disabled: the interface is administratively down. ■ connect: the interface is operationally up. ■ notconnect: the interface is operationally down.
`Vlan`	VLAN type or VLAN IDs associated with the port: ■ When the VLAN mode is trunk, it displays trunk (it does not display the VLAN IDs). ■ When the VLAN mode is access, it displays the VLAN ID. ■ When the VLAN mode is private promiscuous, it displays the primary VLAN ID if it has one, and promiscuous if it does not have a VLAN ID. ■ When the VLAN mode is private host, it displays the primary and secondary VLAN IDs. ■ When the port is an Eth port, it displays none: there is no VLAN associated with it. ■ When the VLAN is dynamically assigned, it displays the current dynamically assigned VLAN ID (not the access VLAN ID), or dynamic if it has multiple VLANs dynamically assigned.
`Duplex`	The actual duplex mode of the interface, preceded by a- if it has autonegotiated this duplex mode. If the port is disabled or not connected, it displays the configured duplex setting.
`Speed`	The actual link speed of the interface, preceded by a- if it has autonegotiated this speed. If the port is disabled or not connected, it displays the configured speed setting.
`Type`	The type of interface, e.g., 1000BaseTX. For SFP bays, it displays Unknown if it does not recognize the type of SFP installed, or Not present if an SFP is not installed or is faulty.

Related Commands

show interface
show interface memory

shutdown

This command shuts down the selected interface. This administratively disables the link and takes the link down at the physical (electrical) layer.

Use the no variant of this command to disable this function and therefore to bring the link back up again.

Syntax `shutdown`

`no shutdown`

Mode Interface Configuration

Example The following example shows the use of the `shutdown` command to shut down `port1.0.20`.

```
awplus# configure terminal
awplus(config)# interface port1.0.20
awplus(config-if)# shutdown
```

The following example shows the use of the `no shutdown` command to bring up `port1.0.12`.

```
awplus# configure terminal
awplus(config)# interface port1.0.12
awplus(config-if)# no shutdown
```

The following example shows the use of the `shutdown` command to shut down `vlan2`.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# shutdown
```

The following example shows the use of the `no shutdown` command to bring up `vlan2`.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no shutdown
```

Chapter 12: Scripting Commands

Command List 12.2
activate 12.2
echo 12.3
wait 12.4

Command List

This chapter provides commands used for command scripts.

activate

This command activates a script file.

Syntax `activate [background] <script>`

Parameter	Description
`background`	Activate a script to run in the background. A process that is running in the background will operate as a separate task, and will not interrupt foreground processing. Generally, we recommend running short, interactive scripts in the foreground and longer scripts in the background. The default is to run the script in the foreground.
<script>	The file name of the script to activate. The script is a command script consisting of commands documented in this software reference. Note that you must use either a .scp or a .sh filename extension for a valid script text file, as described below in the usage section for this command.

Mode Privileged Exec

Usage In a stacked environment you can use the CLI on a stack master to access file systems that are located on a slave device. In this case the command specifies a file on the slave device. The slave's file system will be denoted by: *<hostname>-<member-id>* For example, awplus-1 for member 1, awplus-2 for member 2 etc.

When a script is activated, the privilege level is set to 1 enabling User Exec commands to run in the script. If you need to run Privileged Exec commands in your script you need to add an enable (Privileged Exec mode) command to the start of your script. If you need to run Global Configuration commands in your script you need to add a configure terminal command after the enable command at the start of your script.

The activate command executes the script in a new shell. A terminal length shell command, such as terminal length 0 may also be required to disable a delay that would pause the display.

A script must be a text file with a filename extension of either .sh or .scp only for the AlliedWare Plus™ CLI to activate the script file. The .sh filename extension indicates the file is an ASH script, and the .scp filename extension indicates the file is an AlliedWare Plus™ script.

Examples To activate a command script to run as a background process, use the command:

```
awplus# activate background test.scp
```

To activate a script `/flash:/test.scp` in stack member 2, use the command:

```
awplus-2# activate awplus-2/flash:/test.scp
```

Related Commands
configure terminal
echo
enable (Privileged Exec mode)
wait

echo

This command echoes a string to the terminal, followed by a blank line.

Syntax

```
echo <line>
```

Parameter	Description
<line>	The string to echo

Mode User Exec and Privileged Exec

Usage This command may be useful in CLI scripts, to make the script print user-visible comments.

Example To echo the string `Hello World` to the console, use the command:

```
awplus# echo Hello World
```

```
Hello World
```

Related Commands
activate
wait

wait

This command pauses execution of the active script for the specified period of time.

Syntax `wait <delay>`

Parameter	Description
<delay>	<1-65335> Specify the time delay in seconds

Default No wait delay is specified by default to pause script execution.

Mode Privileged Exec (when executed from a script not directly from the command line)

Usage Use this command to pause script execution in an .scp (AlliedWare Plus™ script) or an .sh (ASH script) file executed by the activate command. The script must contain an enable (Privileged Exec mode) command since the wait command is only executed in the Privileged Exec mode.When a script is activated, the privilege level is set to 1 enabling User Exec commands to run in the script. If you need to run Privileged Exec commands in your script you need to add an enable (Privileged Exec mode) command to the start of your script.

Example See an example .scp script file extract below that will show port counters for interface `port1.0.1` over a 10 second interval:

```
enable
show interface port1.0.1
wait 10
show interface port1.0.1
```

Related Commands activate
echo
enable (Privileged Exec mode)

Chapter 13: Interface Testing Commands

Command List 13.2
clear test interface 13.2
service test 13.3
test interface 13.4

Command List

This chapter provides an alphabetical reference of commands used for testing interfaces.

clear test interface

This command clears test results and counters after issuing a test interface command. Test results and counters must be cleared to issue subsequent test interface commands later on.

Syntax `clear test interface {<port-list>|all}`

Parameter	Description
`<port-list>`	The ports to test. A port-list can be: ■ a switch port (e.g. `port1.0.12`) ■ a continuous range of ports separated by a hyphen, e.g. `port1.0.1-port1.0.24` ■ a comma-separated list of the above, e.g. `port1.0.1,port1.0.5-1.0.24` The specified ports must exist.
`all`	All interfaces

Mode Privileged Exec

Examples To clear the counters for `port1.0.1` use the command:

```
awplus# clear test interface port1.0.1
```

To clear the counters for all interfaces use the command:

```
awplus# clear test interface all
```

To clear the counters for ports 1 to 12 on XEM 1 (`port1.1.1` through `port1.1.12`) apply:

```
awplus# clear test interface port1.1.1-port1.1.12
```

Related Commands test interface

service test

This command puts the device into the interface testing state, ready to begin testing. After entering this command, enter Interface Configuration mode for the desired interfaces and enter the command test interface.

Do not test interfaces on a device that is part of a live network—disconnect the device first.

Use the no variant of this command to stop the test service.

Syntax

```
service test
no service test
```

Mode Global Configuration

Example To put the device into a test state, use the command:

```
awplus(config)# service test
```

Related Commands test interface

test interface

This command starts a test on a port or all ports or a selected range or list of ports.

Use the no variant of this command to disable this function. The test duration can be configured by specifying the time in minutes after specifying a port or ports to test.

For an example of all the commands required to test switch ports, see the Examples section in this command. To test the Eth port, set its speed to 100 by using the command speed 100.

Note Do not run test interface on live networks because this will degrade network performance.

Syntax

```
test interface {<port-list>|all} [time{<1-60>|cont}]
no test interface {<port-list>|all}
```

Parameter	Description
<port-list>	The ports to test. A port-list can be: ■ a switch port (e.g. `port1.0.12`) ■ a continuous range of ports separated by a hyphen, e.g. `port1.0.1-port1.0.24` ■ a comma-separated list of the above, e.g. `port1.0.1,port1.0.5-1.0.24` The specified ports must exist.
`all`	All ports
`time`	Keyword entered prior to the value for the time duration of the interface test.
<1-60>	Specifies duration of time to test the interface or interfaces in minutes (from a minimum of 1 minute to a maximum of 60 minutes). The default is 4 minutes.
`cont`	Specifies continuous interface testing until cancelled with command negation.

Mode Privileged Exec

Example To test the switch ports in VLAN 1, install loopbacks in the ports, and enter the following commands:

```
awplus(config)# service test
awplus(config)# no spanning-tree rstp enable bridge-forward
awplus(config)# interface vlan1
awplus(config-if)# shutdown
awplus(config-if)# end
awplus# test interface all
```

To see the output, use the commands:

```
awplus# show test

awplus# show test count
```

To start the test on all interfaces for 1 minute use the command:

```
awplus# test interface all time 1
```

To start the test on ports 1 to 12 for XEM 1 (`port1.1.1` through `port1.1.12`) use the command:

```
awplus# test interface port1.1.1-port1.1.12
```

To stop testing ports 1 to 12 for XEM 1 (`port1.1.1` through `port1.1.12`) use the command:

```
awplus# no test interface port1.1.1-port1.1.12
```

Related Commands clear test interface

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- Chapter 16 VLAN Introduction
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- Chapter 18 Spanning Tree Introduction: STP, RSTP, and MSTP
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Introduction

This chapter gives an overview of Layer 1 and 2 switching.

Layer 2 switches are used to connect multiple Local Area Network (LAN) segments together to form an extended LAN. Stations connected to different LANs can be configured to communicate with one another as if they were on the same LAN. They can also divide one physical LAN into multiple Virtual LANs (VLANs). Stations connected to each other on the same extended LAN can be grouped in separate VLANs, so that a station in one VLAN can communicate directly with other stations in the same VLAN, but must go through higher layer routing protocols to communicate with those stations in other VLANs.

Layer 2 switches appear transparent to higher layer protocols, transferring frames between the data link layers of the networks to which they are attached. A Layer 2 switch accesses each physical link according to the rules for that particular network. Access may not always be instant, so the switch must be capable of storing and forwarding frames.

Storing and forwarding enables the switch to examine both the VLAN tag fields and Ethernet MAC address fields in order to forward the frames to their appropriate destination. In this way, the switch can act as an intelligent filtering device, redirecting or blocking the movement of frames between networks.

Because switch ports can sometimes receive frames faster than it can forward them, the switch has Quality of Service (QoS) queues in which frames await transmission according to their priority. Such a situation could occur where data enters a number of input ports all destined for the same output port.

The switch can be used to:

- Increase both the physical extent and the maximum number of stations on a LAN. LANs are limited in their physical extent by the signal distortion and propagation delay characteristics of the media. The switch overcomes this limitation by receiving a frame on one LAN and then retransmitting it to another. The physical characteristics of the LAN media also place a practical limit on the number of stations that can be connected to a single LAN segment. The switch overcomes this limitation by joining LAN segments to form an extended LAN capable of supporting more stations than either of the individual LAN segments.
- Connect LANs that have a common data link layer protocol but different physical media, for example, Ethernet 10BASET, 100BASET, and 10BASEF.
- Increase the availability of LANs by allowing multiple redundant paths to be physically configured and selected dynamically, using the Spanning Tree algorithm.
- Reduce the load on a LAN or increase the effective bandwidth of a LAN, by filtering traffic.
- Prioritize the transmission of data with high Quality of Service requirements.

By using Virtual LANs (VLANs), a single physical LAN can be separated into multiple Virtual LANs. VLANs can be used to:

- Further improve LAN performance, as broadcast traffic is limited to LAN segments serving members of the VLAN to which the sender belongs.
- Provide security, as frames are forwarded to those stations belonging to the sender's VLAN, and not to stations in other VLANs on the same physical LAN.
- Reduce the cost of moving or adding stations to function or security based LANs, as this generally requires only a change in the VLAN configuration.

Physical Layer Information

Switch Ports

A unique port number identifies each switch port. The software supports a number of features at the physical level that allow it to be connected in a variety of physical networks. This physical layer (Layer 1) versatility includes:

- Enabling and disabling of ports
- Auto negotiation of port speed and duplex mode for all 10/100 BASE ports
- Manual setting of port speed and duplex mode for all 10/100 BASE ports
- Link up and link down triggers
- Packet storm protection
- Port mirroring
- Support for SNMP management

Port Numbering

Ports are numbered using a 3 digit format `x.y.z` where `x` is the device number (within a stacked configuration), `y` is the module number within the device, and `z` is the port number within the module. Ports connected directly to the switch chassis (rather than a pluggable module) are given the module number `0`. In an unstacked configuration all device numbers are `1`. For example, `port1.2.6` represents device `1`, module `2`, port `6`.

Adding a description

You can add a description to an interface to help identify its purpose or position. For example, to add the description “connected to Nerv” to `port1.0.3`, use the commands:

```
awplus(config)# interface port1.0.3
awplus(config-if)# description connected to Nerv
```

Port ranges

Continuous

To configure a continuous range of ports at the same time, enter the range in the format:

`portx.y.z-portx.y.z`

For example, to configure the same interface setting on `port1.0.10` to `port1.0.20`, enter the Global Configuration mode command:

```
awplus(config)# interface port1.0.10-port1.0.20
```

Non-continuous

To configure a non-continuous set of ports at the same time, enter a comma-separated list:

`portx.y.z,portx.y.z`

For example, to configure the same interface setting on `port1.0.1` and `port1.0.5`, enter the Global Configuration mode command:

```
awplus(config)# interface port1.0.1,port1.0.5
```

You can combine a hyphen-separated range and a comma-separated list. To configure the same setting on `port1.0.1` to `port1.0.3` and `port1.0.5`, enter the Global Configuration mode command:

```
awplus(config)# interface port1.0.1-port1.0.3,port1.0.5
```

Activating and Deactivating Switch Ports

An active switch port is one that is available for packet reception and transmission. Disabling a switch port does not affect the STP operation on the port. By default ports and VLANs are activated.

To shutdown a port or VLAN use the shutdown command on page 11.13. Use the no variant of this command to reactivate it.

Autonegotiation

Autonegotiation lets the port adjust its speed and duplex mode to accommodate the device connected to it. When the port connects to another autonegotiating device, they negotiate the highest possible speed and duplex mode for both of them.

By default, all ports autonegotiate. Setting the port to a fixed speed and duplex mode may be necessary when connecting to a device that cannot autonegotiate.

Duplex mode

Ports can operate in full duplex or half duplex mode depending on the type of port it is. When in full duplex mode, a port transmits and receives data simultaneously. When in half duplex mode, the port transmits or receives but not both at the same time.

You can set a port to use either of these options, or allow it to autonegotiate the duplex mode with the device at the other end of the link. To configure the duplex mode, use these commands:

`awplus#`	
`configure terminal`	Enter Global Configuration mode
`awplus(config)#`	
`interface port1.0.1`	Enter Interface Configuration mode for port 1.0.1
`awplus(config-if)#`	
`duplex {auto|full|half}`	Enter the Duplex mode for port 1.0.1

Speed options

Before configuring a port's speed, check the hardware limit for the particular port type. The following list can be used as a guide:

- non-SFP RJ-45 copper switch ports: 10, 100 or 1000 Mbps
- supported tri-speed copper SFPs: 10, 100 or 1000 Mbps
- fibre SFPs: 100 Mbps to 1000 Mbps, depending on the SFP type
- XFP modules: 10 Gbps

For the latest list of approved SFP transceivers either contact your authorized distributor or reseller, or visit http://www.alliedtelesis.com.

You can set a port to use one of these speed options, or allow it to autonegotiate the speed with the device at the other end of the link.

Most types of switch port can operate in either full duplex or half duplex mode. In full duplex mode a port can transmit and receive data simultaneously. In half duplex mode the port can either transmit or receive, but not at the same time.

Make sure that the configuration of the switch matches the configuration of the device at the far end of the link. In particular, avoid having one end autonegotiate duplex mode while the other end is fixed. For example, if you set one end of a link to autonegotiate and fix the other end at full duplex, the autonegotiating end cannot determine that the fixed end is full duplex capable. Therefore, the autonegotiating end selects half-duplex operation. This results in a duplex mismatch and packet loss. To avoid this, either fix the mode at both ends, or use autonegotiation at both ends.

Configuring the port speed

To set the port speed to 1000 kbps on port 1.0.1

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`interface port1.0.1`	Enter Interface Configuration mode for port 1.0.1
`awplus(config-if)#`	
`speed 1000`	Set the port speed for port 1.0.1 to 1000 Mbps.

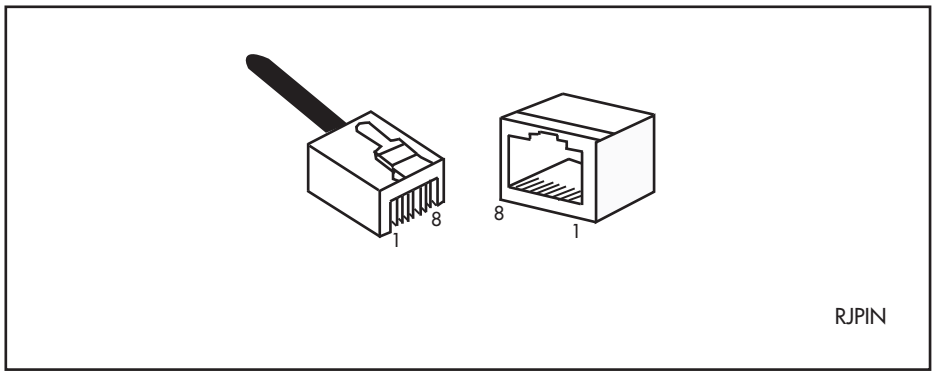
MDI/MDIX Connection Modes

By default, copper 10Base-T, 100Base-T, and 1000Base-T ports on the switch automatically set the Media Dependant Interface mode to MDI or MDIX for successful physical connections. We recommend using this default setting. However, you can configure them to have either fixed MDI mode or fixed MDIX mode by using the polarity command on page 15.39. MDI/MDIX mode polarity does not apply to fibre ports.

Connections to 10BASE-T, 100BASE-T , and 1000BASE-T networks may either be straight though (MDI) or crossover (MDIX). The crossover connection can be achieved by using either a crossover cable or by integrating the crossover function within the device. In the latter situation, the connector is referred to as an MDIX connection. Refer to your switch's Hardware Reference for more detailed information on physical connections cabling.

The IEEE 802.3 standard defines a series of Media Dependant Interface types and their physical connections. For twisted pair (10BASE-T) networking, the standard defines that connectors that conform to the IEC 60603-7 standard. The Figure 14-1f shows a connector of this type.

Figure 14-1: Connector used for 10BASE-T networks



Switch Bay Provisioning

Switch bay provisioning enables the pre-configuration of interfaces on hardware that is not yet physically present. This enables ports belonging to a XEM bay, or stack member, to be configured in advance, ready for device hot-insertion at a later time.

Provisioning enables a network administrator to pre-configure a vacant XEM bay on a switch, ready to be hot-swapped in at a later time. Later, when the XEM is physically added, its configuration is automatically applied with the minimum network disruption. Provisioning is ON by default, and cannot be disabled.

Provsioned capacity can be applied by either of the following actions:

- Applying the appropriate provisioning command
- Installing, then removing a provisionable XEM from its bay

A provisioned interface is assigned the shutdown state and is therefore not able to be activated. Applying the shutdown or no shutdown commands to a provisioned port will change only its administrative state.

Provisioned Board Classes

Provisioning introduces the concept of defined board classes. Each board class is assigned a class and an appropriate port count. Presently no further definitions have been made for additional features such as media type, or PoE capability. This structure simplifies configuration. For example:

- A single class is required to provision a XEM bay for either the XEM-12s, XEM12-T, or the XEM-12T/PoE modules.

The following Board Classes are defined:

Table 14-1: Provisioned Board Classes

Board Classes	
Class	**Port Count**
XEM-1	1
XEM-2	2
XEM-12	12

Applying Hardware Provisioning

As previously mentioned, provisioning is the pre-configuration of vacant XEM bay ready for device insertion at a later time.

Without provisioning

On software versions prior to version 5.3.4 - trying to configure port within a vacant XEM bay will result in the following error message:

```
awplus(config)# interface port4.0.1
% Can't find interface port4.0.1
```

With provisioning

With provisioning you can configure XEMs and their ports that are not presently installed, ready for future connection:

The following example sets the port speed of `port4.2.1` to be 1000 kbps.

```
awplus(config)# interface port4.2.1
awplus(config-if)# speed 1000
```

You can apply provisional configuration to all interface related commands. However, you cannot apply provisioning where it changes the network topology.

The following example creates a provisioned configuration that shows the association of ports with a VLAN:

```
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 12 state enable
awplus(config-vlan)# exit
awplus(config)# interface port2.1.1
awplus(config-if)# switchport mode access
awplus(config-if)# switchport access vlan 12
awplus(config-if)# exit
awplus(config)# interface port2.1.2-port2.1.26
awplus(config-if)# switchport mode access
```

Removing or Changing XEM BAY Provisioning

You cannot un-provision currently installed hardware. Provisioning changes will only be retained if the configuration is saved prior to rebooting.

Displaying Provisioned Configurations

The major difference associated with provisioning is that interface configurations will still exist in the config files and will appear in show commands, even though a device itself may not be physically installed. Provisioning could result from device capability that has been preconfigured for future installation, or could result from the removal of an installed device.

The show running-config command includes switch commands for existing hardware, plus all non existent, but provisioned, hardware. The following example output of the show running-config command illustrates how provisioned and existing hardware is displayed.

Figure 14-2: Sample display of existing and provisioned show output

```
awplus#show running-config
.
.
switch 1 provision x908
switch 1 bay 1 provision xem-12
switch 1 bay 2 provision xem-12
switch 1 bay 3 provision xem-12
switch 1 bay 5 provision xem-12
switch 1 bay 7 provision xem-1
switch 1 bay 8 provision xem-1
switch 2 provision x908
switch 2 bay 1 provision xem-12
switch 2 bay 2 provision xem-12
switch 2 bay 3 provision xem-1
switch 2 bay 8 provision xem-1
!
interface port1.1.1-1.1.12
 switchport
 switchport mode access
!
interface port1.2.1-1.2.12
 switchport
 switchport mode access
!
interface port1.3.1-1.3.12
 switchport
 switchport mode access
.
.
.end
```

Displaying provisioned hardware status

The status, *present* or *provisioned*, appears in monitoring commands, such as the show interface brief. The following sample output from this command shows the provisioning status of two configured stack members.

Figure 14-3: Sample display showing hardware provisioning status

```
Interface              Status          Protocol   Status
port1.1.1              admin up        running    present
port1.1.2              admin up        down       present
.
.
port2.8.1              admin up        down       provisioned
```

A more detailed inspection of the provisioned port 2.8.1 is shown below. Note that the MAC address of 0000.0000.0000, which is a placeholder value for all provisioned ports. Also note that although the port is in the link DOWN state its administrative state of UP PROVISIONED means that it can be further configured. For example, it can be associated with a VLAN, or added to a link aggregation group etc.

Figure 14-4: Sample display showing provisioning status of a specific port

```
Interface port2.8.1
  Scope: both
  Link is DOWN, administrative state is UP PROVISIONED
  Thrash-limiting
    Status Unknown, Action learn-disable, Timeout 1(s)
  Hardware is Ethernet, address is 0000.0000.0000
  index 6801 metric 1 mtu 1500 mru 1522
  <BROADCAST,MULTICAST>
  VRF Binding: Not bound
  SNMP link-status traps: Disabled
    input packets 0, bytes 0, dropped 0, multicast packets 0
    output packets 0, bytes 0, multicast packets 0 broadcast
pks0
```

Provisioning and Change Management

A benefit of provisioning is that configuration settings are no longer dependant on the existence of hardware devices. When a device is removed, all the interfaces for that device are shutdown and its provisioning status is set. This means that you can add or remove physical hardware without affecting your network configuration. Of course when ports go down (i.e. are physically removed) there will be other changes to network configuration, as protocols may re-converge or, for example, routes may be removed etc.

XEMs within a switch, can be hot-swapped without the need for re-configuration.

The configuration of a newly inserted device that matches the provisioned board-class is achieved on a best-effort basis. For example inserting a non-POE switch into a stack member location configured for PoE will result in the failure of the PoE configuration commands.

Take care that your provisioned configurations, match with the type of hardware that you plan to install. For example, the XEM-12 configuration shown below has the port speed set for one of its ports:

```
awplus(config)# switch 2 bay 4 provision xem-12
awplus(config)# int port2.4.1
awplus(config-if)# speed 10
```

This will be fine if a XEM-12T is installed; however installing a XEM-12S (a device that cannot run its ports at 10 Mbps) would result in an error condition.

Possible Hardware Provisioning Conflicts

Conflicting provisioning configurations can occur where there is a mismatch between the XEM or switch type that is provisionally configured, and the device that is physically added.

If a XEM-1XP is inserted into a bay provisioned for a XEM-12T, there would be a mismatch between the board-class of the XEM inserted, and the board-class provisioned. In this situation, the provisioned configuration would not be applied, instead the switch would apply its default configuration to the new XEM.

Where conflicting hardware is installed, and then corrected, the result is dependent on whether or not the configuration is saved. The following example describes the two possibilities that this situation presents:

1. A bay provisioned for a XEM-12T is fitted with a XEM-1XP. On realizing the mistake, it is then replaced with a XEM-12T.

   « In this situation, although the provisioned configuration will have been replaced with the default configuration for the XEM-1XP, when the XEM-12T is installed, its previous (provisioned) configuration will return, because it is part of the switch configuration.

2. A bay provisioned for a XEM-12T is fitted with a XEM-1XP and the configuration is saved. On realizing the mistake, it is then replaced with a XEM-12T.

   « In this situation, the provisioned configuration will have been replaced with the default configuration for the XEM-1XP. As this new configuration is saved, when the XEM-12T is installed, a default configuration will be applied.

Provisioning and Software Version Aspects

When upgrading to version 5.3.4 or later, the provisioning commands will automatically be added to the running configuration of the switch—all other configuration will remain unchanged.

When downgrading from 5.3.4 (for example from 5.3.4 back to 5.3.3), error messages will result if the configuration has been saved using the 5.3.4 version software. This is because the provisioning commands in the configuration file will be unknown to the 5.3.3 version software.

If the configuration has not been saved with the version 5.3.4 software release, then downgrading will not result in error messages. This is because the saved configuration will not contain provisioning commands. All other commands will be unaffected, and the switch will operate as previously.

The Layer 2 Switching Process

The Layer 2 switching process comprises these related but separate processes:

- The Ingress Rules
- The Learning Process
- The Forwarding Process
- The Egress Rules

Ingress rules admit or discard frames based on their VLAN tagging.

The Learning process learns the MAC addresses and VLAN membership of frames admitted on each port.

The Forwarding process determines which ports the frames are forwarded to, and the Quality of Service priority with which they are transmitted.

Finally, Egress rules determine for each frame whether VLAN tags are included in the Ethernet frames that are transmitted.

These processes assume that each station on the extended LAN has a unique data link layer address, and that all data link layer frames have a header which includes the source (sender's) MAC address and destination (recipient's) MAC address.

The Ingress Rules

All frames, tagged and untagged, that a VLAN-aware switch receives must be classified into a VLAN. Each received frame is mapped to exactly one VLAN. If an incoming frame is tagged with a valid VLAN identifier (VID) then that VID is used. If an incoming frame is untagged or is priority tagged (a tagged frame with a VID of all zeros), then the switch uses internal VLAN association rules to determine the VLAN it belongs to. The default settings for the ingress rules are to Admit All Frames, and for Ingress Filtering to be on.

Every port belongs to one or more VLANs so every incoming frame has a VID to show which VLAN it belongs. The final part of the Ingress Rules depends on whether Ingress Filtering is enabled for the port. If Ingress Filtering is disabled, all frames are passed on to the Learning process, regardless of which VLAN they belong to. If Ingress Filtering is enabled (by default), frame are admitted only when they have the VID of a VLAN to which the port belongs. Frames are discarded when they do not have an associated VID matching the VLAN assigned to a port.

The possible association rules, in order of precedence, are:

- IP subnet/IPX network classification
- protocol classification
- port classification

The default VLAN classification is based upon the port on which the incoming frame (untagged, or priority tagged) was received. It is possible for an incoming untagged, or priority tagged, frame to match more than one of the association rules.

Each port on the switch can be configured to be one of two modes:

- only untagged frames - access mode
- only VLAN-tagged frames - trunk mode

Access Mode

This mode can be used to connect to VLAN unaware devices. Frames to and from access mode ports carry no VLAN tagging information.

Trunk Mode

This mode is used to connect VLAN capable devices. All devices that connect using trunk mode ports must be VLAN aware.

The Learning Process

The learning process uses an adaptive learning algorithm, sometimes called *backward learning*, to discover the location of each station on the extended LAN.

All frames admitted by the ingress rules on any port are passed on to the forwarding process when they are for destinations in the same VLAN. Frames destined for other VLANs are passed to a Layer 3 protocol, such as IP. For every frame admitted, the frame's source MAC address and VID are compared with entries in the forwarding database for the VLAN (also known as a *MAC Address table*) maintained by the switch. When the frame's source address is not in the forwarding database for the VLAN, the address is added and an ageing timer for that entry is started. When the frame's source address is already in the forwarding database, the ageing timer for that entry is restarted.

By default, switch learning is enabled. It can be disabled with the no mac address-table acquire command, and re-enabled using the **mac address-table acquire command on page 15.17**.

If the ageing timer for an entry in the forwarding database expires before another frame with the same source address is received, the entry is removed from the forwarding database. This prevents the forwarding database from being filled with information about stations that are inactive or have been disconnected from the network. It also ensures that entries for active stations are kept alive in the forwarding database.

By default, the ageing timer is enabled with a default ageing-time. The ageing timer can be reset to the default with the **no mac address-table ageing-time** command. The ageing timer can be increased or decreased using the **mac address-table ageing-time** command.

If switch learning is disabled and the ageing timer has aged out all dynamically learned filter entries, only statically entered MAC source addresses decide the packets to forward or discard. When the switch finds no matching entries in the forwarding database during the forwarding process, all switch ports in the VLAN are flooded with the packet, except the port that received it.

The default for the mac address-table ageing-time is 300 seconds (5 minutes) and can be modified by using the command **mac address-table ageing-time**. The **no mac address-table ageing-time** command will reset the ageing-time back to the default (5 minutes).

To set the mac address-table ageing-time to 1000 seconds:

```
                                awplus#
                  configure terminal  Enter the config terminal mode
                                awplus(config)#
  mac address-table ageing-time 1000  Set the ageing time to 1000 seconds
```

To display general switch settings, including settings for switch learning and the switch ageing timer, use the show system command on page 8.53.

The Forwarding Process

After a VID is assigned to a frame using the ingress rules, the switch forwards it to the destination MAC address specified in the frame. To do this the switch must learn which MAC addresses are available on each port for each VLAN. When the destination MAC address is not found, the switch floods the frame on all ports that are members of the VLAN except the port on which the frame was received.

The forwarding database (also known as the *MAC Address table*) determines the egress port on which the destination MAC address has been learned. MAC addresses are learned dynamically as part of the Layer 2 switching process.

The forwarding database is ordered according to MAC address and VLAN identifier. This means a MAC address can appear more than once in the forwarding database having been learned on the same port but for different VLANs. This could occur if the IP address of an end station is changed thereby moving the end station to a different IP subnet-based VLAN while still connected to the same switch port. When the forwarding database ageing process is enabled, old entries in the forwarding database are deleted after a user-configurable period.

If the destination address is found, the switch discards the frame when the port is not in the STP forwarding or disabled state if the destination address is on the same port as the source address, or if there is a static filter entry for the destination address set to discard (see "Layer 2 Filtering" on page 14.15). Otherwise, the frame is forwarded on the indicated port.

Forwarding occurs only when the port on which the frame was received is in the Spanning Tree forwarding or disabled state. The destination address is then looked up in the forwarding database for the VLAN.

The Egress Rules

After the forwarding process has determined from which ports and transmission queues to forward a frame, the egress rules for each port determine whether the outgoing frame is VLAN-tagged with its numerical VLAN identifier (VID).

A port must belong to a VLAN at all times unless the port has been set as the mirror port for the switch.

A port can transmit VLAN-tagged frames for any VLAN to which the port belongs. A port can transmit untagged frames for any VLAN for which the port is configured, e.g. IP subnet-based or protocol-based, unless prevented by the port-based VLAN egress rules. A port that belongs to a port-based VLAN can transmit untagged packets for only one VLAN. For more information about VLANs and VLAN tagging, see Chapter 16, VLAN Introduction.

For more information on port tagging see the following commands:
switchport mode access command on page 17.13
switchport mode trunk command on page 17.19

Layer 2 Filtering

The switch has a forwarding database (also known as the *MAC address table*) whose entries determine whether frames are forwarded or discarded over each port. Entries in the forwarding database are created dynamically by the learning process. A dynamic entry is automatically deleted from the forwarding database when its ageing timer expires.

The forwarding database supports queries by the forwarding process as to whether frames with given values of the destination MAC address field should be forwarded to a given port.

For each VLAN, the destination MAC address of a frame to be forwarded is checked against the forwarding database. If there is no entry for the destination address and VLAN, the frame is transmitted on all ports in the VLAN that are in the forwarding or disabled state, except the port on which the frame was received. This process is referred to as *flooding*. If an entry is found in the forwarding database but the entry is not marked *forwarding* or the entry points to the same port the frame was received on, the frame is discarded. Otherwise, the frame is transmitted on the port specified by the forwarding database.

Ingress Filtering

The ingress-filter parameter of the switchport mode trunk command on page 17.19 and the switchport mode access command on page 17.13, enables or disables ingress filtering of frames entering the specified port (or port range). Each port on the switch belongs to one or more VLANs. If ingress filtering is enabled, any frame received on the specified port is only admitted if its VID matches one for which the port is tagged. Any frame received on the port is discarded if its VID does not match one for which the port is tagged.

Untagged frames are admitted and are assigned the VLAN Identifier (VID) of the port's native VLAN. Ingress filtering can be turned off by setting the disable parameter of the above two commands. The default setting of the enable / disable parameter option is enable.

Note

Enabling the vlan-disable parameter of the thrash-limiting command on page 15.72 will also enable ingress filtering, and will override the setting of the switchport mode access, and trunk commands

Storm-control

The packet storm-control feature enables you to set limits on the reception rate of broadcast, multicast frames and destination lookup failures. You can set separate limits beyond which each of the different packet types are discarded.

Note A destination lookup failure (DLF) is the event of receiving a unicast Ethernet frame with an unknown destination address.

For more information on applying storm-control, see the **storm-control level command on page 15.66**.

To apply storm-control by limiting broadcasts to 30% on `port1.0.4`

`awplus(config-if)#` `configure terminal`	Enter Global Configuration mode.
`awplus(config-if)#` `interface port1.0.4`	Enter the Interface Configuration mode for the selected port.
`awplus(config-if)#` `storm-control broadcast level 30`	Configure the interface.

To turn off storm protection on `port1.0.4`

`awplus(config-if)#` `configure terminal`	Enter Global Configuration mode.
`awplus(config-if)#` `interface port1.0.4`	Enter the Interface Configuration mode for the selected port.
`awplus(config-if)#` `no storm-control broadcast level`	Configure the interface.

Loop Protection

Loop protection is a general term that embraces several different methods you can apply to protect your network from effects such as broadcast storms that can result from data loops or equipment malfunction. Presently two methods of loop protection are available:

- Loop Detection
- Thrash Limiting

Loop Detection

Introduction

This feature is used to detect loops with a network segment. If a loop is detected then a selected protection mechanism is applied to limit the effect of the loop. The loop protection actions can be applied either to the port at which the loop is detected or to the VLAN within which the loop was detected.

Limiting Actions

You can configure loop detection to apply one of the following mechanisms when a loop condition is detected:

- Disable all MAC address learning.
- Block all traffic on the port (or aggregated link) that detected the loop, and take down the link.
- Block all traffic on the port (or aggregated link) that detected the loop, but keep the link in the up state.
- Block all traffic on a vlan. Note that setting this parameter will also enable ingress filtering. This is the default action.
- Take no action, but log the details.
- Take no action.

Operation

To detect loops this feature operates by transmitting a series of Loop Detection Frames (LDFs) from each switch port out into the network. If no loops exist, then none of these frame should ever return. If a frame returns to its original port, the detection mechanism assumes that there is a loop somewhere in the network and offers a number of protective options.

Each LDF is a Layer 2 LLC frame that contains the following components:

- the source MAC address of the originating switch
- the destination MAC address of the non-existent end station 00-00-F4-27-71-01
- VLAN ID (where the port is a tagged member of a VLAN).
- a randomly generated LDF ID number.

You can set the detection mechanism to remember the LDF ID of up to 5 of the most recently transmitted LDF frames. Each of the 5 most recently transmitted frames is compared with every frame that arrives at that same port.

Configuration

To enable loop protection and configure its basic parameters, you use the loop-protection command on page 15.14.

Example To enable the loop-detect mechanism, and generate loop-detect frames once every 5 seconds, use the command:

```
awplus(config)# loop-protection loop-detect ldf-interval 5
```

Note LDFs are sent sequentially for each VLAN defined to a particular port. For example, if a particular port in this example is a member of 4 VLANs, then the LDFs will be sent from this port at the rate of 4 frames every 5 seconds.

You can now use the loop-protection action command on page 15.15 configure the action that the switch will take if a loop is detected.

Example To disable an interface, and bring the link down, when a network loop is detected, use the command:

```
awplus(config-if)# loop-protection action link-down
```

Now decide how long you want the protective action to apply for. You configure this function by using the loop-protection timeout command on page 15.16.

Example To configure a loop protection action timeout of 10 seconds, use the command:

```
awplus(config-if)# loop-protection timeout 10
```

Thrash Limiting

MAC address thrashing occurs when MAC addresses move rapidly between one or more ports or trunks, for example, due to a network loop.

Thrash limiting enables you to apply actions to a port when thrashing is detected. It is supported on all port types and also on aggregated ports.

Limiting Actions There are several different thrash actions that you can apply to a port when thrashing is detected. These actions are:

- learnDisable
  Address learning is temporarily disabled on the port.
- portDisable
  The port is logically disabled. Traffic flow is prevented, but the link remains up. The device at the other end does not notice that the port has changed status, and the link LEDs at both ends stay on.
- linkDown
  The port is physically disabled and the link is down. This is equivalent to entering the shutdown command on page 11.13.
- vlanDisable
  The port is disabled only for the VLAN on which thrashing has occurred. It can still receive and transmit traffic for any other VLANs of which it is a member.

When a MAC address is thrashing between two ports, one of these ports (the first to cross its thrashing threshold) is disabled. All other ports on the device will then have their threshold counters reset.

To set a thrash action for a port, use the thrash-limiting command on page 15.72:

To view the thrash action that is set for a port, use the show interface switchport command on page 15.42:

Re-enabling a port

When a port is disabled, either completely or for a specific VLAN, it remains disabled until it is manually re-enabled in any of the following ways:

- by using SNMP
- by rebooting the switch or stack
- by specifying a thrash timeout value along with the thrash action
- via the CLI

Support for Jumbo Frames

You can enable jumbo frame support on the switch to improve throughput and network utilization. By increasing frame size, more data is put in each packet that the switch has to process.

When jumbo frames support is enabled, the maximum received packet size is:

- 9710 bytes for ports that work at speeds of either 10Mbps or 100Mbs
- 10240 bytes for ports that work at speeds of 1000Mbps

Jumbo frame support is enabled or disabled on the entire switch, not on a per port basis. To enable them, use the platform jumboframe command on page 15.27; to see whether they are enabled, use the show platform command on page 15.49. Jumbo frame support is disabled by default.

Port Mirroring

Port mirroring enables traffic being received and transmitted on a switch port to be sent to another switch port, the mirror port, usually for the purposes of capturing the data with a protocol analyzer.

The mirror port is the only switch port that does not belong to a VLAN, and therefore does not participate in any other switching. Before the mirror port can be set, it must be removed from all trunk groups and all VLANs except the default VLAN.

The following example sets mirroring on ports 1.0.2 and 1.0.5 for both incoming and outgoing data.

Note

Due to the internal hardware properties of the switch, frames that are destined to leave the mirrored port untagged (i.e. will have their VLAN tag removed on egress) will be received by the mirror port with the tag retained. Consequently, if frames were being transmitted by the mirror port (into the network) at wire speed, then the mirror port might be unable to accept all the frames supplied to it.

To configure port 1. 0. 2 to mirror port 1. 0. 5

`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`interface port1.0.2`	Enter the Interface Configuration mode for port1.0.2.
`awplus(config-if)#`	
`mirror interface port1.0.5 direction both`	Configure this port to mirror port 1. 0. 5.

Port Security

The port security features provide control over the stations connected to each switch port. These comprise:

- MAC address learn limits
- IEEE 802.1X

MAC Address Learn Limits

MAC address limiting is applied using the switchport port-security command on page 15.68. If enabled on a port, the switch will learn MAC addresses up to a user-defined limit from 1 to 256, then lock out all other MAC addresses. One of the following options can be specified for the action taken when an unknown MAC address is detected on a locked port:

- Discard the packet and take no further action.
- Discard the packet and notify management with an SNMP trap.
- Discard the packet, notify management with an SNMP trap and disable the port.

IEEE 802.1X

IEEE 802.1X restricts unauthenticated devices from connecting to the switch. After authentication is successful, traffic is allowed through the switch. For more information see Chapter 62, 802.1X Introduction and Configuration.

Quality of Service

Quality of Service (QoS) enables you to both prioritize traffic and limit its available bandwidth. The concept of QoS is a departure from the original networking protocols, in which all traffic on the Internet or within a LAN had the same available bandwidth. Without QoS, all traffic types are equally likely to be dropped if a link becomes oversubscribed. This approach is now inadequate in many networks, because traffic levels have increased and networks often carry time-critical applications such as streams of real-time video data. QoS also enables service providers to easily supply different customers with different amounts of bandwidth.

Configuring Quality of Service involves two separate stages:

1. Classifying traffic into flows, according to a wide range of criteria. Classification is performed by the switch's class maps.

2. Acting on these traffic flows.

The switch's QoS functionality includes the following:

- policies, to provide a QoS configuration for a port or ports
- traffic classes, for bandwidth limiting and user prioritization
- maximum bandwidth limiting on a traffic class
- flow groups within traffic classes, for user prioritization
- control of the egress scheduling algorithm
- priority relabelling of frames, at Layer 2, by replacing the VLAN tag User Priority field
- class of service relabelling of frames, at Layer 3, by replacing the DSCP (DiffServ Code Point) or the TOS precedence value in the IP header's Type of Service (TOS) field.

For more information on QoS see Chapter 60, Quality of Service (QoS) Introduction and Chapter 61, QoS Commands.

IGMP Snooping

IGMP (Internet Group Management Protocol) is used by IP hosts to report their multicast group memberships to routers and switches. IP hosts join a multicast group to receive broadcast messages directed to the multicast group address. IGMP is an IP-based protocol and uses IP addresses to identify both the multicast groups and the host members. For a VLAN-aware devices, this means multicast group membership is on a per-VLAN basis. If at least one port in the VLAN is a member of a multicast group, by default multicast packets will be flooded onto all ports in the VLAN.

IGMP snooping enables the switch to forward multicast traffic intelligently on the switch. The switch listens to IGMP membership reports, queries and leave messages to identify the switch ports that are members of multicast groups. Multicast traffic will only be forwarded to ports identified as members of the specific multicast group.

IGMP snooping is performed at Layer 2 on VLAN interfaces automatically. By default, the switch will forward traffic only from those ports with multicast listeners, therefore it will not act as a simple hub and flood all multicast traffic out all ports. IGMP snooping is independent of the IGMP and Layer 3 configuration, so an IP interface does not have to be attached to the VLAN, and IGMP does not have to be enabled or configured.

IGMP snooping is enabled by default.

Chapter 15: Switching Commands

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Command List

This chapter provides an alphabetical reference of commands used to configure switching. For more information see Chapter 14, Switching Introduction.

clear loop-protection counters

Use this command to clear the counters for the Loop Protection counters.

Syntax `clear loop-protection [interface <port-list>] counters`

Parameters	Description
`interface`	The interface whose counters are to be cleared.
`<port-list>`	A port, a port range, or an aggregated link.

Mode Privileged Exec

Examples To clear the counter information:

```
awplus# clear loop-protection counters
awplus# clear loop-protection interface port1.0.1 counters
```

clear mac address-table static

Use this command to clear the filtering database of all statically configured entries for a selected MAC address, interface, or VLAN.

Syntax

```
clear mac address-table static
   [address <mac-address>|interface <port>|vlan <vid>]
```

Parameter	Description
address	Specify a MAC (Media Access Control) address to be cleared from the filtering database.
<mac-address>	Enter a MAC address to be cleared from the database in the format HHHH.HHHH.HHHH.
interface	Specify a switch port to be cleared from the filtering database.
<port>	Specify the switch port from which address entries will be cleared. This can be a single switch port, (e.g. port1.0.4), a static channel group (e.g. sa3), or a dynamic (LACP) channel group (e.g. po4).
vlan	Specify a VLAN to be cleared from the filtering database.
<vid>	Enter a VID (VLAN ID) in the range <1-4094> to be cleared from the filtering database.

Mode Privileged Exec

Usage Use this command with options to clear the filtering database of all entries made from the CLI for a given MAC address, interface or VLAN. Use this command without options to clear any entries made from the CLI.

Compare this usage with clear mac address-table dynamic command on page 15.5.

Examples This example shows how to clear all filtering database entries configured through the CLI.

```
awplus# clear mac address-table static
```

This example shows how to clear all filtering database entries for a given interface configured through the CLI.

```
awplus# clear mac address-table static interface port1.0.3
```

This example shows how to clear filtering database entries filtering database entries configured through the CLI for a given mac address.

```
awplus# clear mac address-table static address 0202.0202.0202
```

Related Commands

clear mac address-table dynamic
mac address-table static
show mac address-table

clear mac address-table dynamic

Use this command to clear the filtering database of all entries learned for a selected MAC address, an MSTP instance, a switch port interface or a VLAN interface.

Syntax

```
clear mac address-table dynamic
   [address <mac-address>|interface <port> [instance <inst>]|
   vlan <vid>]
```

Parameter	Description
`interface`	Specify a switch port to be cleared from the filtering database.
<port>	Specify the switch port from which address entries will be cleared. This can be a single switch port, (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).
`address`	Specify a MAC (Media Access Control) address to be cleared from the filtering database.
<mac-address>	Enter a MAC address to be cleared from the database in the format HHHH.HHHH.HHHH.
`instance`	Specify an MSTP (Multiple Spanning Tree) instance to be cleared from the filtering database.
<inst>	Enter an MSTP instance in the range <`1-63`> to be cleared from the filtering database.
`vlan`	Specify a VLAN to be cleared from the filtering database.
<vid>	Enter a VID (VLAN ID) in the range <`1-4094`> to be cleared from the filtering database.

Mode Privileged Exec

Usage Use this command with options to clear the filtering database of all entries learned for a given MAC address, interface or VLAN. Use this command without options to clear any learned entries.

Use the optional `instance` parameter to clear the filtering database entries associated with a specified MSTP instance Note that you must first specify a switch port interface before you can specify an MSTP instance.

Compare this usage and operation with the clear mac address-table static command on page 15.4. Note that an MSTP instance cannot be specified with clear mac address-table static.

Examples This example shows how to clear all dynamically learned filtering database entries for all interfaces, addresses, VLANs.

```
awplus# clear mac address-table dynamic
```

This example shows how to clear all dynamically learned filtering database entries when learned through switch operation for a given MAC address.

```
awplus# clear mac address-table dynamic address 0202.0202.0202
```

This example shows how to clear all dynamically learned filtering database entries when learned through switch operation for a given MSTP instance `1` on switch port interface `port1.0.2`.

```
awplus# clear mac address-table dynamic interface port1.0.2
        instance 1
```

Related Commands clear mac address-table static
show mac address-table

clear port counter

Use this command to clear the packet counters of the port.

Syntax `clear port counter [<port>]`

Parameter	Description
<port>	The port number or range

Mode Privileged Exec

Example To clear the packet counter for `port1.0.1`

```
awplus#  clear port counter port1.0.1
```

Related Commands show platform port

debug loopprot

This command enables Loop Protection debugging.

The no variant of this command disables Loop Protection debugging.

Syntax

```
debug loopprot {info|msg|pkt|state|nsm|all}
no debug loopprot {info|msg|pkt|state|nsm|all}
```

Parameter	Description
info	General Loop Protection information.
msg	Received and transmitted Loop Detection Frames (LDFs).
pkt	Echo raw ASCII display of received and transmitted LDF packets to the console.
state	Loop Protection states transitions.
nsm	Network Service Module information.
all	All debugging information.

Mode Privileged Exec and Global Configuration

Example To enable debug for all state transitions, use the command:

```
awplus#  debug loopprot state
```

Related Commands show debugging loopprot
undebug loopprot

debug platform packet

This command enables platform to CPU level packet debug functionality on the switch.

Use the no variant of this command to disable platform to CPU level packet debug. If the result means both send and receive packet debug are disabled, then any active timeout will be cancelled.

Syntax

```
debug platform packet [recv] [send] [sflow] [timeout <timeout>]
    [vlan <vlan-id>|all]

no debug platform packet [recv] [send]
```

Parameter	Description
recv	Debug packets received.
send	Debug packets sent.
sflow	Debug sFlow packets.
timeout	Stop debug after a specified time.
<*timeout*>	<0-3600>The timeout period, specified in seconds.
vlan	Limit debug to a single VLAN ID specified.
<*vlan-id*>	<1-4094> The VLAN ID to limit the debug output on.
all	Debug all VLANs (default setting).

Default A 5 minute timeout is configured by default if no other timeout duration is specified.

Mode Privileged Exec and Global Configuration

Usage This command can be used to trace packets sent and received by the CPU. If a timeout is not specified, then a default 5 minute timeout will be applied.

If a timeout of 0 is specified, packet debug will be generated until the no variant of this command is used or another timeout value is specified. The timeout value applies to both send and receive debug and is updated whenever the debug platform packet command is used.

Examples To enable both receive and send packet debug for the default timeout of 5 minutes, enter:

```
awplus# debug platform packet
```

To enable receive packet debug for 10 seconds, enter:

```
awplus# debug platform packet recv timeout 10
```

To enable packet debug for sFlow packets only for the default timeout of 5 minutes, enter:

```
awplus# debug platform packet sflow
```

To enable send packet debug with no timeout, enter:

```
awplus# debug platform packet send timeout 0
```

To enable VLAN packet debug for VLAN 2 with a timeout duration of 3 minutes, enter:

```
awplus# debug platform packet vlan 2 timeout 150
```

To disable receive packet debug, enter:

```
awplus# no debug platform packet recv
```

Related Commands show debugging platform packet
undebug platform packet

duplex

This command changes the duplex mode for the specified port.

By default, ports auto-negotiate duplex mode (except for 100Base-FX ports which do not support auto-negotiation, so default to full duplex mode).

To see the currently-negotiated duplex mode for ports whose links are up, use the command show interface. To see the configured duplex mode (when different from the default), use the command show running-config.

Syntax `duplex {auto|full|half}`

Parameter	Description
`auto`	Auto-negotiate duplex mode.
`full`	Operate in full duplex mode only.
`half`	Operate in half duplex mode only.

Mode Interface Configuration

Usage Switch ports in a static or dynamic (LACP) channel group must have the same port speed and be in full duplex mode. Once switch ports have been aggregated into a channel group, you can set the duplex mode of all the switch ports in the channel group by applying this command to the channel group.

Examples To specify full duplex for `port1.0.4`, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# duplex full
```

To specify half duplex for `port1.0.4`, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# duplex half
```

To auto-negotiate duplex mode for `port1.0.4`, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# duplex auto
```

Related Commands polarity
speed
show interface

flowcontrol (switch port)

Use this command to enable flow control, and configure the flow control mode for the switch port.

Use the no variant of this command to disable flow control for the specified switch port.

Syntax

```
flowcontrol receive {off|on}
no flowcontrol
```

Parameter	Description
`receive`	When the port receives pause frames, it temporarily stops (pauses) sending traffic.
`on`	Enable the specified flow control.
`off`	Disable the specified flow control.

Default By default, flow control is disabled.

Mode Interface Configuration

Usage The flow control mechanism specified by 802.3x is only for full duplex links. It operates by sending PAUSE frames to the link partner to temporarily suspend transmission on the link

Flow control enables connected Ethernet ports to control traffic rates during congestion by allowing congested nodes to pause link operation at the other end. If one port experiences congestion, and cannot receive any more traffic, it notifies the other port to stop sending until the condition clears. When the local device detects congestion at its end, it notifies the remote device by sending a pause frame. On receiving a pause frame, the remote device stops sending data packets, which prevents loss of data packets during the congestion period.

Flow control is not recommended when running QoS or ACLs, because the complex queuing, scheduling, and filtering configured by QoS or ACLs may be slowed by applying flow control.

For flow control on async serial (console) ports, see flowcontrol hardware (asyn/console) command on page 5.11.

Examples

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# flowcontrol receive on
```

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# flowcontrol receive off
```

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no flowcontrol
```

Validation Commands show running-config

loop-protection

Use this command to enable the Loop Protection - loop detection - feature, and configure the detection mechanism parameters.

Use the no variant of this command to disable the Loop Protection feature.

Syntax

```
loop-protection loop-detect [ldf-interval <period>] [ldf-rx-window
   <frames>]

no loop-protection [loop-detect]
```

Parameter	Description
`loop-detect`	Enables loop detection when used with loop-protection keywords. Disables loop detection when used with no loop-protection keywords.
`ldf-interval`	The time (in seconds) between successive loop-detect frames being sent.
<period>	A period between 5 and 600 seconds. The default is 10 seconds.
`ldf-rx-window`	The number of transmitted loop detection frames whose details are held for comparing with frames arriving at the same port.
<frames>	A value for the window size between 1 and 5 frames. The default is 3 frames.

Default Loop Protection is disabled.

Mode Global Configuration

Usage Use this command to enable the Loop Protection feature, and configure the detection mechanism, and the detection mechanism parameters.

Example To enable the loop-detect mechanism on the switch, and generate loop-detect frames once every 5 seconds, use the command:

```
awplus# configure terminal
awplus(config)# loop-protection loop-detect ldf-interval 5
```

loop-protection action

Use this command to specify the protective action to apply when a network loop is detected.

Use the no variant of this command to reset the loop protection actions to the default action, vlan-disable.

Note Currently the learn-disable parameter is not supported. If specified, an error message will be displayed.

Syntax

```
loop-protection action {learn-disable|link-down|log-only|
   port-disable|vlan-disable|none}

no loop-protection action
```

Parameter	Description
`learn-disable`	Disable MAC address learning
`link-down`	Block all traffic on a port (or aggregated link) that detected the loop, and take down the link.
`log-only`	Details of loop conditions are logged. No action is applied to the port (or aggregated link).
`port-disable`	Block all traffic on interface for which the loop occurred, but keep the link in the up state.
`vlan-disable`	Block all traffic for the VLAN on which the loop traffic was detected. Note that setting this parameter will also enable ingress filtering. This is the default action.
`none`	Applies no protective action.

Default loop-protection action vlan-disable

Mode Interface Configuration

Example To disable an interface (`port1.0.4`), and bring the link down, when a network loop is detected, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# loop-protection action link-down
```

loop-protection timeout

Use this command to specify the Loop Protection recovery action duration.

Use the no variant of this command to set the loop protection timeout to the default.

Syntax

```
loop-protection timeout <duration>
no loop-protection timeout
```

Parameter	Description
<duration>	The time (in seconds) for which the configured action will apply before being disabled. This duration can be set between 1 and 86400 seconds (24 hours).

Default The default is 7 seconds.

Mode Interface Configuration

Example To configure a loop protection action timeout of 10 seconds for `port1.0.4`, use the command:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# loop-protection timeout 10
```

mac address-table acquire

Use this command to enable MAC address learning on the device.

Use the no variant of this command to disable learning.

Syntax

```
mac address-table acquire
no mac address-table acquire
```

Default Learning is enabled by default for all instances.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# mac address-table acquire
```

mac address-table ageing-time

Use this command to specify an ageing-out time for a learned MAC address. The learned MAC address will persist for at least the specified time.

The no variant of this command will reset the ageing-out time back to the default of 300 seconds (5 minutes).

Syntax

```
mac address-table ageing-time <ageing-timer> none
no mac address-table ageing-time
```

Parameter	Description
<ageing-timer>	*<10-1000000>* The number of seconds of persistence.
none	Disable learned MAC address timeout.

Default The default ageing time is 300 seconds.

Mode Global Configuration

Examples

```
awplus# configure terminal
awplus(config)# mac address-table ageing-time 1000

awplus# configure terminal
awplus(config)# mac address-table ageing-time none

awplus# configure terminal
awplus(config)# no mac address-table ageing-time
```

mac address-table static

Use this command to statically configure the MAC address-table to forward or discard frames with a matching destination MAC address.

Syntax

```
mac address-table static <mac-addr> {forward|discard} interface
   <port> [vlan <vid>]

no mac address-table static <mac-addr> {forward|discard} interface
   <port> [vlan <vid>]
```

Parameter	Description
<mac-addr>	The destination MAC address in `HHHH.HHHH.HHHH` format.
<port>	The port to display information about. The port may be a switch port (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).
<vid>	The VLAN ID. If you do not specify a VLAN, its value defaults to vlan 1.

Mode Global Configuration

Usage The mac address-table static command is only applicable to Layer 2 switched traffic within a single VLAN. Do not apply the mac address-table static command to Layer 3 switched traffic passing from one VLAN to another VLAN. Frames will not be discarded across VLANs because packets are routed across VLANs. This command only works on Layer 2 traffic.

Example

```
awplus# configure terminal

awplus(config)# mac address-table static 2222.2222.2222 forward
                interface port1.0.4 vlan 3
```

Related Commands clear mac address-table static
show mac address-table

mac address-table thrash-limit

Use this command to set the thrash limit on the switch or stack. Thrashing occurs when a MAC address table rapidly "flips" its mapping of a single MAC address between two subnets, usually as a result of a network loop.

Use the no variant of this command to disable thrash limiting.

Syntax

```
mac address-table thrash-limit <rate>
no mac address-table thrash-limit
```

Parameter	Description
<rate>	sets the maximum thrash rate at which limiting is applied. This rate can be set between 5 and 255 MAC thrashing flips per second. Once the thrash limit rate is reached, the port is considered to be thrashing.

Default No thrash limiting

Mode Global Configuration

Usage Use this command to limit thrashing on the selected port range.

Example To apply a thrash limit of 100 MAC address flips per second:

```
awplus# configure terminal
awplus(config)# mac address-table thrash-limit 100
```

Related Commands show mac address-table thrash-limit

mirror interface

Use this command to define a mirror port and mirrored (monitored) ports and direction of traffic to be mirrored. The port for which you enter interface mode will be the mirror port.

The destination port is removed from all VLANs, and no longer participates in other switching.

Use the no variant of this command to disable port mirroring by the destination port on the specified source port.

Use the none variant of this command when using copy-to-mirror ACL and QoS commands.

Syntax

```
mirror interface <source-port-list> direction {both|receive|transmit}
mirror interface none
no mirror interface <source-port-list>
no mirror interface none
```

Parameter	Description
<source-port-list>	The source switch ports to mirror. A port-list can be: ■ a port (e.g. `port1.0.12`) ■ a continuous range of ports separated by a hyphen, e.g. `port1.0.1-1.0.24` ■ a comma-separated list of ports and port ranges, e.g. `port1.0.1,port1.0.8-1.0.24` The source port list cannot include dynamic or static channel groups (link aggregators).
`direction`	Specifies whether to mirror traffic that the source port receives, transmits, or both.
`both`	Mirroring traffic both received and transmitted by the source port.
`receive`	Mirroring traffic received by the source port.
`transmit`	Mirroring traffic transmitted by the source port.
`none`	Specify this parameter for use with the ACL (Access Control List) access-list and QoS (Quality of Service) default action commands when used with the copy-to-mirror parameter option, so you can specify the destination port (the analyzer port) for the traffic without specifying a source mirror port. See the ACL commands access-list (hardware IP numbered) and access-list (hardware MAC numbered), and the QoS command default-action for further information.

Mode Interface Configuration

Usage Use this command to send traffic to another device connected to the mirror port for monitoring.

See "Port Mirroring" on page 14.20.

A mirror port cannot be associated with a VLAN. If a switch port is configured to be a mirror port, it is automatically removed from any VLAN it was associated with.

This command can only be applied to a single mirror (destination) port, not to a range of ports, nor to a static or dynamic channel group. Do not apply multiple interfaces with an interface command before issuing the mirror interface command. One interface may have multiple mirror interfaces.

Note A port cannot be configured as a mirror or mirrored port, if it is already configured for sFlow monitoring.

Example To mirror traffic received and transmitted on `port1.0.4` and `port1.0.5` to destination `port1.0.3`, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# mirror interface port1.0.4,port1.0.5
                   direction both
```

To enable use with the access-list (hardware IP numbered) ACL and default-action QoS commands to destination `port1.0.3` without specifying a source port, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# mirror interface none
```

To mirror all TCP traffic, received or transmitted to analyzer `port1.0.1`, see the sample config below:

```
awplus#show running-config

!
mls qos enable
access-list 3000 copy-to-mirror tcp any any
access-group 3000
!
interface port1.0.1
 mirror interface none
 switchport
!
```

Related Commands
access-list (hardware IP numbered)
access-list (hardware MAC numbered)
default-action

platform bist

This command performs a self test on the switch. This command tests the ASIC (Application Specific Integrated Circuit) memory.

Syntax `platform bist instance {<0-127>|all} [full]`

Parameter	Description
`instance`	ASIC (Application Specific Integrated Circuit) instance.
`<0-127>`	ASIC instance number.
`all`	All platform instances.
`full`	Run full BIST tests.

Mode Privileged Exec

Example To run the full built in self test for all memory in the ASIC on the switch, enter the command:

```
awplus# platform bist instance all full
```

Related Commands platform prbs
show platform bist

platform control-plane-prioritization rate

The CPU protection feature ensures that different traffic types can share the CPU effectively.

Use this command to set the maximum traffic rate on the CPU port to limit the CPU getting overloaded with unnecessary data packets that may result in poor performance of the control plane, for example, CLI console lock up or control packet loss following a broadcast storm.

The default rate limiting value is set to transmit the packets to the CPU at 60 Mbps. The CPU port uses the WRR (Weighted Round Robin) scheduler with appropriate weights assigned.

Use the no variant of this command to restore the rate limiting on the CPU port to the default of 60 Mbps. Note only integer values are accepted for rate limits.

Set the rate to 0 using platform control-plane prioritization rate to disable CPU protection.

Syntax

```
platform control-plane-prioritization rate <rate-limit>
no platform control-plane-prioritization rate
```

Parameter	Description
<rate-limit>	<1-1000> 1 Mbps to 1000 Mbps. Default is 60 Mbps.

Default 60 Mbps

Mode Global Configuration

Usage Confirming default settings:

Use show platform to confirm the default rate limit settings displayed with platform information:

```
awplus# show platform
```

```
Load Balancing                  srt-dst-mac, src-dst-ip
Control-plane-prioritization Max 60 Mbps
Jumboframe support              off
Enhanced mode                   qos counters
Vlan-stacking TPID              0x8100
```

Disabling CPU protection:

To disable the CPU protection feature you can set the control plane prioritization rate to 0:

```
awplus# platform control-plane-prioritization 0
```

Then you can confirm the CPU protection feature has been disabled using show platform:

```
awplus# show platform
```

```
Load Balancing                  srt-dst-mac, src-dst-ip
Control-plane-prioritization Max 0 Mbps
Jumboframe support              off
Enhanced mode                   qos counters
Vlan-stacking TPID              0x8100
```

Examples To set the maximum traffic rate on the CPU port to 10 Mbps enter the following command, enter:

```
awplus# configure terminal
awplus(config)# platform control-plane-prioritization 10
```

Confirm the maximum traffic rate has been configured using the following show command:

```
awplus#show platform
Load Balancing                  srt-dst-mac, src-dst-ip
Control-plane-prioritization Max 10 Mbps
Jumboframe support              off
Enhanced mode                   qos counters
Vlan-stacking TPID              0x8100
```

To reset the maximum traffic rate on the CPU port to 60 Mbps enter the following command, enter:

```
awplus# configure terminal
awplus(config)# no platform control-plane-prioritization
```

Related Commands show platform
show running-config

platform delay-locked-loop-monitoring

This command should only be used when directed by Allied Telesis support personnel. This command allows you to configure the DLL (Delayed Locked Loop) monitoring parameters used for hardware environmental monitoring functionality.

Syntax `platform delay-locked-loop-monitoring <poll-interval> <temp-delta>`

Parameter	Description
<poll-interval>	<1-4294967295> Time interval in seconds between two successive temperature readings.
<temp-delta>	<1-200> Maximum rise in temperature in degrees Celsius after which the Delay Locked Loop is reset.

Default The default poll interval is 10 seconds, and the default temperature delta is 30 degrees Celsius.

Mode Global Configuration

Usage In field resetting of the Delayed Locked Loop (DLL) may be used under some extreme thermal conditions, such as a reboot at a very low temperature with a ramp-up to a high temperature.

The two integer parameters configured by this command are the values for the time interval in seconds to poll for temperature variations (which is the poll interval), and the temperature limit in degrees Celsius (which is the maximum temperature delta).

Example To set the poll interval to 20 seconds and the temperature delta to 35 degrees Celsius, enter:

```
awplus# configure terminal
awplus(config)# platform delay-locked-loop-monitoring 20 35
```

platform enhancedmode (deprecated)

This command has been replaced by the platform silicon-profile command on page 15.34.

platform jumboframe

This command enables the device to forward jumbo frames. For more information, see "Support for Jumbo Frames" on page 14.19.

When jumbo frame support is enabled, the maximum size of packets that the device can forward is:

- 9710 bytes for ports that work at speeds of either 10Mbps or 100Mbps
- 10240 bytes for ports that work at speeds of 1000Mbps

The no variant of this command disables the device from forwarding jumbo frames. This stops the ports from forwarding packets larger than VLAN tagged frames (1522 bytes).

Syntax

```
platform jumboframe
no platform jumboframe
```

Default By default, jumbo frames is off.

Mode Global Configuration

Usage You must restart the device after entering this command for it to take effect. You can use the reboot command on page 8.23 to restart the device.

Example To enable the device to forward jumbo frames, use the following commands:

```
awplus# configure terminal
awplus(config)# platform jumboframe
```

Related Commands

show platform
show running-config

platform l2mc-overlap

Use this command to enable checking for overlapping (shared) multicast entries, so that shared entries are not deleted if they are still in use.

Use the no version of this command to disable checking for overlapping entries before deletion.

Syntax

```
platform l2mc-overlap
no platform l2mc-overlap
```

Mode Global Configuration

Default By default, Layer 2 multicast overlap checking is disabled.

Example To prevent the deletion of overlapping (shared) Layer 2 multicast entries, use the command:

```
awplus# configure terminal
awplus(config)# platform l2mc-overlap
```

Related Commands show platform

platform load-balancing

This command selects which packet fields are used in the channel (link aggregation) load balancing algorithm. The load balancing algorithm determines the member port of a channel group when the packet is destined for a port within a channel.

Use the no variant of this command to restrict the default choice of packet fields in the channel load balancing algorithm.

Syntax

```
platform load-balancing {src-dst-mac|src-dst-ip}
no platform load-balancing
```

Parameter	Description
src-dst-mac	Include Source and Destination MAC data (Layer 2)
src-dst-ip	Include Source and Destination IP data (Layer 3)

Default The default is src-dst-mac and src-dst-ip.

Mode Global Configuration

Usage The configuration use of the load balancing options on x600 and x610 Series switches is a Boolean "OR", whereas for the x900 the use of the load balancing options is a Boolean "AND".

Examples To set the load balancing algorithm to include Layer 2 MAC information, enter:

```
awplus# configure terminal
awplus(config)# platform load-balancing src-dst-mac
```

To set the load balancing algorithm to include Layer 3 IP information, enter:

```
awplus# configure terminal
awplus(config)# platform load-balancing src-dst-ip
```

Related Commands show platform

platform portstorm

Use this command to perform a port storm test on the system. This test generates a high packet load on switch ports, exercising the packet data path and front-panel ports.

Syntax `platform portstorm [duration <seconds>]`

Parameter	Description
`duration`	Duration of test.
`<seconds>`	The duration period, in seconds.

Mode Privileged Exec

Usage For this test, at least three ports must be looped back individually or pair-wise. Normally all ports on a switching instance are included. Additionally, Spanning Tree should be disabled using a no spanning-tree rstp enable command before issuing the platform portstorm command.

Example To perform a port storm test for 5 minutes on the switch, ensure ports are externally looped back correctly, and use the following commands:

```
awplus# configure terminal
awplus(config)# no spanning-tree rstp enable
awplus(config)# exit
awplus# platform portstorm duration 300
```

Related Commands show platform portstorm
spanning-tree enable

platform prbs

Use this command to perform a PRBS (Pseudo-Random Bit Stream) test on the system. This test sends a PRBS bidirectionally to and from every fabric port on the switch.

Note You cannot run this command on a XEM-STK module in an x900. Run a platform bist command on a XEM-STK instead.

Syntax

```
platform prbs {internal-fabric|stack-fabric|all-fabric}
   [duration <seconds>]
```

Parameter	Description
`internal-fabric`	Test the baseboard internal fabric links.
`stack-fabric`	Test the baseboard stacking fabric links. For x908 switches only.
`all-fabric`	Run both tests for x908 switches or run the `stack-fabric` test.
`duration`	Duration of test.
<seconds>	The duration period, in seconds.

Mode Privileged Exec

Example To perform a PRBS on the internal fabric links for 5 minutes, use the following command:

```
awplus# platform prbs internal-fabric duration 300
```

Related Commands

platform bist
show platform prbs

platform routingratio

This command changes the amount of memory allocated to IPv4 routing tables relative to IPv6 routing tables.

Use the no variant of this command to restore to the default setting.

The switching hardware contains memory that it uses to store tables of routes and nexthop addresses. IPv4 and IPv6 addresses have separate tables. This command adjusts the amount of memory allocated to the tables depending on whether they are for IPv4 or IPv6 addresses.

Syntax

```
platform routingratio {ipv4only|ipv4andipv6}
no platform routingratio
```

Parameter	Description
`ipv4only`	All memory resources are allocated to the IPv4 address tables.
`ipv4andipv6`	50% of memory resources are allocated to the IPv4 address tables, and 50% to IPv6 address tables.

Default The routing ratio is set to `ipv4andipv6` by default to store both IPv4 and IPv6 addresses.

Mode Global Configuration

Usage The default routing memory ratio is set to `ipv4andipv6` allowing both IPv4 and IPv6 to run concurrently. Use the negated form of this command to restore to the default. If you need to maximize routing memory capacity for IPv4, then set the routing memory ratio to `ipv4only`.

Note For this command to take effect, you must copy it to the startup configuration using the copy running-config startup-config command and then reboot the switch.

Examples To set the route and nexthop tables to store IPv4 addresses only, use the following commands:

```
awplus# configure terminal
awplus(config)# platform routingratio ipv4only
% The device needs to be restarted for this
change to take effect.
```

To reset the route and nexthop tables to store both IPv4 and IPv6 addresses, use the following commands:

```
awplus# configure terminal
awplus(config)# platform routingratio ipv4andipv6
% The device needs to be restarted for this
change to take effect.
```

To reset the route and nexthop tables to the default setting, use the following commands:

```
awplus# configure terminal

awplus(config)# no platform routingratio

             % The device needs to be restarted for this
               change to take effect.
```

Related Commands

platform silicon-profile
show platform
show running-config
show startup-config

platform silicon-profile

Use this command to rearrange memory in the switch's silicon hardware, to provide differing numbers of table entries for different uses. For a new silicon profile setting to take effect, it must be in the startup configuration when the switch starts up. For more details about the limits that are modified by this command, see Table 15-1.

The no variant of this command restores the memory to the default state: no silicon profile set. For the default silicon profile setting to take effect, you must restart the switch with the no version of the command in the startup config.

This command replaces the platform enhancedmode command.

Syntax x900

```
platform silicon-profile {nexthop|qoscounters|qospolicers}
no platform silicon-profile
```

Syntax SBx908

```
platform silicon-profile {nexthop|qoscounters|qospolicers|extended}
no platform silicon-profile
```

Parameter	Description
nexthop	Increases the number of individual routes that can be stored in the nexthop table. The maximum number of multicast groups and traffic classes is reduced. This profile is only useful on: ■ x900 Series switches, or ■ SwitchBlade x908 switches with one or more of these XEMs present: XEM-1XP, XEM-12T, XEM-12S. On a SwitchBlade x908 that only has XEM-2XP, XEM-2XT, and XEM-2XS XEMs installed, more nexthops are available with the extended profile.
qoscounters	Enables the QoS counters profile so that the hardware monitors QoS counters for traffic classes (policers). The maximum number of traffic classes is reduced. This profile is only useful on: ■ x900 Series switches, or ■ SwitchBlade x908 switches with one or more of these XEMs present: XEM-1XP, XEM-12T, XEM-12S. Before you configure QoS storm protection, you must set either this profile or the extended profile. On a SwitchBlade x908 that only has XEM-2XP, XEM-2XT, and XEM-2XS XEMs installed, QoS counters are available in the extended profile.
qospolicers	Enables the QoS policers profile. The internal memory for the switch is rearranged to allow more QoS policers at the expense of a reduced multicast route capacity. This profile is only useful on: ■ x900 Series switches, or ■ SwitchBlade x908 switches with one or more of these XEMs present: XEM-1XP, XEM-12T, XEM-12S. On a SwitchBlade x908 that only has XEM-2XP, XEM-2XT, and XEM-2XS XEMs installed, more QoS policers are available in the extended profile.

Parameter	Description
extended	SBx908 with only XEM-2XP, XEM-2XT, and XEM-2XS XEMs installed: This profile increases silicon hardware table sizes to make use of the larger capacity of these XEMs when installed in a SwitchBlade x908. This profile increases the maximum number of: ■ static channel groups ■ LACP channel groups ■ Forwarding Database (FDB) entries ■ Unicast nexthop entries ■ Layer 3 multicast entries

Default By default, no silicon profile is set.

Mode Global Configuration

Usage Memory in the switch hardware silicon can be allocated in various ways when the switch starts up. The memory allocations that can be made depend on the hardware (which switch model and which XEMs are installed). On some hardware platforms, using this command to increase the allocation for one use reduces the memory available for other uses.

Before you configure QoS storm protection (storm-protection command on page 61.80.), you must set the silicon profile to either extended or qoscounters.

The silicon profile setting in the startup configuration takes effect when the switch starts up. Once you have entered this platform silicon-profile command (or the no version), you can copy the running-config to the startup-config (copy running-config command on page 7.12) and reboot the switch (reboot command on page 8.23):

```
awplus# copy running-config startup-config
awplus# reboot
```

SBx908 only: The switch will only start up with the platform silicon-profile set to extended if all the XEMs installed are XEM-2XP, XEM-2XT, and XEM-2XS XEMs. When the switch is running with the extended profile, you cannot install any of the other XEMs (XEM-1XP, XEM-12T, or XEM-12S)—if you insert one of these XEMs, the XEM will not start up. To install one of these XEMs, you must remove the extended profile setting from the startup config, and restart the switch. This results in the table sizes being reduced to the default settings.

Before connecting switches into a stack, all stack members must be operating in the same mode (enhanced or default/none).

Table 15-1: Memory allocation for silicon profiles with routing ratio IPv4 and IPv6

	Silicon profile options				
	None (default)	**nexthop**	**qoscounters**	**qospolicers**	**extended**
Route Entry/Policer Limits					
Unicast nexthop entries	2500	5060	2500	2500	8192
Multicast nexthop entries	2048	256	2048	1280	8192
QoS policers (traffic classes)	713	329	475	1097	4096
FDB Limits					
Forwarding Database entries (MAC addresses)	16384	16384	16384	16384	65536
Link Aggregation Limits					
Link aggregators: total	31	31	31	31	128
Link aggregators: LACP (dynamic)	31	31	31	31	32
Link aggregators: static	31	31	31	31	96
QoS Counters Enabled					
QoS counters	No	No	Yes	No	Yes

Examples To enable monitoring of QoS traffic class counters, use the following commands:

```
awplus# configure terminal
awplus(config)# platform silicon-profile qoscounters
```

To increase the size of the nexthop table, use the following commands:

```
awplus# configure terminal
awplus(config)# platform silicon-profile nexthop
```

To allow more QoS policers at the expense of multicast routes, use the commands:

```
awplus# configure terminal
awplus(config)# platform silicon-profile qospolicers
```

SBx908 only: On a SwitchBlade x908 with XEM-2XP, XEM-2XT, and XEM-2XS XEMs installed (and no XEM-1XP, XEM-12T, or XEM-12S XEMs present), to increase table sizes, use the commands:

```
awplus# configure terminal
awplus(config)# platform silicon-profile extended
```

To restore the silicon profile to its default setting (no profile), use the commands:

```
awplus# configure terminal
awplus(config)# no platform silicon-profile
```

Related Commands:
copy running-config
channel-group
reboot
show platform
static-channel-group
storm-protection

platform vlan-stacking-tpid

This command specifies the Tag Protocol Identifier (TPID) value that applies to all frames that are carrying double tagged VLANs. All nested VLANs must use the same TPID value. (This feature is sometimes referred to as VLAN stacking or VLAN double-tagging.)

Use the no variant of this command to revert to the default TPID value (0x8100).

Note

Because the additional tag increases the frame size beyond 1522 bytes, you must turn on Jumbo frames to activate VLAN-stacking.

Syntax

```
platform vlan-stacking-tpid <tpid>

no platform vlan-stacking-tpid
```

Parameter	Description
<tpid>	The Ethernet type of the tagged packet, as a two byte hexadecimal number.

Default The default TPID value of 0x8100 is restored using a no platform vlan-stacking-tpid command.

Mode Global Configuration

Examples To set the VLAN stacking TPID value to 0x9100, use the following commands:

```
awplus# configure terminal
awplus(config)# platform vlan-stacking-tpid 9100
```

To reset the VLAN stacking TPID value to the default (0x8100), use the following commands:

```
awplus# configure terminal
awplus(config)# no platform vlan-stacking-tpid
```

Related Commands

switchport vlan-stacking (double tagging)
show platform
show running-config

polarity

This command sets the MDI/MDIX polarity on a copper-based switch port.

Syntax `polarity {auto|mdi|mdix}`

Parameter	Description
`mdi`	Sets the polarity to MDI (medium dependent interface).
`mdix`	Sets the polarity to MDI-X (medium dependent interface crossover).
`auto`	The switch port sets the polarity automatically. This is the default option.

Default By default, switch ports set the polarity automatically (auto).

Mode Interface Configuration

Usage We recommend the default auto setting for MDI/MDIX polarity. Polarity applies to copper 10BASE-T, 100BASE-T, and 1000BASE-T switch ports; It does not apply to fibre ports. For more information, see "MDI/MDIX Connection Modes" on page 14.5.

Example To set the polarity for `port1.0.7` to fixed MDI mode, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.7
awplus(config-if)# polarity mdi
```

show debugging loopprot

This command shows Loop Protection debugging information.

Syntax `show debugging loopprot`

Mode User Exec and Privileged Exec

Example To display the enabled Loop Protection debugging modes, use the command:

```
awplus# show debugging loopprot
```

Related Commands debug loopprot

show debugging platform packet

This command shows platform to CPU level packet debugging information.

Syntax `show debugging platform packet`

Mode User Exec and Privileged Exec

Example To display the platform packet debugging information, use the command:

```
awplus# show debugging platform packet
```

Related Commands debug platform packet
undebug platform packet

show flowcontrol interface

Use this command to display flow control information.

Syntax `show flowcontrol interface <port>`

Parameter	Description
<port>	Specifies the name of the port to be displayed.

Mode User Exec and Privileged Exec

Example To display the flow control for the `port1.0.5`, use the command:

```
awplus# show flowcontrol interface port1.0.5
```

Output Figure 15-1: Example output from the **show flowcontrol interface** command for a specific interface

```
Port     Send  FlowControl    Receive  FlowControl  RxPause TxPause
          admin    oper         admin    oper
-----     ------- --------     ------- --------     ------- -------
port1.0.5 on       on           on       on           0       0
```

show interface switchport

Use this command to show VLAN information about each switch port.

Syntax `show interface switchport`

Mode User Exec and Privileged Exec

Example To display VLAN information about each switch port, enter the command:

```
awplus# show interface switchport
```

Output Figure 15-2: Example output from the **show interface switchport** command

```
Interface name          : port1.0.1
Switchport mode         : access
Ingress filter          : enable
Acceptable frame types  : all
Default Vlan            :  2
Configured Vlans        : 2

Interface name          : port1.0.2
Switchport mode         : trunk
Ingress filter          : enable
Acceptable frame types  : all
Default Vlan            :  1
Configured Vlans        : 1 4 5 6 7 8
...
```

Related Commands show interface memory

show loop-protection

Use this command to display the current loop protection setup for the device.

Syntax `show loop-protection [interface <port-list>] [counters]`

Parameter	Description
`interface`	The interface selected for display.
`<port-list>`	A port, a port range, or an aggregated link.
`counters`	Displays counter information for loop protection.

Mode User Exec and Privileged Exec

Usage This command is used to display the current configuration and operation of the Loop Protection feature

Examples To display the current configuration status for `port1.0.1`, use the command:

```
awplus# show loop-protection interface port1.0.1
```

Figure 15-3: Example output from the **show loop-protection** command

```
Loop-Detection:          Enabled
LDF Interval:            10 [sec]
Interface:               port1.0.1
 Action:                 port-disable
 Timeout:                300 [sec]
 Vlan:                   1
  Status:                Blocking
  Timeout Remaining:     115 [sec]
 Vlan:                   2
  Status:                Normal
  Timeout Remaining:     0 [sec]
```

To display the counter information for `port1.0.1`, use the command:

```
awplus# show loop-protection interface port1.0.1 counters
```

Figure 15-4: Example output from the **show loop-protection interface counters** command for port1.0.1

```
Interface:               port1.0.1
 Vlan:                   1
  LDF Tx:                3
  LDF Rx:                1
  Invalid LDF Rx:        1
  Action:                1
Vlan:                    2
  LDF Tx:                3
  LDF Rx:                0
  Invalid LDF Rx:        0
  Action:                0
```

show mac address-table

Use this command to display the mac address-table for all configured VLANs.

Syntax `show mac address-table`

Mode User Exec and Privileged Exec

Usage The show mac address-table command is only applicable to view a mac address-table for Layer 2 switched traffic within VLANs.

Example To display the mac address-table, use the following command:

```
awplus# show mac address-table
```

Output See the below sample output captured when there was no traffic being switched:

```
awplus#show mac address-table

VLAN port          mac               type
1    unknown       0000.cd28.0752    forward   static
ARP  -             0000.cd00.0000    forward   static
```

See the sample output captured when packets were switched and mac addresses were learnt:

```
awplus#show mac address-table

VLAN port          mac               type
1    unknown       0000.cd28.0752    forward   static
1    port1.0.11    0030.846e.9bf4    forward   dynamic
1    port1.0.9     0030.846e.bac7    forward   dynamic
ARP  -             0000.cd00.0000    forward   static
```

Note the new mac addresses learnt for `port1.0.9` and `port1.0.11` added as dynamic entries.

Note the first column of the output below shows VLAN IDs if multiple VLANs are configured:

```
awplus#show mac address-table

VLAN port          mac               type
1    unknown       0000.cd28.0752    forward   static
1    port1.0.9     0030.846e.bac7    forward   dynamic
2    unknown       0000.cd28.0752    forward   static
2    port1.0.11    0030.846e.9bf4    forward   dynamic
ARP  -             0000.cd00.0000    forward   static
```

Also note manually configured static mac-addresses are shown to the right of the type column:

```
awplus(config)#mac address-table static 0000.1111.2222 for int
port1.0.11 vlan 2
awplus(config)#end
awplus#
awplus#show mac address-table

VLAN port          mac               type
1    unknown       0000.cd28.0752    forward   static
1    port1.0.9     0030.846e.bac7    forward   dynamic
2    port1.0.11    0000.1111.2222    forward   static
2    unknown       0000.cd28.0752    forward   static
2    port1.0.11    0030.846e.9bf4    forward   dynamic
ARP  -             0000.cd00.0000    forward   statics
```

Related Commands

clear mac address-table dynamic
clear mac address-table static
mac address-table static

show mac address-table thrash-limit

Use this command to display the current thrash limit set for all interfaces on the device.

Syntax `show mac address-table thrash-limit`

Mode User Exec and Privileged Exec

Example To display the current, use the following command:

```
awplus# show mac address-table thrash-limit
```

Output Figure 15-5: Example output from the **show mac address-table thrash-limit** command

```
% Thrash-limit  7 movements per second
```

Related Commands mac address-table thrash-limit

show mirror

Use this command to display the status of all mirrored ports.

Syntax `show mirror`

Mode User Exec and Privileged Exec

Example To display the status of all mirrored ports, use the following command:

```
awplus# show mirror
```

Output Figure 15-6: Example output from the **show mirror** command

```
Mirror Test Port Name: port1.0.1
Mirror option: Enabled
Mirror direction: both
Monitored Port Name: port1.0.2
Mirror Test Port Name: port1.0.3
Mirror option: Enabled
Mirror direction: receive
Monitored Port Name: port1.0.4
Mirror Test Port Name: port1.0.3
Mirror option: Enabled
Mirror direction: receive
Monitored Port Name: port1.0.1
Mirror Test Port Name: port1.0.1
Mirror option: Enabled
Mirror direction: receive
Monitored Port Name: port1.0.3
Mirror Test Port Name: port1.0.1
Mirror option: Enabled
Mirror direction: transmit
Monitored Port Name: port1.0.4
```

show mirror interface

Use this command to display port mirroring configuration for a mirrored (monitored) switch port.

Syntax `show mirror interface <port>`

Parameter	Description
<port>	The monitored switch port to display information about.

Mode User Exec, Privileged Exec and Interface Configuration

Example To display port mirroring configuration for the `port1.0.4`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# show mirror interface port1.0.4
```

Output Figure 15-7: Example output from the **show mirror interface** command

```
Mirror Test Port Name: port1.0.3
Mirror option: Enabled
Mirror direction: both
Monitored Port Name: port1.0.4
```

show platform

This command displays the settings configured by using the platform commands.

Syntax `show platform`

Mode Privileged Exec

Usage This command displays the settings in the running config. For changes in some of these settings to take effect, the switch must be rebooted with the new settings in the startup config.

Example To check the settings configured with platform commands on the switch, use the following command:

```
awplus# show platform
```

Output Figure 15-8: Example output from the **show platform** command

```
awplus# show platform

Load Balancing                  src-dst-mac, scr-dst-ip
Control-plane-prioritization    Max 60 Mbps
L2MC overlapped group check     off
silicon-profile                 extended
Jumboframe support              off
Vlan-stacking TPID              0x8100
Routing ratio                   IPv4 and IPv6
```

Table 15-2: Parameters in the output of the **show platform** command

Parameter	Description
Load Balancing	Which packet fields are used in the channel load balancing algorithm (platform load-balancing command on page 15.29).
Control-plane-prioritization	Maximum traffic rate on the CPU port, set using the platform control-plane-prioritization rate command on page 15.24.
L2MC overlapped group check	Whether Layer 2 multicast entries are checked before deletion (platform l2mc-overlap command on page 15.28).
silicon-profile	The silicon profile setting (platform silicon-profile command on page 15.34) for the switch hardware; one of: ■ nexthop ■ qoscounters ■ qospolicers ■ extended (SBx908 only) ■ None (default)
Jumboframe support	Whether the jumbo frames setting is enabled or disabled.
Vlan-stacking TPID	The value of the TPID set in the Ethernet type field when a frame has a double VLAN tag (platform vlan-stacking-tpid command on page 15.38).
Routing Ratio	Whether all memory is allocated to IPv4 address tables (ipv4only), or whether it is allocated evenly to both IPv4 and IPv6 address tables (ipv4andipv6) (platform routingratio command on page 15.32).

Related Commands

platform control-plane-prioritization rate
platform jumboframe
platform l2mc-overlap
platform load-balancing
platform routingratio
platform silicon-profile
platform vlan-stacking-tpid

show platform bist

This command displays the result of a previously run BIST (Built In Self Test) on the switch.

Syntax `show platform bist`

Mode Privileged Exec

Example To show the result of a previously run BIST on the switch, enter the following command:

```
awplus# show platform bist
```

Output Figure 15-9: Example output from the **show platform bist** command

```
Platform Built In Self Test Results
  Switch Instance 0 ......... Passed
00   forward   static
```

Related Commands platform bist

show platform classifier statistics utilization brief

This command displays the total memory space, and free memory space of CAM (Content-Addressable Memory). Utilization statistics for various platform functions, such as ACLs and QoS are also shown.

Syntax `show platform classifier statistics utilization brief`

Mode Privileged Exec

Example To display the platform classifier utilization statistics, use the following command:

```
awplus# show platform classifier statistics utilization brief
```

Output Figure 15-10: Output from the **show platform classifier statistics utilization brief** command

```
awplus#show platform classifier statistics utilization brief

[Instance 0]
  [ port1.0.1-1.0.12]                  Used / Total
  ---------------------------------
  DHCP Snooping       0
  Web Auth            0
  Loop Detection      0
  EPSR                0
  Global ACL          1
  ACL                 0
  QoS                 0
  Total               1 / 1024 (0.10%)

 Ext (IPv6) Number of PCE Entries:
                  Used / Total
  ---------------------------------
  MLD Snooping        0
  IPv6 Global ACL     1
  IPv6 ACL            0
  Total               1 / 512 (0.20%)

  Profiles:
  Legend of Offset Type) 1:Ether 2:IP 3:TCP/UDP
  Packet Type    Offset Type       Used / Total
  -------------- 0------8------15 ------------
  TCP (IPv4)     2222000000000000     4 / 16
  UDP (IPv4)     2222000000000000     4 / 16
  IPv4 fragment  2222000000000000     4 / 16
  IPv4 other     2222000000000000     4 / 16
  Ethernet       0000000000000000     0 / 16
  IPv6           2222220000000000     6 / 16
```

Figure 15-11: Output from the **show platform classifier statistics utilization brief** command (XEM-2XP)

```
[Instance 0]
  [ port1.1.1-1.1.2 ]
  Note: Each v6 classifier take two entries
                  Used / Total
  --------------------------------
  MLD Snooping        0
  DHCP Snooping       0
  Web Auth            0
  Loop Detection      0
  EPSR                0
  IPv6 Global ACL     2
  IPv6 ACL            0
  Global ACL          1
  ACL                 0
  QoS                 0
  Total               3 / 8172 (0.00%)

  Profiles:
  Legend of Offset Type) 1:Ether 2:IP 3:TCP/UDP
  Packet Type   Offset Type      Used / Total
  ------------- 0------8------15 ------------
  TCP (IPv4)    2222220000000000    6 / 16
  UDP (IPv4)    2222220000000000    6 / 16
  IPv4 fragment 2222220000000000    6 / 16
  IPv4 other    2222220000000000    6 / 16
  Ethernet      0000000000000000    0 / 16
  IPv6          2222220000000000    6 / 16
```

show platform port

This command displays the various port registers or platform counters for specified switchports.

Syntax `show platform port [<port-list>|counters]`

Parameter	Description
<port-list>	The ports to display information about. A port-list can be: ■ a continuous range of ports separated by a hyphen, e.g. `port1.0.1-1.0.24` ■ a comma-separated list of ports and port ranges, e.g. `port1.0.1,port1.0.7-1.0.24`.
`counters`	Show the platform counters.

Mode Privileged Exec

Examples To display port registers for `port1.0.1` and `port1.0.2` use the following command:

```
awplus# show platform port port1.0.1-port1.0.2
```

To display platform counters for `port1.0.1` and `port1.0.2` use the following command:

```
awplus# show platform port port1.0.1-port1.0.2 counters
```

Output Figure 15-12: Example output from the **show platform port** command

```
awplus#show platform port port1.1.1

Stack member 1

PHY Registers for ifx 5101 (lport 0x00000004)
   0 1140  1 796D  2 0141  3 0CD4  4 01E1  5 4501  6 0007  7 2801
   8 0000  9 0E00 10 4000 11 0000 12 0000 13 0000 14 0000 15 3000
  16 0078 17 6D40 18 0000 19 1F40 20 0CEA 21 0001 22 0000 23 0000
  24 4141 25 03A0 26 400A 27 848B 28 0000 29 0005 30 05AC 31 0000

Port configurations:
  lport  4    macStatus:     0x01000804      value: 0x00002019
              macCtrl:       0x01000800      value: 0x11266619
              macCounters:   0x01010400      value: 0x00A07404
              portControl:   0x02004000      value: 0x0010C684
              portVid:       0x02004004      value: 0x00000001
              brdByteLimit:  0x02004008      value: 0xFFFF0000
              brdByteWindow: 0x0200400C      value: 0x00FFFF00
              protoVidBased: 0x02004800      value: 0x20012001
              rxBufLimit:    0x03011010      value: 0x00001038
              flowCntrlThr:  0x03010010      value: 0xFA404001
```

Output Figure 15-13: Example output from the **show platform port counters** command

```
awplus#show platform port port1.1.1 counters

Stack member 1

 Switch Port Counters
------------------------------------------------------------------------

Port 1.1.1    Ethernet MAC counters:
 Combined receive/transmit packets by size (octets) counters:
  64                                58 512 - 1023                        17
  65 - 127                       18246 1024 - MaxPktSz                  415
  128 - 255                     200588
  256 - 511                        731

 General Counters:
 Receive                             Transmit
  Octets                10544144711680 Octets                    24004329
  Pkts                          50748 Pkts                        169307
  CRCErrors                         0
  UnicastPkts                       0 UnicastPkts                        0
  MulticastPkts                 50743 MulticastPkts                 156914
  BroadcastPkts                     1 BroadcastPkts                  10541
  FlowCtrlFrms                      0 FlowCtrlFrms                       0
  OversizePkts                      0
  Fragments                         0
  Jabbers                           0
  UpsupportOpcode                   0
  UndersizePkts                     0
                                      Collisions                         0
                                      LateCollisions                     0
                                      ExcessivCollsns                    0

 Miscellaneous Counters:
  MAC TxErr                         0
  MAC RxErr                         0
  Drop Events                       0

------------------------------------------------------------------------
```

Table 15-3: Output parameters from the **show platform port counters** command

Parameter	Description
Ethernet MAC counters	
Combined receive/ transmit packets by size (octets) counters	Number of packets in each size range received and transmitted.
64	Number of 64 octet packets received and transmitted.
65 - 127	Number of 65 - 127 octet packets received and transmitted.
128 - 255	Number of 128 - 255 octet packets received and transmitted.
256 - 511	Number of 256 - 511 octet packets received and transmitted.
512 - 1023	Number of 512 - 1023 octet packets received and transmitted.
1024 - MaxPktSz	Number of packets received and transmitted with size 1024 octets to the maximum packet length.
General Counters	
Receive	Counters for traffic received.
Octets	Number of octets received.

Table 15-3: Output parameters from the **show platform port counters** command(cont.)

Parameter	Description
Pkts	Number of packets received.
CRCErrors	Number of CRC (Cyclic Redundancy Check) error events received.
UnicastPkts	Number of unicast packets received.
MulticastPkts	Number of multicast packets received.
BroadcastPkts	Number of broadcast packets received.
FlowCtrlFrms	Number of good Flow Control frames received.
OversizePkts	Number of oversize packets received.
Fragments	Number of fragments received.
Jabbers	Number of jabber frames received.
UnsupportOpcode	Number of MAC Control frames with unsupported opcode received.
UndersizePkts	Number of undersized packets received.
Transmit	Counters for traffic transmitted.
Octets	Number of octets transmitted.
Pkts	Number of packets transmitted.
UnicastPkts	Number of unicast packets transmitted.
MulticastPkts	Number of multicast packets transmitted.
BroadcastPkts	Number of broadcast packets transmitted.
FlowCtrlFrms	Number of good Flow Control frames transmitted.
OversizePkts	Number of oversize packets transmitted.
FlowCtrlFrms	The number of Flow Control frames transmitted.
Collisions	Total number of collisions seen by the MAC.
LateCollisions	Total number of late collisions seen by the MAC.
ExcessivCollsns	Number of frames dropped in the transmit MAC due to excessive collisions. This is applicable for Half-Duplex mode only.
Miscellaneous Counters	
Mac TxErr	Number of frames not transmitted correctly or dropped due to internal MAC transmit error.
Mac RxErr	Number of Receive Error events seen by the receive side of the MAC.
DropEvents	Number of instances that the port was unable to receive packets due to insufficient bandwidth to one of the PP internal resources, such as the DRAM or buffer allocation.

show platform portstorm

This command displays the result of a previously run port storm test on the switch.

Syntax `show platform portstorm [full]`

Parameter	Description
`full`	Optional parameter to display the full result output

Mode Privileged Exec

Example To show the result of a previously run port storm on the switch, use the following command:

```
awplus# show platform portstorm
```

Related Commands platform portstorm

show platform prbs

This command displays the result of a previously run PRBS (Pseudo-Random Bit Stream) test on the switch.

Syntax `show platform prbs [full]`

Parameter	Description
`full`	Optional parameter to display the full result output

Mode Privileged Exec

Example To show the result of a previously run PRBS on the switch, use the following command:

```
awplus# show platform prbs
```

Related Commands platform prbs

show port-security interface

Use this command to show the current port-security configuration and the switch port status.

Syntax `show port-security interface <port>`

Parameter	Description
`<port>`	The port to display information about. The port may be a switch port (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).

Mode Privileged Exec

Example To see the port-security status on `port1.0.1`, use the following command:

```
awplus# show port-security interface port1.0.1
```

Output Figure 15-14: Example output from the **show port-security interface** command

```
Port Security configuration
Security Enabled              : YES
Port Status                   : ENABLED
Violation Mode                : TRAP
Aging                         : OFF
Maximum MAC Addresses         : 3
Total MAC ddresses            : 1
Lock Status                   : UNLOCKED
Security Violation Count      : 0
Last Violation Source Address : None
```

show port-security intrusion

Shows the intrusion list. If the port is not give, entire intrusion table is shown.

Syntax `show port-security intrusion [interface <port>]`

Parameter	Description
`interface`	Specify a port
<port>	The port to display information about. The port may be a switch port (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).

Mode Privileged Exec

Example To see the intrusion list on `port1.0.1`, use the following command:

```
awplus# show port-security intrusion interface port1.0.1
```

Output Figure 15-15: Example output from the **show port-security intrusion** command for port 1.0.1

```
Port Security Intrusion List
Interface: port1.0.1 -3 intrusion(s) detected
11-22-33-44-55-04 11-22-33-44-55-06 11-22-33-44-55-08
```

show provisioning (xem-bay)

This command shows the provisioning status of all installed or provisioned hardware. Provisioning is the preconfiguration necessary to accommodate future connection of hardware items such as a XEM bay.

Syntax `show provisioning`

Mode User Exec and Privileged Exec

Example To show provisioning, use the following command:

```
awplus# show provisioning
```

Output Figure 15-16: Example output from the **show provisioning** command

```
awplus#show provisioning
Switch provisioning summary information

ID  Board class Status
1.0 x908        Hardware present
1.1 xem-12      Provisioned
1.4 xem-2       Hardware present
1.5 xem-1       Provisioned
```

Table 15-4: Output parameters from the **show provisioning** command

Parameter	Meaning
ID	The unit.bay-location of the hardware provision.
Board class	The hardware type.
Status	The provisioned state: ■ Hardware Present means that the hardware is currently installed in the stack or switch. ■ Provisioned means that although the hardware is not currently installed; the stack, or bay, is preconfigured ready to accept the hardware installation.

Related Commands show stack
switch bay provision

show storm-control

Use this command to display storm-control information for all interfaces or a particular interface.

Syntax `show storm-control [<port>]`

Parameter	Description
<port>	The port to display information about. The port may be a switch port (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).

Mode User Exec and Privileged Exec

Example To display storm-control information for `port1.0.2`, use the following command:

```
awplus# show storm-control port1.0.2
```

Output Figure 15-17: Example output from the **show storm-control** command for port1.0.2

```
Port       BcastLevel  McastLevel  DlfLevel
port1.0.2      40. 0%     100. 0%   100. 0%
```

Example To display storm-control information for all ports, use the following command:

```
awplus# show storm-control
```

Output Figure 15-18: Example output from the **show storm-control** command for all ports

```
awplus#show storm-control
Port       BcastLevel  McastLevel  DlfLevel
port1.0.1      100.0%      100.0%    100.0%
port1.0.2      100.0%      100.0%    100.0%
port1.0.3      100.0%      100.0%    100.0%
port1.0.4      100.0%      100.0%    100.0%
port1.0.5      100.0%      100.0%    100.0%
port1.0.6      100.0%      100.0%    100.0%
port1.0.7      100.0%      100.0%    100.0%
port1.0.8      100.0%      100.0%    100.0%
port1.0.9      100.0%      100.0%    100.0%
port1.0.10     100.0%      100.0%    100.0%
port1.0.11     100.0%      100.0%    100.0%
port1.0.12     100.0%      100.0%    100.0%
port1.0.13     100.0%      100.0%    100.0%
port1.0.14     100.0%      100.0%    100.0%
port1.0.15     100.0%      100.0%    100.0%
port1.0.16     100.0%      100.0%    100.0%
port1.0.17     100.0%      100.0%    100.0%
port1.0.18     100.0%      100.0%    100.0%
port1.0.19     100.0%      100.0%    100.0%
port1.0.20     100.0%      100.0%    100.0%
port1.0.21     100.0%      100.0%    100.0%
port1.0.22     100.0%      100.0%    100.0%
port1.0.23     100.0%      100.0%    100.0%
port1.0.24     100.0%      100.0%    100.0%
```

Related Commands storm-control level

speed

This command changes the speed of the specified port. You can optionally specify the speed or speeds that get autonegotiated, so autonegotiation is only attempted at the specified speeds.

To see the currently-negotiated speed for ports whose links are up, use the show interface command. To see the configured speed (when different from the default), use the show running-config command.

Syntax `speed {10|100|1000|10000|auto [10][100][1000][10000]}`

The following table shows the speed options for each type of port.

Port type	Speed Options (units are Mbps)
non-SFP RJ-45 copper ports	auto (default) 10 100 1000
supported tri-speed copper SFPs	auto (default) 10 100 1000
100Mb fibre SFPs	100
1000Mb fibre SFPs	auto (default) 1000
XFP modules	auto (default) 10000 Note that XFG is fixed speed and runs at 10G. For example, XFG cannot be stepped down to run at the same port speed as a 1G SFP.

Mode Interface Configuration

Default By default, ports autonegotiate speed (except for 100Base-FX ports which do not support auto-negotiation, so default to 100Mbps).

Usage Switch ports in a static or dynamic (LACP) channel group must have the same port speed and be in full duplex mode. Once switch ports have been aggregated into a channel group, you can set the speed of all the switch ports in the channel group by applying this command to the channel group.

Note Note that if multiple speeds are specified after the auto option to autonegotiate speeds, then only those speeds specified are attempted for autonegotiation.

Examples To set the speed of a tri-speed port to 100Mbps, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# speed 100
```

To return the port to auto-negotiating its speed, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# speed auto
```

To set a port to auto-negotiate its speed at 100Mbps and 1000Mbps, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# speed auto 100 1000
```

To set a port to auto-negotiate its speed at 1000Mbps only, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# speed auto 1000
```

Related Commands
duplex
polarity
show interface
speed (asyn)

storm-control level

Use this command to specify the threshold level for broadcasting, multicast, or destination lookup failure (DLF) traffic for the port. Storm-control limits the specified traffic type to the specified threshold.

Use the no variant of this command to disable storm-control for broadcast, multicast or DLF traffic.

Syntax

```
storm-control {broadcast|multicast|dlf} level <level>
no storm-control {broadcast|multicast|dlf} level
```

Parameter	Description
<level>	<0-100> Specifies the threshold as a percentage of the maximum port speed.
broadcast	Applies the storm-control to broadcast frames.
multicast	Applies the storm-control to multicast frames.
dlf	Applies the storm-control to destination lookup failure traffic.

Default By default, storm-control is disabled.

Mode Interface Configuration

Usage Flooding techniques are used to block the forwarding of unnecessary flooded traffic. A packet storm occurs when a large number of broadcast packets are received on a port. Forwarding these packets can cause the network to slow down or time out.

Example To limit broadcast traffic on `port1.0.2` to 30% of the maximum port speed, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# storm-control broadcast level 30
```

Related Commands show storm-control

switch bay provision

This command enables you to pre-configure a specific empty bay within a switch ready for inserting a particular XEM type. To run this command, the bay position must be vacant and the selected XEM type must be one that is currently supported.

Use the no variant of this command to remove an existing switch provision.

Syntax

```
switch <1-8> bay <1-8> {provision|reprovision}{xem-1|xem-2|xem-12}
no switch <1-8> bay <1-8> provision
```

Parameter	Description
`switch <1-8>`	The stack member switch position to be either provisioned or reprovisioned.
`bay <1-8>`	The switch bay to be either provisioned or reprovisioned.
`provision`	Provides settings within the switch configuration ready for a specific XEM to be inserted into a specific bay.
`reprovision`	Reconfigure an existing provision switch bay configuration.

Mode Global Configuration

Examples To provision a 12 port XEM in bay 1 of stack member 2, use the following commands:

```
awplus# configure terminal
awplus(config)# switch 2 bay 1 provision xem-12
```

To change the provisioning of the XEM bay to accommodate a 2 port XEM, use the following commands:

```
awplus# configure terminal
awplus(config)# switch 2 bay 1 reprovision xem-2
```

To remove the above provisioning, use the following commands:

```
awplus# configure terminal
awplus(config)# no switch 2 bay 1 provision
```

Related Commands show provisioning (xem-bay)

switchport port-security

Enables the port-security feature. This feature is also known as port-based learn limit. It allows the user to set the maximum number of MAC addresses that each port can learn.

Use the no variant of this command to disable the port-security feature.

Syntax

```
switchport port-security
no switchport port-security
```

Mode Interface Configuration

Examples To enable the port-security feature on `port1.0.4`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# switchport port-security
```

To disable port-security feature on `port1.0.4`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# no switchport port-security
```

switchport port-security aging

Sets the port-security MAC to time out.

Use the no variant of this command to set the port-security to not time out.

Syntax

```
switchport port-security aging
no switchport port-security aging
```

Mode Interface Configuration

Examples To set the MAC to time out, use the following command:

```
awplus# switchport port-security aging
```

To unset the MAC time out, use the following command:

```
awplus# no switchport port-security aging
```

switchport port-security maximum

Sets the maximum MAC address that each port can learn.

Use the no variant of this command to unset the maximum number of MAC addresses that each port can learn. This is same as setting the maximum number to 0. This command also resets the intrusion list table.

Syntax

```
switchport port-security maximum <0-256>
no switchport port-security maximum
```

Parameter	Description
`maximum`	Maximum number of address to learn
<0-256>	Maximum number of address to learn

Mode Interface Configuration

Examples To learn 3 MAC addresses on `port1.0.4`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# switchport port-security maximum 3
```

To remove the MAC learning limit on `port1.0.4`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# no switchport port-security maximum
```

switchport port-security violation

Sets the violation action for a switch port when the port exceeds the learning limits. The port action can be either shutdown, restrict or protect. If shutdown is set, the physical link will be disabled and “shutdown” will be shown in the config. If restrict is set, the packet from the un-authorized MAC will be discarded and SNMP TRAP will be generated to alert management. If protect is set, the packet will simply be discarded by the packet processor silently.

The no variant of this command sets the violation action to default. The default violation action is protect.

Syntax

```
switchport port-security violation {shutdown|restrict|protect}
no switchport port-security violation
```

Parameter	Description
shutdown	Disable the port
restrict	Alert the network administrator
protect	Discard the packet

Mode Interface Configuration

Examples To set the action to be shutdown on port1.0.4, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# switchport port-security violation shutdown
```

To set the port-security action to the default (protect) on port1.0.4, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# no switchport port-security violation
```

thrash-limiting

Sets and configures the thrash limit action that will be applied to any port on the switch when a thrashing condition is detected. The thrash-limiting timeout specifies the time, in seconds, for which the thrash action is employed.

Syntax

```
thrash-limiting {[action {learn-disable|link-down|port-disable|
   vlan-disable|none}] [timeout <0-86400>]}

no thrash-limiting {action|timeout}
```

Parameter	Description
`action`	The mac thrashing detected action. The default is vlan-disable.
`learn-disable`	Disable mac address learning
`link-down`	Block all traffic on an interface - link down
`port-disable`	Block all traffic on an interface - link remains up
`vlan-disable`	Block all traffic on a vlan Note that setting this parameter will also enable ingress filtering.
`none`	No thrash action
`timeout`	Set the duration for the thrash action
<0-86400>	The duration of the applied thrash action in seconds. The default is 1 seconds.

Default The default action is vlan-disable.

Mode Interface Configuration

Examples To set the action to learn disable for `port1.0.4`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# thrash-limiting action learn-disable
```

To set the thrash limiting timeout to 5 seconds, use the following command:

```
awplus(config-if)# thrash-limiting timeout 5
```

To set the thrash limiting action to its default, use the following command:

```
awplus(config-if)# no thrash-limiting action
```

To set the thrash limiting timeout to its default, use the following command:

```
awplus(config-if)# no thrash-limiting timeout
```

undebug platform packet

This command applies the functionality of the no debug platform packet command on page 15.9.

undebug loopprot

This command applies the functionality of the no debug loopprot command on page 15.8.

Chapter 16: VLAN Introduction

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Introduction

This chapter describes Virtual LANs (VLAN), VLAN features and configuration on the switch. For detailed descriptions of commands used to configure VLANs, see Chapter 17, VLAN Commands. For information about Voice VLAN and LLDP-MED, see Chapter 90, LLDP Introduction and Configuration.

Virtual LANs (VLANs)

A Virtual LAN (VLAN) is a logical, software-defined subnetwork. It allows similar devices on the network to be grouped together into one broadcast domain, irrespective of their physical position in the network. Multiple VLANs can be used to group workstations, servers, and other network equipment connected to the switch, according to similar data and security requirements.

Decoupling logical broadcast domains from the physical wiring topology offers several advantages, including the ability to:

- Move devices and people with minimal, or no, reconfiguration
- Change a device's broadcast domain and access to resources without physically moving the device, by software reconfiguration or by moving its cable from one switch port to another
- Isolate parts of the network from other parts, by placing them in different VLANs
- Share servers and other network resources without losing data isolation or security
- Direct broadcast traffic to only those devices which need to receive it, to reduce traffic across the network
- Connect 802.1Q-compatible switches together through one port on each switch

Devices that are members of the same VLAN only exchange data with each other through the switch's Layer 2 switching capabilities. To exchange data between devices that are located in different VLANs, the switch's Layer 3 (routing) capabilities are used.

Different IP subnets are associated with different VLANs. The switch's IP router table will be populated by the routes to the subnets on any active VLANs, and by routes statically configured over active VLAN interfaces, or learnt via routing protocols operating over these interfaces.

The device supports up to 4094 VLANs (the maximum allowed by the VID field in the 802.1Q tag). On some devices a few of these VLANs may be reserved for management purposes.

When the switch is first powered up (and therefore unconfigured), it creates a default VLAN with a VID of 1 and an interface name of *vlan1*. In this initial condition, the switch attaches all its ports to this default VLAN.

The default VLAN cannot be deleted, and ports can only be removed from it if they also belong to at least one other VLAN. If all the devices on the physical LAN belong to the same logical LAN, that is, the same broadcast domain, then the default settings will be acceptable, and no additional VLAN configuration is required.

Configuring VLANs

Defaults

By default, all switch ports are in access mode, are associated with the default VLAN (vlan1), and have ingress filtering on. You cannot delete vlan1.

VLAN names

When you create a VLAN (using the vlan command), you give it a numerical VLAN Identifier (VID) - a number from 2 to 4094. If tagged frames are transmitted from this VLAN, they will contain this VID in their tag. You may also give it an arbitrary alphanumeric name containing a meaningful description, which is not transmitted to other devices.

When referring to a VLAN, some commands require the VLAN to be specified by its VID while some commands require it to be specified by its interface name: vlan<VID>. In command output, the VLAN may be referred to by its VID, its interface name (vlan<VID>), or its VLAN name (the arbitrary alphanumeric string).

You can name a VLAN with a string containing “vlan” and its VLAN Identifier (VID). To avoid confusion, we recommend not naming it “vlan” followed by any number different from its VID.

Access mode

A switch port in access mode sends untagged Ethernet frames, that is, frames without a VLAN tag. Each port is associated with one VLAN (the port-based VLAN, by default, *vlan1*), and when it receives untagged frames, it associates them with the VID of this VLAN. You can associate the port with another VLAN (using the switchport access vlan command). This removes it from the default VLAN.

Use access mode for any ports connected to devices that do not use VLAN tagging, for instance PC workstations.

Trunk mode

A switch port in trunk mode is associated with one or more VLANs for which it transmits VLAN-tagged frames, and for which it identifies incoming tagged frames with these VIDs.

To allow a switch port to distinguish and identify traffic from different VLANs, put it in trunk mode (using the switchport mode trunk command), and add the VLANs (using the switchport trunk allowed vlan command). Use trunk mode for ports connected to other switches which send VLAN-tagged traffic from one or more VLANs.

A trunk mode port may also have a native VLAN (by default vlan1), for which it transmits untagged frames, and with which it associates incoming untagged frames (using the switchport trunk native vlan command).

Ports in trunk mode can be enabled as promiscuous ports for private VLANs (using the switchport mode private-vlan trunk promiscuous) and secondary ports for private VLANs (using the switchport mode private-vlan trunk secondary).

Mirror ports

A mirror port cannot be associated with a VLAN. If a switch port is configured to be a mirror port (using the mirror interface command), it is automatically removed from any VLAN it was associated with.

VLANs and channel groups

All the ports in a channel group must have the same VLAN configuration: they must belong to the same VLANs and have the same tagging status, and can only be operated on as a group.

Table 16-1: Configuration procedure for VLANs

Create VLANs	
`awplus#`	
`configure terminal`	Enter Configuration mode.
`awplus(config)#`	
`vlan database`	Enter VLAN Configuration mode.
`awplus(config-vlan)#`	
`vlan <vid> [name <vlan-name>] [state {enable|disable}]`	Create VLANs.
or	
`vlan <vid-range> [state {enable|disable}]`	
Associate switch ports with VLANs	
`awplus(config-vlan)#`	
`interface <port-list>`	Associate switch ports in access mode with VLANs:
`awplus(config-if)#`	Enter Interface Configuration mode for the switch ports that will be in access mode for a particular VLAN.
`switchport access vlan <vlan-id>`	Associate the VLAN with these ports in access mode. Repeat for other VLANs and ports in access mode.
`awplus(config-if)#`	
`interface <port-list>`	Associate switch ports in trunk mode with VLANs. Enter Interface Configuration mode for all the switch ports that will be in trunk mode for a particular set of VLANs.
`awplus(config-if)#`	Set these switch ports to trunk mode.
`switchport mode trunk [ingress-filter {enable|disable}]`	
`awplus(config-if)#`	Allow these switch ports to trunk this set of VLANs.
`switchport trunk allowed vlan all`	
or	
`switchport trunk allowed vlan add <vid-list>`	
`awplus(config-if)#`	
`switchport trunk native vlan {<vid>|none}`	By default, a trunk mode switch port's native VLAN, the VLAN that the port uses for untagged packet, is VLAN 1. If required, change the native VLAN from the default.
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`exit`	Return to Privileged Exec mode.
`awplus#`	
`show vlan {all|brief|dynamic|static|<1-4094>}`	Confirm VLAN configuration.

VLAN Double Tagging (VLAN Stacking)

VLAN double tagging, also known as VLAN Stacking, Nested VLANs, or Q-in-Q VLANs, is used to operate a number of private Layer 2 networks within a single public Layer 2 network. This feature provides simple access infrastructure for network service providers to operate Metropolitan Area Networks (MANs) as commercial value added networks. Customers can connect to a service provider's network at multiple locations and use their own VLAN IDs, without requiring the service provider's equipment between to know about those VLANs.

A nested VLAN implementation consists of the following port types:

- Provider ports - these connect to a service provider's Layer 2 network
- Customer edge ports - these connect to a customer's private Layer 2 network

How double-tagged VLANs work

In a nested VLAN environment VLAN tagging exists at two levels:

- client tagging (C-tag)
- service provider tagging (S-tag)

When nested VLAN functionality is enabled, the service provider assigns to each of its clients an individual 12 bit customer VID called an S-Tag. The S-Tag field has an identical structure to a conventional VLAN tag field.

The S-Tag is attached to a packet as it enters the service provider network at the customer edge port. From this point on, the S-Tag is used for transmission within the service provider, or public Layer 2, network. The S-Tag is then removed as it leaves the destination customer edge port. This process is shown in Figure 16-1 on page 16.7.

The VID that is used within the client's own network, the C-Tag, is ignored by the service provider network and bridging is based on the value of the S-Tag. The ethertype of the S-Tag is set by changing the Tag Protocol Identifier (TPID). Once the S-Tag is removed from the packet, it is forwarded "as is" out of the customer-edge port. The tagged status of the Customer port is ignored on egress.

VLAN Rules for double tagging

When double-tagged VLANs are created on the switch:

- a nested VLAN belongs to only one customer and can have multiple customer-edge ports
- a port must be either a customer-edge port or a provider port, but cannot be both

A service provider port:

- accepts only tagged packets
- transmits only tagged packets
- can be in many double-tagged VLANs

A customer edge port:

- accepts both tagged and untagged packets
- transmits both tagged and untagged packets
- can be a member of only one nested VLAN

Restrictions when using double-tagged VLANs

Restrictions when double-tagged VLANs are implemented are:

- Ethernet bridging is based on the S-Tag VID instead of the packet C-Tag VID. The packets C-Tag VID does not change
- ARP packet trapping is restricted
- hardware filtering does not work above MAC address level

Configuring double-tagged VLANs

You need a special feature license to use double-tagged VLANs. Contact your authorized Allied Telesis distributor or reseller for more information.

Set the Tag Protocol Identifier (TPID)

If required, you can change the Tag Protocol Identifier (TPID) from its default (for VLAN stacking) of 0x8100 (specified as hex notation), with the platform vlan-stacking-tpid command on page 15.38. Note that this command specifies the TPID value that applies to all VLANs used for double-tagged VLANs. You cannot set individual TPID values for different VLANs within a multi double-tagged VLAN network

Turn on Jumbo frame support

Adding the S-Tag can result in frame sizes that exceed the maximum of 1522 bytes. In order to cope with these larger than normal frames, you should turn on Jumbo packet support on all devices running within the service provider network. For more information, see the platform jumboframe command on page 15.27.

Double-tagged VLAN configuration example

Figure 16-1: VLAN double tagging

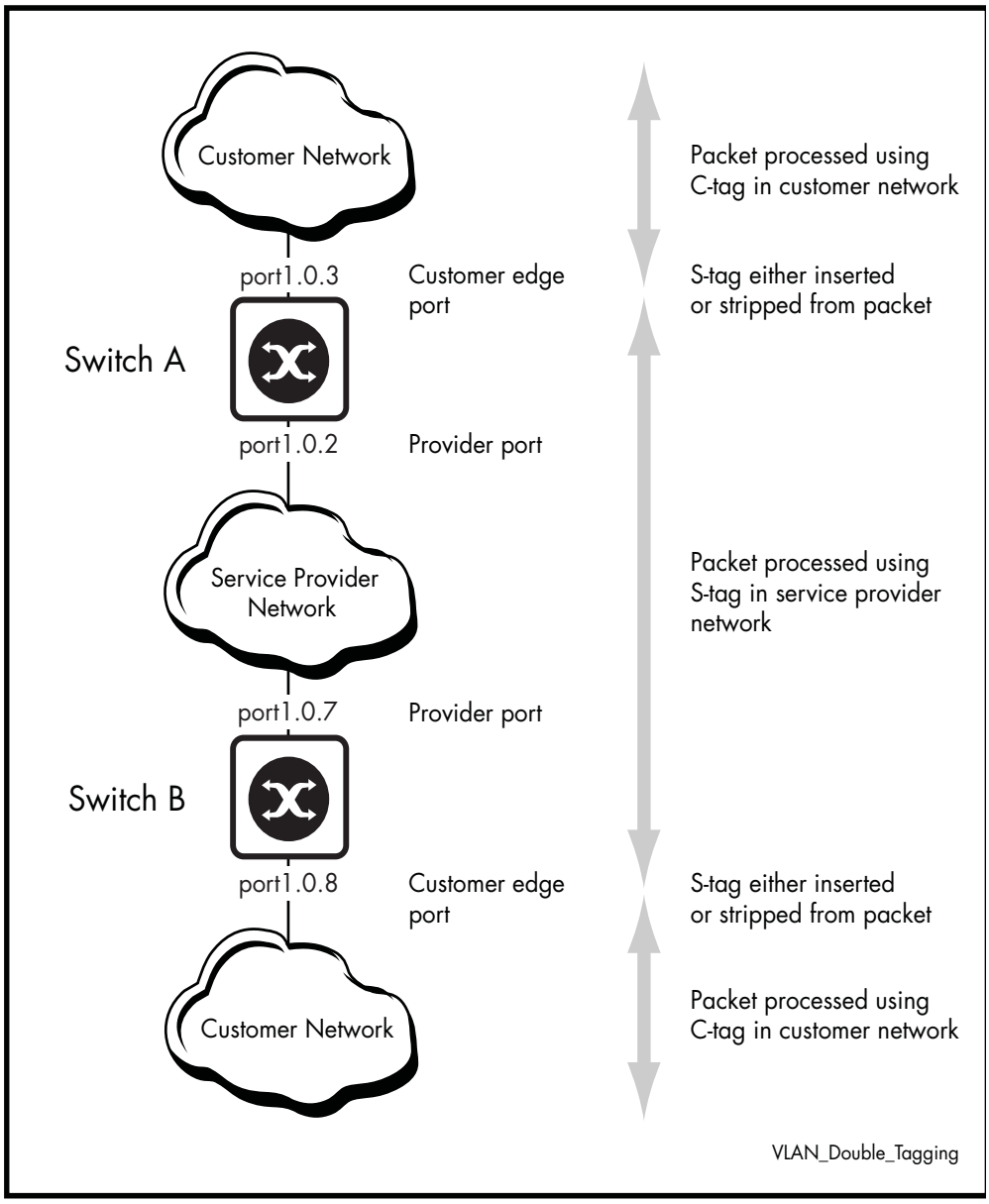


Table 16-2: Switch A Configuration

Turn on Jumbo frame support	
`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`platform jumboframe`	Configure the switch to forward Jumbo frames.
`awplus(config)#`	
`exit`	Return to Global Configuration mode.

Table 16-2: Switch A Configuration(cont.)

awplus#	
reboot	Reboot the switch to enable Jumbo frame support
awplus#	
exit	Return to Global Configuration mode.
Create and enable the service provider VLAN 2 (the VLAN that will be used in the outer-tag)	
awplus#	
configure terminal	Enter Global Configuration mode.
awplus(config)#	
vlan database	Enter VLAN database mode.
awplus(config-vlan)#	
vlan 2 state enable	Create and enable VLAN 2.
awplus(config-vlan)#	
exit	Return to Global Configuration mode.
Configure port 1.0.2 as a provider-port member of VLAN 2	
awplus#	
configure terminal	Enter Global Configuration mode.
awplus(config)#	
interface port1.0.2	Select port1.0.2 for configuring.
awplus(config-if)#	
switchport mode trunk	Set the port to trunk mode.
awplus(config-if)#	
switchport trunk allowed vlan add 2	Add the VLAN to be trunked over the port.
awplus(config-if)#	
switchport vlan-stacking provider-port	Enable VLAN stacking and set the port to be a provider port.
awplus(config-if)#	
exit	Return to Global Configuration mode.
Configure port 1.0.3 as a customer edge port member of VLAN 10	
awplus#	
configure terminal	Enter Global Configuration mode.
awplus(config)#	
interface port1.0.3	Select port1.0.3 for configuring.
awplus(config-if)#	
switchport mode access	Set the port to access mode.

Table 16-2: Switch A Configuration(cont.)

`awplus(config-if)#`	
`switchport access vlan 2`	Associate the port with VLAN 2.
`awplus(config-if)#`	
`switchport vlan-stacking customer-edge-port`	Enable VLAN stacking and set the port to be a customer edge port.
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.

Table 16-3: Switch B Configuration

Turn on Jumbo frame support	
`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`platform jumboframe`	Configure the switch to forward Jumbo frames.
`awplus(config)#`	
`exit`	Return to Global Configuration mode.
`awplus#`	
`reboot`	Reboot the switch to enable Jumbo frame support
`awplus#`	
`exit`	Return to Global Configuration mode.
Create and enable the service provider VLAN 2 (the VLAN that will be used in the outer-tag)	
`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`vlan database`	Enter VLAN database mode.
`awplus(config-vlan)#`	
`vlan 2 state enable`	Create and enable VLAN 2.
`awplus(config-vlan)#`	
`exit`	Return to Global Configuration mode.
Configure port 1.0.7 as a provider-port member of VLAN 2	
`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`interface port1.0.7`	Select `port1.0.7` for configuring.
`awplus(config-if)#`	
`switchport mode trunk`	Set the port to trunk mode.

Table 16-3: Switch B Configuration(cont.)

`awplus(config-if)#`	
`switchport trunk allowed vlan add 2`	Add the VLAN to be trunked over the port.
`awplus(config-if)#`	
`switchport vlan-stacking provider-port`	Enable VLAN stacking and set the port to be provider port.
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
Configure port 1.0.8 as a customer edge port member of VLAN 10	
`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`interface port1.0.8`	Select `port1.0.8` for configuring.
`awplus(config-if)#`	
`switchport mode access`	Set the port to access mode.
`awplus(config-if)#`	
`switchport access vlan 2`	Associate the port with VLAN 2.
`awplus(config-if)#`	
`switchport vlan-stacking customer-edge-port`	Enable VLAN stacking and set the port to be a customer edge port.
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.

Private VLANs

Private VLANs combine the network advantages of conventional VLANs, with an added degree of privacy obtained by limiting the connectivity between selected ports.

This section provides an introduction to:

- Private VLANs for ports in access mode
- Private VLANs for trunked ports

Private VLANs for ports in access mode

An example application of a private VLAN would be a library in which user booths each have a PC with Internet access. In this situation it would usually be undesirable to allow communication between these individual PCs. Connecting the PC to ports within a private isolated VLAN would enable each PC to access the Internet or a library server via a single connection, whilst preventing access between the PCs in the booths.

Another application might be to use private VLANs to simplify IP address assignment. Ports can be isolated from each other whilst still belonging to the same subnet.

A private VLAN comprises the following components:

- a single promiscuous port
- one or more host ports
  There are two types of host ports:
  - **isolated ports**
    These can only communicate with the promiscuous port that is associated with the isolated VLAN.
  - **community ports**
    These can communicate with their associated promiscuous port and other community ports within the community VLAN.
- a single primary VLAN
- one or more secondary VLANS
  There are two types of secondary VLANs:
  - **isolated VLANs**
    In this VLAN type, communication can only take place between each host port and its associated promiscuous port.
  - **community VLANs**
    In this VLAN type, communication can take place between host ports and between each host port and its associated promiscuous port.

Membership rules for private VLANs in access mode

The following membership rules apply when creating and operating private VLANs in access mode.

Each private VLAN:

- must contain one promiscuous port (or aggregated link)
- may contain multiple host ports
- can be configured to span switch instances
- can only contain promiscuous and host ports
- cannot use the default VLAN (vlan1)
- a private *isolated* VLAN can only contain a single promiscuous port
- a private *community* VLAN can contain more than one promiscuous port

A promiscuous port:

- is a member of the primary VLAN and all its associated secondary VLANs
- cannot be a member of both private and non-private VLANs

A host port:

- can be a member of multiple private (community) VLANs, but all these VLANs must share the same promiscuous port
- cannot be a host port in some VLANs and a non-host port in others
- cannot be a promiscuous port in another VLAN

Promiscuous ports

A promiscuous port can communicate with all ports that are members of its associated secondary VLANs. Multiple promiscuous ports can exist in a primary VLAN, but only if the primary VLAN is only associated with community VLANS (that is, that there are no isolated VLANs associated with this port).

A promiscuous port is a member of the primary VLAN and all associated secondary VLANs. Its Port VID is set to the VLAN ID of the primary VLAN.

Host ports

Host ports have two levels of connectivity depending on whether they exist in an isolated or a community VLAN.

1. Host ports within an isolated VLAN

These ports are only allowed to communicate with their VLAN's promiscuous port, even though they share their secondary (isolated) VLAN with other hosts. The host ports receive their data from the promiscuous port via the primary VLAN, and individually transmit their data to the promiscuous port via their common secondary VLAN.

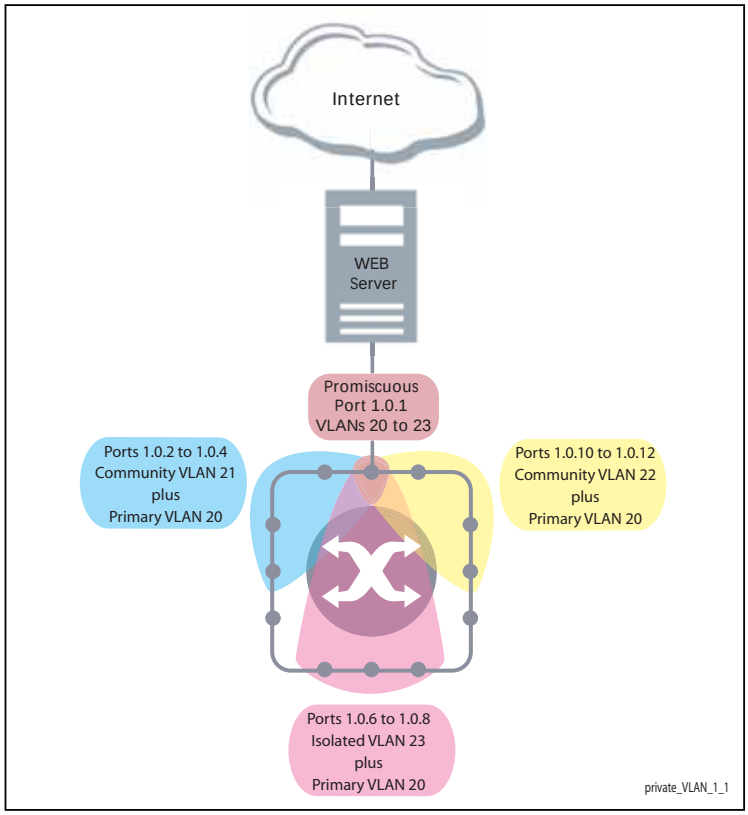
2. Host ports within a community VLAN

These ports are able to communicate with both the promiscuous port and the other ports within the community VLAN that they are associated with. They receive their data from the promiscuous port via the primary VLAN, and transmit their data to both the promiscuous port and the other host ports (within their community VLAN) via their common secondary VLAN. However, the only external path from a community VLAN is from its promiscuous port.

Private VLAN operation with ports in access mode

A basic private VLAN operation is shown in Figure 16-2. It comprises primary VLAN 20 plus three secondary VLANS, two community VLANs 21 and 22, and an isolated VLAN 23.

Figure 16-2: Private VLAN



The ports on this switch have the following configuration:

- Port 1.0.1 is the promiscuous port and is a member of the primary VLAN 20 and all its associated secondary VLANs.
- Ports 1.0.2 to 1.0.4 are members of the community VLAN 21 and are able to communicate with both the promiscuous port and all other ports in VLAN 21.
- Ports 1.0.10 to 1.0.12 are members of the community VLAN 22 and are able to communicate with both the promiscuous port and all other ports in VLAN 22.
- Ports 1.0.6 to 1.0.8 are members of the isolated VLAN 23. Each of these ports can only communicate with the promiscuous port.

Table 16-4: Private VLANs - Port Tagging

Port	Mode	Untagged VLAN Membership	PVID
1.0.1	Promiscuous	20, 21, 22, 23	20
1.0.2 to 1.0.4	Host	20, 21	21
1.0.10 to 1.0.12	Host	20, 22	22
1.0.6 to 1.0.8	Host	20, 23	23
1.0.5	Not members of the private VLAN		-
1.0.9	Not members of the private VLAN		-

Private VLANs operate within a single switch and comprise one primary VLAN plus a number of secondary VLANS. All data enters the private VLAN ports untagged. Using the example of Figure 16-2, data enters the switch via the promiscuous `port1.0.1` and is forwarded to the host ports using VLAN 20, the primary VLAN. Data returning from the host ports to the promiscuous port (and exiting the switch) use the secondary VLAN associated with its particular host port, VLAN 21, 22, or 23 in the example. Thus the data flows into the switch via the primary VLAN and out of the switch via the secondary VLANs. This situation is not detected outside of the switch, because all its private ports are untagged. Note however, that data flowing between ports within the same community VLAN will do so using the VID of the community VLAN.

Portfast on private VLANS

Within private VLANs, we recommend that you place all host ports into spanning-tree portfast mode and enable BPDU guard. Portfast assumes that because host ports will also be edge ports, they will have no alternative paths (loops) via other bridges. These ports are therefore allowed to move directly from the spanning-tree blocking state into the forwarding state, thus bypassing the intermediate states.

Applying BPDU guard is an extra precaution. This feature disables an edge port if it receives a BPDU frame, because receiving such a frame would indicate that the port has a connection to another network bridge.

For more information on BPDU guard and portfast, see their following commands:

- spanning-tree portfast bpdu-filter command on page 19.59
- spanning-tree portfast (STP) command on page 19.57

Access mode private VLAN configuration example

Table 16-5: Configuration procedure for access mode private VLANs

Command	Description
Create the VLANs	
`awplus#` `configure terminal`	Enter Global Configuration mode.
`awplus(config)#` `vlan database`	Enter VLAN Configuration mode.
`awplus(config-vlan)#` `vlan 20-23`	Create the VLANs.
Create the private VLANs and set the type	
`awplus(config-vlan)#` `private-vlan 20 primary`	Create primary VLAN 20.
`awplus(config-vlan)#` `private-vlan 21 community`	Create community VLAN 21.
`awplus(config-vlan)#` `private-vlan 22 community`	Create community VLAN 22.
`awplus(config-vlan)#` `private-vlan 23 isolated`	Create isolated VLAN 23.

Table 16-5: Configuration procedure for access mode private VLANs(cont.)

Associate the secondary VLANs with the primary VLAN	
`awplus(config-vlan)#`	
`private-vlan 20 association add 21`	Associate secondary VLAN 21 with the primary VLAN 20.
`awplus(config-vlan)#`	
`private-vlan 20 association add 22`	Associate secondary VLAN 22 with the primary VLAN 20.
`awplus(config-vlan)#`	
`private-vlan 20 association add 23`	Associate secondary VLAN 23 with the primary VLAN 20.
Set port 1.0.1 to be the promiscuous port	
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`interface port1.0.1`	Enter Interface Configuration mode for `port1.0.1`.
`awplus(config-if)#`	
`switchport mode private-vlan promiscuous`	Set the port as a promiscuous ports.
Set the other ports to be host ports	
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`interface port1.0.2-1.0.4, port1.0.6-1.0.8, port1.0.10-1.0.12`	Enter Interface Configuration mode for the ports.
`awplus(config-if)#`	
`switchport mode private-vlan host`	Set the ports as host ports.
On the promiscuous port, map the primary VLAN to each of the secondary VLANs	
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`interface port1.0.1`	Enter Interface Configuration mode for `port1.0.1`.
`awplus(config-if)#`	
`switchport private-vlan mapping 20 add 21-23`	Associate primary VLAN 20 and the secondary VLANs 21 to 23 to the promiscuous port.

Table 16-5: Configuration procedure for access mode private VLANs(cont.)

Associate the community host ports with the community VLANs	
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`interface port1.0.2-1.0.4`	Enter Interface Configuration mode for ports 1.0.2 to 1.0.4.
`awplus(config-if)#`	
`switchport private-vlan host-association 20 add 21`	Associate primary VLAN 20 and secondary VLAN 21 to the host ports.
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`interface port1.0.10-1.0.12`	Enter Interface Configuration mode for ports 1.0.10 to 1.0.12.
`awplus(config-if)#`	
`switchport private-vlan host-association 20 add 22`	Associate primary VLAN 20 and secondary VLAN 22 to the host ports.
Associate the isolated host ports with the isolated VLAN 23	
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`interface port1.0.6-1.0.8`	Enter Interface Configuration mode for ports 1.0.6 to 1.0.8.
`awplus(config-if)#`	
`switchport private-vlan host-association 20 add 23`	Associate primary VLAN 20 and secondary VLAN 23 to the host ports.

Private VLANs for trunked ports

Private VLAN trunk ports allow you to combine traffic for private isolated VLANs over a trunk. A port in trunk mode enabled as a promiscuous port with the switchport mode private-vlan trunk promiscuous command can carry both multiple isolated private VLANs and non-private VLANs. A promiscuous port in trunk mode allows you to combine multiple isolated VLANs on a single trunk port. A port in trunk mode enabled as a secondary port with the switchport mode private-vlan trunk secondary command can combine traffic for multiple isolated VLANs over a trunk.

Note Private VLAN trunk ports are not supported by the current AlliedWare Plus GVRP implementation. Private VLAN trunk ports and GVRP are mutually exclusive.

A private VLAN group for trunked ports comprises the following components:

- a single promiscuous port
- one or more isolated secondary ports
  These can only communicate with the associated promiscuous port.
- isolated VLANs
  In this VLAN type, communication can only take place between each secondary port and its associated promiscuous port. Membership rules for private VLANs for trunked ports

The following membership rules apply when creating and operating private VLANs for trunked ports.

A promiscuous trunk port:

- must be in trunk mode
- can be a member of both isolated VLANs and non-isolated VLANs
- has a group ID that is solely used to associate the promiscuous port with secondary ports

A secondary trunk port:

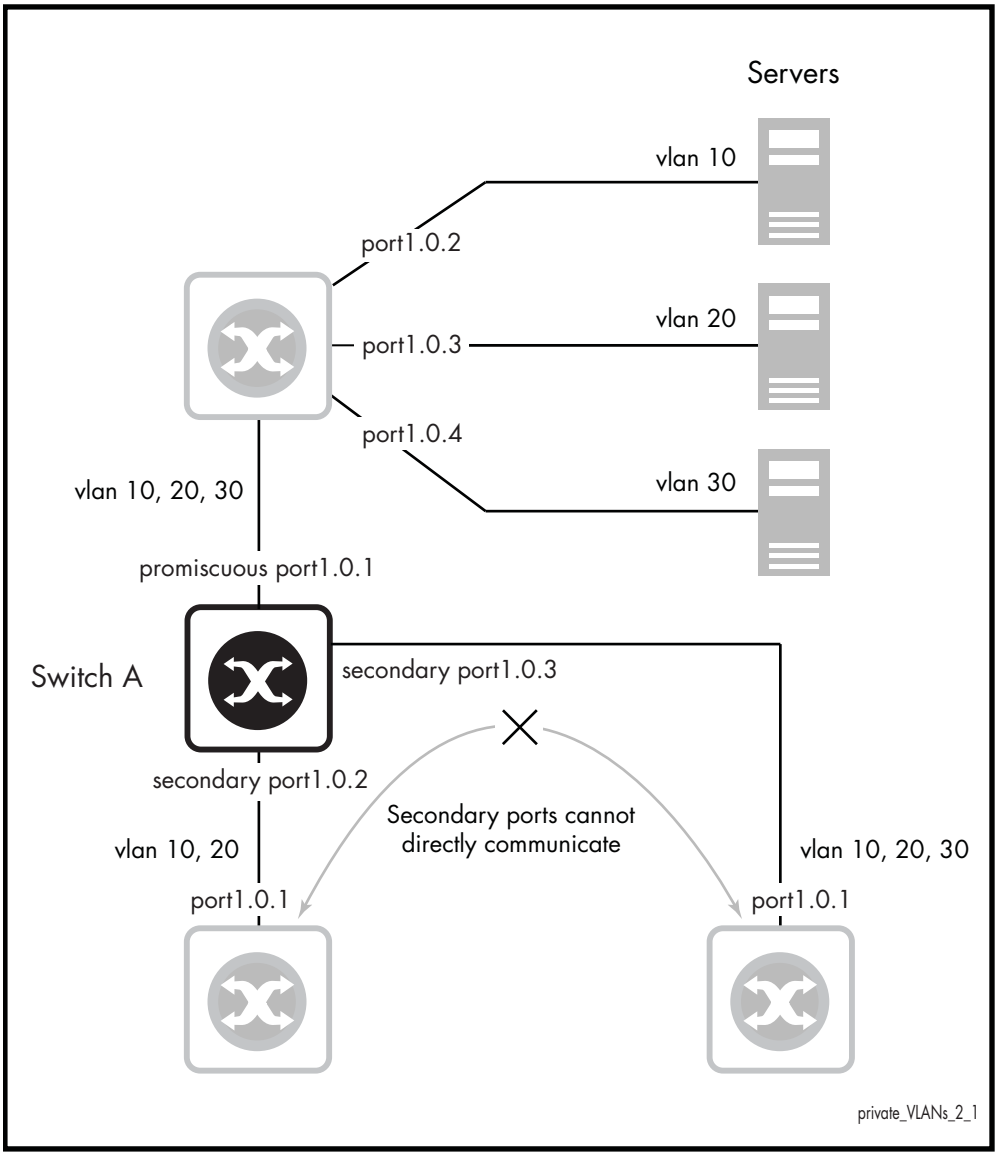
- must be in trunk mode
- can only be a member of isolated VLANs
- cannot be a promiscuous port in another VLAN
- has a group ID that is solely used to associate the secondary port with its promiscuous port

Unlike private VLANs for ports in access mode, private VLANs for trunked ports have no secondary to primary VLAN mappings.

Trunked port private VLAN configuration example

A basic trunked port private VLAN operation is shown in Figure 16-3.

Figure 16-3: Trunked port private VLAN



The ports on Switch A have the following configuration:

- Port 1.0.1 is the promiscuous port, and has a group ID of 1
- Port 1.0.2 is a secondary port for isolated private VLANs 10 and 20, and has a group ID of 1
- Port 1.0.3 is a secondary port for isolated private VLANs 10, 20 and 30, and has a group ID of 1

The configuration procedure in Table 16-6 show the steps to configure Switch A.

Table 16-6: Configuration procedure for Switch A

Command	Description
Create the VLANs	
`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`vlan database`	Enter VLAN Configuration mode.
`awplus(config-vlan)#`	
`vlan 10,20,30`	Create the VLANs.
Create the private VLANs and set the type	
`awplus(config-vlan)#`	
`private-vlan 10 isolated`	Create isolated VLAN 10.
`awplus(config-vlan)#`	
`private-vlan 20 isolated`	Create isolated VLAN 20.
`awplus(config-vlan)#`	
`private-vlan 30 isolated`	Create isolated VLAN 30.
Set port 1.0.1 to trunk mode and add the VLANs to be trunked over the port	
`awplus(config-vlan)#`	
`interface port1.0.1`	Enter Interface Configuration mode for `port1.0.1`.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of the port to trunk.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 10,20,30`	Add the VLANs to be trunked over this port.
Set port 1.0.2 to trunk mode and add the VLANs to be trunked over the port	
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`interface port1.0.2`	Enter Interface Configuration mode for `port1.0.2`.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of the port to trunk.

Table 16-6: Configuration procedure for Switch A(cont.)

awplus(config-if)#	
switchport trunk allowed vlan add 10,20	Add the VLANs to be trunked over this port.
Set port 1.0.3 to trunk mode and add the VLANs to be trunked over the port	
awplus(config-if)#	
exit	Return to Global Configuration mode.
awplus(config)#	
interface port1.0.3	Enter Interface Configuration mode for port 1.0.3.
awplus(config-if)#	
switchport mode trunk	Set the switching characteristics of the port to trunk.
awplus(config-if)#	
switchport trunk allowed vlan add 10,20,30	Add the VLANs to be trunked over this port.
Set port 1.0.1 to be the promiscuous port	
awplus(config-if)#	
exit	Return to Global Configuration mode.
awplus(config)#	
interface port1.0.1	Enter Interface Configuration mode for port 1.0.1.
awplus(config-if)#	
switchport mode private-vlan trunk promiscuous group 1	Enable the port in trunk mode to be promiscuous port for isolated VLANs 10, 20 and 30 with a group ID of 1.
Set port 1.0.2 to be a secondary port	
awplus(config-if)#	
exit	Return to Global Configuration mode.
awplus(config)#	
interface port1.0.2	Enter Interface Configuration mode for port1.0.2.
awplus(config-if)#	
switchport mode private-vlan trunk secondary group 1	Enable the port in trunk mode to be a secondary port for isolated VLANs 10 and 20 with a group ID of 1.
Set port 1.0.3 to be a secondary port	
awplus(config-if)#	
exit	Return to Global Configuration mode.
awplus(config)#	
interface port1.0.3	Enter Interface Configuration mode for port1.0.3.
awplus(config-if)#	
switchport mode private-vlan trunk secondary group 1	Enable the port in trunk mode to be a secondary port for isolated VLANs 10, 20 and 30 with a group ID of 1.

Chapter 17: VLAN Commands

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Command List

This chapter provides an alphabetical reference of commands used to configure VLANs. For more information see Chapter 16, VLAN Introduction.

private-vlan

Use this command to a create a private VLAN. Private VLANs can be either primary or secondary. Secondary VLANs can be ether community or isolated.

Use the no variant of this command to remove the specified private VLAN.

For more information, see the section "Private VLANs" on page 16.11.

Syntax

```
private-vlan <vlan-id> {community|isolated|primary}
no private-vlan <vlan-id> {community|isolated|primary}
```

Parameter	Description
<vlan-id>	VLAN ID in the range <2-4094> for the VLAN which is to be made a private VLAN.
`community`	Community VLAN.
`isolated`	Isolated VLAN.
`primary`	Primary VLAN.

Mode VLAN Configuration

Examples

```
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 2 name vlan2 state enable
awplus(config-vlan)# vlan 3 name vlan3 state enable
awplus(config-vlan)# vlan 4 name vlan4 state enable
awplus(config-vlan)# private-vlan 2 primary
awplus(config-vlan)# private-vlan 3 isolated
awplus(config-vlan)# private-vlan 4 community

awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# no private-vlan 2 primary
awplus(config-vlan)# no private-vlan 3 isolated
awplus(config-vlan)# no private-vlan 4 community
```

private-vlan association

Use this command to associate a secondary VLAN to a primary VLAN. Only one isolated VLAN can be associated to a primary VLAN. Multiple community VLANs can be associated to a primary VLAN.

Use the no variant of this command to remove association of all the secondary VLANs to a primary VLAN.

For more information, see the section "Private VLANs" on page 16.11.

Syntax

```
private-vlan <primary-vlan-id> association
    {add <secondary-vlan-id> | remove <secondary-vlan-id>}

no private-vlan <primary-vlan-id> association
```

Parameter	Description
<primary-vlan-id>	VLAN ID of the primary VLAN.
<secondary-vlan-id>	VLAN ID of the secondary VLAN (either isolated or community).

Mode VLAN Configuration

Examples

```
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# private-vlan 2 association add 3
awplus(config-vlan)# private-vlan 2 association remove 3
awplus(config-vlan)# no private-vlan 2 association
```

show vlan

Use this command to display information about a particular VLAN by specifying the VLAN ID. It displays information for all the VLANs configured.

Syntax `show vlan {all|brief|dynamic|static|<1-4094>}`

Parameter	Description
<1-4094>	Display information about the VLAN specified by the VLAN ID.
`all`	Display information about all VLANs on the device.
`brief`	Display information about all VLANs on the device.
`dynamic`	Display information about all VLANs learned dynamically.
`static`	Display information about all statically configured VLANs.

Mode User Exec and Privileged Exec

Example To display information about VLAN 2, use the command:

```
awplus# show vlan 2
```

Output Figure 17-1: Example output from the **show vlan** command

```
VLAN ID  Name            Type    State   Member ports
                                         (u)-Untagged, (t)-Tagged
======= ================ ======= ======= ====================================
2       VLAN0002         STATIC  ACTIVE  port1.0.5(u) port1.0.6(u) port1.0.7(u)
                                         port1.0.8(u)
.
.
```

Related Commands vlan

show vlan classifier group

Use this command to display information about all configured VLAN classifier groups or a specific group.

Syntax `show vlan classifier group [<1-16>]`

Parameter	Description
<1-16>	VLAN classifier group identifier

Mode User Exec and Privileged Exec

Usage If a group ID is not specified, all configured VLAN classifier groups are shown. If a group ID is specified, a specific configured VLAN classifier group is shown.

Example To display information about VLAN classifier group 1, enter the command:

```
awplus# show vlan classifier group 1
```

Related Commands vlan classifier group

show vlan classifier group interface

Use this command to display information about a single switch port interface for all configured VLAN classifier groups.

Syntax `show vlan classifier group interface <switch-port>`

Parameter	Description
<switch-port>	Specify the switch port interface classifier group identifier

Mode User Exec and Privileged Exec

Usage All configured VLAN classifier groups are shown for a single interface.

Example To display VLAN classifier group information for switch port interface `port1.0.2`, enter the command:

```
awplus# show vlan classifier group interface port1.0.2
```

Output Figure 17-2: Example output from the **show vlan classifier group interface port1.0.1** command:

```
vlan classifier group 1 interface port1.0.1
```

Related Commands vlan classifier group
show vlan classifier interface group

show vlan classifier interface group

Use this command to display information about all interfaces configured for a VLAN group or all the groups.

Syntax `show vlan classifier interface group [<1-16>]`

Parameter	Description
<1-16>	VLAN classifier interface group identifier

Mode User Exec and Privileged Exec

Usage If a group ID is not specified, all interfaces configured for all VLAN classifier groups are shown. If a group ID is specified, the interfaces configured for this VLAN classifier group are shown.

Example To display information about all interfaces configured for all VLAN groups, enter the command:

```
awplus# show vlan classifier interface group
```

To display information about all interfaces configured for VLAN group 1, enter the command:

```
awplus# show vlan classifier interface group 1
```

Output Figure 17-3: Example output from the **show vlan classifier interface group** command

```
vlan classifier group 1 interface port1.0.1
vlan classifier group 1 interface port1.0.2
vlan classifier group 2 interface port1.0.3
vlan classifier group 2 interface port1.0.4
```

Output Figure 17-4: Example output from the **show vlan classifier interface group** 1 command

```
vlan classifier group 1 interface port1.0.1
vlan classifier group 1 interface port1.0.2
```

Related Commands vlan classifier group
show vlan classifier group interface

show vlan classifier rule

Use this command to display information about all configured VLAN classifier rules or a specific rule.

Syntax `show vlan classifier rule [<1-256>]`

Parameter	Description
<1-256>	VLAN classifier rule identifier

Mode User Exec and Privileged Exec

Usage If a rule ID is not specified, all configured VLAN classifier rules are shown. If a rule ID is specified, a specific configured VLAN classifier rule is shown.

Example To display information about VLAN classifier rule 1, enter the command:

```
awplus# show vlan classifier rule 1
```

Output Figure 17-5: Example output from the **show vlan classifier rule** 1 command

```
vlan classifier group 1 add rule 1
```

Related Commands
vlan classifier activate
vlan classifier rule ipv4
vlan classifier rule proto

show vlan private-vlan

Use this command to display the private VLAN configuration and associations.

Syntax `show vlan private-vlan`

Mode User Exec and Privileged Exec

Example To display the private VLAN configuration and associations, enter the command:

```
awplus# show vlan private-vlan
```

Output Figure 17-6: Example output from the **show vlan private-vlan** command

```
awplus#show vlan private-vlan
 PRIMARY       SECONDARY          TYPE          INTERFACES
 -------       ---------        ----------      ----------
       2               3          isolated
       2               4        community
                       8          isolated
```

Related Commands private-vlan
private-vlan association

switchport access vlan

Use this command to change the port-based VLAN of the current port.

Use the no variant of this command to change the port-based VLAN of this port to the default VLAN, *vlan1*.

Syntax

```
switchport access vlan <vlan-id>
no switchport access vlan
```

Parameter	Description
<vlan-id>	<1-4094> The port-based VLAN ID for the port.

Default Reset the default VLAN 1 to specified switchports using the negated form of this command.

Mode Interface Configuration

Usage Any untagged frame received on this port will be associated with the specified VLAN.

Examples To change the port-based VLAN to VLAN 3 for `port1.0.2`, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# switchport access vlan 3
```

To reset the port-based VLAN to the default VLAN 1 for `port1.0.2`, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no switchport access vlan
```

Validation Command show interface switchport

Related Commands show vlan

switchport enable vlan

This command enables the VLAN on the port manually once disabled by certain actions, such as QSP (QoS Storm Protection) or EPSR (Ethernet Protection Switching Ring). Note that if the VID is not given, all disabled VLANs are re-enabled.

Syntax `switchport enable vlan [<1-4094>]`

Parameter	Description
`vlan`	Re-enables the VLAN on the port.
<1-4094>	VLAN ID.

Mode Interface Configuration

Example To re-enable the `port1.0.1` from VLAN 1:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# switchport enable vlan 1
```

Related Commands show mls qos interface storm-status
storm-window

switchport mode access

Use this command to set the switching characteristics of the port to access mode. Received frames are classified based on the VLAN characteristics, then accepted or discarded based on the specified filtering criteria.

Syntax

```
switchport mode access [ingress-filter {enable|disable}]
```

Parameter	Description
`ingress-filter`	Set the ingress filtering for the received frames.
`enable`	Turn on ingress filtering for received frames. This is the default.
`disable`	Turn off ingress filtering to accept frames that do not meet the classification criteria.

Default By default, ports are in access mode with ingress filtering on.

Usage Use access mode to send untagged frames only.

Mode Interface Configuration

Example

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# switchport mode access ingress-filter
enable
```

Validation Command show interface switchport

switchport mode private-vlan

Use this command to make a Layer 2 port a private VLAN host port or a promiscuous port.

Use the no variant of this command to remove the configuration.

Syntax

```
switchport mode private-vlan {host|promiscuous}
no switchport mode private-vlan {host|promiscuous}
```

Parameter	Description
`host`	This port type can communicate with all other host ports assigned to the same community VLAN, but it cannot communicate with the ports in the same isolated VLAN. All communications outside of this VLAN must pass through a promiscuous port in the associated primary VLAN.
`promiscuous`	A promiscuous port can communicate with all interfaces, including the community and isolated ports within a private VLAN.

Mode Interface Configuration

Examples

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# switchport mode private-vlan host
awplus(config)# interface port1.0.3
awplus(config-if)# switchport mode private-vlan promiscuous
awplus(config)# interface port1.0.4
awplus(config-if)# no switchport mode private-vlan promiscuous
```

Related Commands switchport private-vlan mapping

switchport mode private-vlan trunk secondary

Use this command to enable a port in trunk mode to be a secondary port for isolated VLANs.

Note Private VLAN trunk ports are not supported by the current AlliedWare Plus GVRP implementation. Private VLAN trunk ports and GVRP are mutually exclusive.

Use the no variant of this command to remove a port in trunk mode as a secondary port for isolated VLANs.

Syntax

```
switchport mode private-vlan trunk secondary group <group-id>
no switchport mode private-vlan trunk secondary
```

Parameter	Description
<group-id>	The group ID is a numeric value in the range 1 to 32 that is used to associate a secondary port with its promiscuous port.

Default By default, a port in trunk mode is disabled as a secondary port.

When a port in trunk mode is enabled to be a secondary port for isolated VLANs, by default it will have a native VLAN of none (no native VLAN specified).

Mode Interface Configuration

Usage A port must be put in trunk mode with switchport mode trunk command before the port is enabled as a secondary port in trunk mode.

To add VLANs to be trunked over the secondary port use the switchport trunk allowed vlan command. These must be isolated VLANs and must exist on the associated promiscuous port.

To configure the native VLAN for the secondary port, use the switchport trunk native vlan command. The native VLAN must be an isolated VLAN and must exist on the associated promiscuous port.

For further information, see "Private VLANs for trunked ports" on page 16.17.

Examples To create isolated private VLAN 2 and then enable `port1.0.3` in trunk mode as a secondary port for the this VLAN with the group ID of `3`, use the following commands:

```
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 2
awplus(config-vlan)# private-vlan 2 isolated
```

```
awplus(config-vlan)# exit
awplus(config)# interface port1.0.3
awplus(config-if)# switchport mode trunk
awplus(config-if)# switchport trunk allowed vlan add 2
awplus(config-if)# switchport mode private-vlan trunk
secondary group 3
```

To remove `port1.0.3` in trunk mode as a secondary port, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# no switchport mode private-vlan trunk
secondary
```

Related Commands

switchport mode private-vlan trunk promiscuous
switchport mode trunk
switchport trunk allowed vlan
switchport trunk native vlan
show vlan private-vlan

switchport mode private-vlan trunk promiscuous

Use this command to enable a port in trunk mode to be promiscuous port for isolated VLANs.

Note Private VLAN trunk ports are not supported by the current AlliedWare Plus GVRP implementation. Private VLAN trunk ports and GVRP are mutually exclusive.

Use the no variant of this command to remove a port in trunk mode as a promiscuous port for isolated VLANs. You must first remove the secondary port, or ports, in trunk mode associated with the promiscuous port with the no switchport mode private-vlan trunk secondary command.

Syntax

```
switchport mode private-vlan trunk promiscuous group <group-id>
no switchport mode private-vlan trunk promiscuous
```

Parameter	Description
<group-id>	The group ID is a numeric value in the range 1 to 32 that is used to associate the promiscuous port with secondary ports.

Default By default, a port in trunk mode is disabled as a promiscuous port.

Mode Interface Configuration

Usage A port must be put in trunk mode with switchport mode trunk command before it can be enabled as a promiscuous port.

To add VLANs to be trunked over the promiscuous port, use the switchport trunk allowed vlan command. These VLANs can be isolated VLANs, or non-private VLANs.

To configure the native VLAN for the promiscuous port, use the switchport trunk native vlan command. The native VLAN can be an isolated VLAN, or a non-private VLAN.

When you enable a promiscuous port, all of the secondary port VLANs associated with the promiscuous port via the group ID number must be added to the promiscuous port. In other words, the set of VLANs on the promiscuous port must be a superset of all the VLANs on the secondary ports within the group.

For further information, see "Private VLANs for trunked ports" on page 16.17.

Examples To create the isolated VLANs 2, 3 and 4 and then enable `port1.0.2` in trunk mode as a promiscuous port for these VLANs with the group ID of 3, use the following commands:

```
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 2-4
awplus(config-vlan)# private-vlan 2 isolated
awplus(config-vlan)# private-vlan 3 isolated
awplus(config-vlan)# private-vlan 4 isolated
```

```
awplus(config-vlan)# exit
awplus(config)# interface port1.0.2
awplus(config-if)# switchport mode trunk
awplus(config-if)# switchport trunk allowed vlan add 2-4
awplus(config-if)# switchport mode private-vlan trunk
promiscuous group 3
```

To remove `port1.0.2` in trunk mode as a promiscuous port for a private VLAN, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no switchport mode private-vlan trunk
promiscuous
```

Note that you must remove the secondary port or ports enabled as trunk ports that are associated with the promiscuous port before removing the promiscuous port.

Related Commands

switchport mode private-vlan trunk secondary
switchport mode trunk
switchport trunk allowed vlan
switchport trunk native vlan
show vlan private-vlan

switchport mode trunk

Use this command to set the switching characteristics of the port to trunk. Received frames are classified based on the VLAN characteristics, then accepted or discarded based on the specified filtering criteria.

Syntax

```
switchport mode trunk [ingress-filter {enable|disable}]
```

Parameter	Description
`ingress-filter`	Set the ingress filtering for the frames received.
`enable`	Turn on ingress filtering for received frames. This is the default.
`disable`	Turn off ingress filtering to accept frames that do not meet the classification criteria.

Default By default, ports are in access mode, are untagged members of the default VLAN (vlan1), and have ingress filtering on.

Mode Interface Configuration

Usage A port in trunk mode can be a tagged member of multiple VLANs, and an untagged member of one native VLAN.

To configure which VLANs this port will trunk for, use the switchport trunk allowed vlan command.

Example

```
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# switchport mode trunk ingress-filter enable
```

Validation Command show interface switchport

switchport private-vlan host-association

Use this command to associate a primary VLAN and a secondary VLAN to a host port. Only one primary and secondary VLAN can be associated to a host port.

Use the no variant of this command to remove the association.

Syntax

```
switchport private-vlan host-association <primary-vlan-id> add
   <secondary-vlan-id>

no switchport private-vlan host-association
```

Parameter	Description
<primary-vlan-id>	VLAN ID of the primary VLAN.
<secondary-vlan-id>	VLAN ID of the secondary VLAN (either isolated or community).

Mode Interface Configuration

Examples

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# switchport private-vlan host-association 2
add 3

awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no switchport private-vlan host-association
```

switchport private-vlan mapping

Use this command to associate a primary VLAN and a set of secondary VLANs to a promiscuous port.

Use the no variant of this to remove all the association of secondary VLANs to primary VLANs for a promiscuous port.

Syntax

```
switchport private-vlan mapping <primary-vlan-id> add
   <secondary-vid-list>

switchport private-vlan mapping <primary-vlan-id> remove
   <secondary-vid-list>

no switchport private-vlan mapping
```

Parameter	Description
<primary-vlan-id>	VLAN ID of the primary VLAN.
<secondary-vid-list>	VLAN ID of the secondary VLAN (either isolated or community), or a range of VLANs, or a comma-separated list of VLANs and ranges.

Mode Interface Configuration

Usage This command can be applied to a switch port or a static channel group, but not a dynamic (LACP) channel group. LACP channel groups (dynamic/LACP aggregators) cannot be promiscuous ports in private VLANs.

Examples

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# switchport private-vlan mapping 2 add 3-4
awplus(config-if)# switchport private-vlan mapping 2 remove 3-4
awplus(config-if)# no switchport private-vlan mapping
```

Related Commands switchport mode private-vlan

switchport trunk allowed vlan

Use this command to add VLANs to be trunked over this switch port. Traffic for these VLANs can be sent and received on the port.

Use the no variant of this command to reset switching characteristics of a specified interface to negate a trunked configuration specified with switchport trunk allowed vlan command.

Syntax

```
switchport trunk allowed vlan all
switchport trunk allowed vlan none
switchport trunk allowed vlan add <vid-list>
switchport trunk allowed vlan remove <vid-list>
switchport trunk allowed vlan except <vid-list>
no switchport trunk
```

Parameter	Description
`all`	Allow all VLANs to transmit and receive through the port.
`none`	Allow no VLANs to transmit and receive through the port.
`add`	Add a VLAN to transmit and receive through the port. Only use this parameter if a list of VLANs are already configured on a port.
`remove`	Remove a VLAN from transmit and receive through the port. Only use this parameter if a list of VLANs are already configured on a port.
`except`	All VLANs, except the VLAN for which the VID is specified, are part of its port member set. Only use this parameter to remove VLANs after either this parameter or the all parameter have added VLANs to a port.
<vid-list>	<2-4094> The ID of the VLAN or VLANs that will be added to, or removed from, the port. A single VLAN, VLAN range, or comma-separated VLAN list can be set. For a VLAN range, specify two VLAN numbers: lowest, then highest number in the range, separated by a hyphen. For a VLAN list, specify the VLAN numbers separated by commas. Do not enter spaces between hyphens or commas when setting parameters for VLAN ranges or lists.

Default By default, ports are untagged members of the default VLAN (vlan1).

Mode Interface Configuration

Usage The all parameter sets the port to be a tagged member of all the VLANs configured on the device. The none parameter removes all VLANs from the port's tagged member set. The add and remove parameters will add and remove VLANs to and from the port's member set. See the note below about restrictions when using the add, remove, except, and all parameters.

Note: Only use the add or the remove parameters with this command if a list of VLANs are configured on a port. Only use the except parameter to remove VLANs after either the except or the all parameters have first been used to add a list of VLANs to a port.

To remove a VLAN, where the configuration for `port1.0.18` shows the below output:

```
awplus#show running-config
!
interface port1.0.18
switchport
switchport mode trunk
switchport trunk allowed vlan except 4
```

Remove VLAN `3` by re-entering the except parameter with the list of VLANs to remove, instead of using the remove parameter, as shown in the command example below:

```
awplus# configure terminal
awplus(config)# interface port1.0.18
awplus(config-if)# switchport trunk allowed vlan except 3,4
```

Then the configuration is changed after entering the above commands to remove VLAN 3:

```
awplus#show running-config
!
interface port1.0.18
switchport
switchport mode trunk
switchport trunk allowed vlan except 3-4
```

To add a VLAN, where the configuration for `port1.0.18` shows the below output:

```
awplus#show running-config
!
interface port1.0.18
switchport
switchport mode trunk
switchport trunk allowed vlan except 3-5
```

Add VLAN `4` by re-entering the except parameter with a list of VLANs to exclude, instead of using the add parameter to include VLAN 4, as shown in the command example below:

```
awplus# configure terminal
awplus(config)# interface port1.0.18
awplus(config-if)# switchport trunk allowed vlan except 3,5
```

The configuration is changed after entering the above commands to add VLAN 4:

```
awplus#show running-config
!
interface port1.0.18
switchport
switchport mode trunk
switchport trunk allowed vlan except 3,5
```

Examples The following shows adding a single VLAN to the port's member set.

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# switchport trunk allowed vlan add 2
```

The following shows adding a range of VLANs to the port's member set.

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# switchport trunk allowed vlan add 2-4
```

The following shows adding a list of VLANs to the port's member set.

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# switchport trunk allowed vlan add 2,3,4
```

switchport trunk native vlan

Use this command to configure the native VLAN for this port. The native VLAN is used for classifying the incoming untagged packets. Use the none parameter with this command to remove the native VLAN from the port and set the acceptable frame types to vlan-tagged only.

Use the no variant of this command to revert the native VLAN to the default VLAN ID 1. Command negation removes tagged VLANs, and sets the native VLAN to the default VLAN.

Syntax

```
switchport trunk native vlan {<vid>|none}
no switchport trunk native vlan
```

Parameter	Description
<*vid*>	<2-4094> The ID of the VLAN that will be used to classify the incoming untagged packets. The VLAN ID must be a part of the VLAN member set of the port.
none	No native VLAN specified. This option removes the native VLAN from the port and sets the acceptable frame types to vlan-tagged only. Note: Use the no variant of this command to revert to the default VLAN 1 as the native VLAN for the specified interface switchport - not none.

Default VLAN 1 (the default VLAN), which is reverted to using the no form of this command.

Mode Interface Configuration

Examples The following commands show configuration of VLAN 2 as the native VLAN for interface port1.0.2:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# switchport trunk native vlan 2
```

The following commands show the removal of the native VLAN for interface port1.0.2:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# switchport trunk native vlan none
```

The following commands revert the native VLAN to the default VLAN 1 for interface port1.0.2:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no switchport trunk native vlan
```

switchport vlan-stacking (double tagging)

Use this command to enable VLAN stacking on a port and set it to be a customer-edge-port or provider-port. This is sometimes referred to as VLAN double-tagging, nested VLANs, or QinQ.

Use no parameter with this command to disable VLAN stacking on an interface.

Syntax

```
switchport vlan-stacking {customer-edge-port|provider-port}
no switchport vlan-stacking
```

Parameter	Description
`customer-edge-port`	Set the port to be a customer edge port. This port must already be in access mode.
`provider-port`	Set the port to be a provider port. This port must already be in trunk mode.

Default By default, ports are not VLAN stacking ports.

Mode Interface Configuration

Usage Use VLAN stacking to separate traffic from different customers to that they can be managed over a provider network

Traffic with an extra VLAN header added by VLAN stacking cannot be routed.

Example

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# switchport vlan-stacking customer-edge-port
```

switchport voice dscp

Use this command to configure the Layer 3 DSCP value advertised when the transmission of LLDP-MED Network Policy TLVs for voice devices is enabled. When LLDP-MED capable IP phones receive this network policy information, they transmit voice data with the specified DSCP value.

Use the no variant of this command to reset the DSCP value to the default, 0.

Syntax

```
switchport voice dscp <0-63>
no switchport voice dscp
```

Parameter	Description
`dscp`	Specify a DSCP value for voice data.
<0-63>	DSCP value.

Default A DSCP value of 0 will be advertised.

Mode Interface Configuration

Usage LLDP-MED advertisements including Network Policy TLVs are transmitted via a port if:

- LLDP is enabled (lldp run command on page 91.16)
- Voice VLAN is configured for the port (switchport voice vlan command on page 17.28)
- The port is configured to transmit LLDP advertisements—enabled by default (lldp transmit receive command on page 91.20)
- The port is configured to transmit Network Policy TLVs—enabled by default (lldp med-tlv-select command on page 91.9)
- There is an LLDP-MED device connected to the port

Example To tell IP phones connected to `port1.0.5` to send voice data with DSCP value 27, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# switchport voice dscp 27
```

Related Commands

lldp med-tlv-select
show lldp
switchport voice vlan

switchport voice vlan

Use this command to configure the Voice VLAN tagging advertised when the transmission of LLDP-MED Network Policy TLVs for voice endpoint devices is enabled. When LLDP-MED capable IP phones receive this network policy information, they transmit voice data with the specified tagging. This command also sets the ports to be spanning tree edge ports, that is, it enables spanning tree portfast on the ports.

Use the no variant of this command to remove LLDP-MED network policy configuration for voice devices connected to these ports. This does not change the spanning tree edge port status.

Syntax

```
switchport voice vlan [<vid>|dot1p|dynamic|untagged]
no switchport voice vlan
```

Parameter	Description
`<vid>`	VLAN identifier, in the range 1 to 4094.
`dot1p`	The IP phone should send User Priority tagged packets, that is, packets in which the tag contains a User Priority value, and a VID of 0. (The User Priority tag is also known as the 802.1p priority tag, or the Class of Service (CoS) tag.)
`dynamic`	The VLAN ID with which the IP phone should send tagged packets will be assigned by RADIUS authentication.
`untagged`	The IP phone should send untagged packets.

Default By default, no Voice VLAN is configured, and therefore no network policy is advertised for voice devices.

Mode Interface Configuration

Usage LLDP-MED advertisements including Network Policy TLVs are transmitted via a port if:

- LLDP is enabled (lldp run command on page 91.16)
- Voice VLAN is configured for the port using this command (switchport voice vlan)
- The port is configured to transmit LLDP advertisements—enabled by default (lldp transmit receive command on page 91.20)
- The port is configured to transmit Network Policy TLVs—enabled by default (lldp med-tlv-select command on page 91.9)
- There is an LLDP-MED device connected to the port.

To set the priority value to be advertised for tagged frames, use the switchport voice vlan priority command on page 17.30.

If the Voice VLAN details are to be assigned by RADIUS, then the RADIUS server must be configured to send the attribute 'Egress-VLANID (56)' or 'Egress-VLAN-Name (58)' in the RADIUS Accept message when authenticating a phone attached to this port. To set these attributes on the local RADIUS server, use the egress-vlan-id command on page 73.19 or the egress-vlan-name command on page 73.20.

For more information about configuring authentication for Voice VLAN, "Configuring LLDP" on page 90.11.

If the ports have been set to be edge ports by the switchport voice vlan command, the no variant of this command will leave them unchanged as edge ports. To set them back to their default non-edge port configuration, use the spanning-tree edgeport (RSTP and MSTP) command on page 19.37.

Examples To tell IP phones connected to `port1.0.5` to send voice data tagged for VLAN 10, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# switchport voice vlan 10
```

To tell IP phones connected to ports 1.0.8-1.0.12 to send priority tagged packets (802.1p priority tagged with VID 0, so that they will be assigned to the port VLAN) use the following commands. The priority value is 5 by default, but can be configured with the switchport voice vlan priority command.

```
awplus# configure terminal
awplus(config)# interface port1.0.8-port1.0.12
awplus(config-if)# switchport voice vlan dot1p
```

To dynamically configure the VLAN ID advertised to IP phones connected to `port1.0.1` based on the VLAN assigned by RADIUS authentication (with RADIUS attribute 'Egress-VLANID' or 'Egress-VLAN-Name' in the RADIUS accept packet), use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# switchport voice vlan dynamic
```

To remove the Voice VLAN, and therefore disable the transmission of LLDP-MED network policy information for voice devices on `port1.0.24`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.24
awplus(config-if)# no switchport voice vlan
```

Related Commands
egress-vlan-id
egress-vlan-name
lldp med-tlv-select
spanning-tree edgeport (RSTP and MSTP)
switchport voice dscp
switchport voice vlan priority
show lldp

switchport voice vlan priority

Use this command to configure the Layer 2 user priority advertised when the transmission of LLDP-MED Network Policy TLVs for voice devices is enabled. This is the priority in the User Priority field of the IEEE 802.1Q VLAN tag, also known as the Class of Service (CoS), or 802.1p priority. When LLDP-MED capable IP phones receive this network policy information, they transmit voice data with the specified priority.

Syntax

```
switchport voice vlan priority <0-7>
no switchport voice vlan priority
```

Parameter	Description
`priority`	Specify a user priority value for voice data.
<0-7>	Priority value.

Default By default, the Voice VLAN user priority value is 5.

Mode Interface Configuration

Usage LLDP-MED advertisements including Network Policy TLVs are transmitted via a port if:

- LLDP is enabled (lldp run command on page 91.16)
- Voice VLAN is configured for the port (switchport voice vlan command on page 17.28)
- The port is configured to transmit LLDP advertisements—enabled by default (lldp transmit receive command on page 91.20)
- The port is configured to transmit Network Policy TLVs—enabled by default (lldp med-tlv-select command on page 91.9)
- There is an LLDP-MED device connected to the port.

To set the Voice VLAN tagging to be advertised, use the switchport voice vlan command on page 17.28.

Example To tell IP phones connected to `port1.0.5` to send voice data with a user priority value of 6, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# switchport voice vlan priority 6
```

Related Commands

lldp med-tlv-select
show lldp
switchport voice vlan

vlan

This command creates VLANs, assigns names to them, and enables or disables them. Specifying the `disable` state causes all forwarding over the specified VLAN ID to cease. Specifying the `enable` state allows forwarding of frames on the specified VLAN.

The no variant of this command destroys the specified VLANs.

Syntax

```
vlan <vid> [name <vlan-name>] [state {enable|disable}]
vlan <vid-range> [state {enable|disable}]
vlan {<vid>|<vlan-name>} [mtu <mtu-value>]
no vlan {<vid>|<vid-range>} [mtu]
```

Parameter	Description
<vid>	The VID of the VLAN to enable or disable in the range <1-4094>.
<vlan-name>	The ASCII name of the VLAN. Maximum length: 32 characters.
<vid-range>	Specifies a range of VLAN identifiers.
<mtu-value>	Specifies the Maximum Transmission Unit (MTU) size in bytes, in the range 68 to1500 bytes, for the VLAN.
`enable`	Sets VLAN into an `enable` state.
`disable`	Sets VLAN into a `disable` state.

Default By default, VLANs are enabled when they are created.

Mode VLAN Configuration

Examples

```
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 45 name accounts state enable
```

```
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# no vlan 45
```

Related Commands

mtu
vlan database
show vlan

vlan classifier activate

Use this command in Interface Configuration mode to associate a VLAN classifier group with the switch port, and optionally associate the group with a VLAN identifier and a switch port.

Use the no variant of this command to remove the VLAN classifier group from the switch port, and a VLAN if the VLAN classifier group was also associated with a VLAN identifier.

Syntax

```
vlan classifier activate <vlan-class-group-id> [vlan <VID>]
no vlan classifier activate <vlan-class-group-id>
```

Parameter	Description
<vlan-class-group-id>	Specify a VLAN classifier group identifier in the range <1-16>.
<VID>	Specify a VLAN identifier in the range <1-4094>.

Mode Interface Configuration mode for a switch port.

Example To associate VLAN classifier group 3 with switch `port1.0.3`, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# vlan classifier activate 3
```

To associate VLAN classifier group 3 with switch `port1.0.3` and the default VLAN 1, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# vlan classifier activate 3 vlan 1
```

To remove VLAN classifier group 3 from switch `port1.0.3`, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# no vlan classifier activate 3
```

Related Commands

show vlan classifier rule
vlan classifier group
vlan classifier rule ipv4
vlan classifier rule proto

vlan classifier group

Use this command to create a group of VLAN classifier rules. The rules must already have been created.

Use the no variant of this command to delete a group of VLAN classifier rules.

Syntax

```
vlan classifier group <1-16> {add|delete} rule <vlan-class-rule-id>
no vlan classifier group <1-16>
```

Parameter	Description
<1-16>	VLAN classifier group identifier
add	Add the rule to the group.
delete	Delete the rule from the group.
<vlan-class-rule-id>	The VLAN classifier rule identifier.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# vlan classifier group 3 add rule 5
```

Related Commands

show vlan classifier rule
vlan classifier activate
vlan classifier rule ipv4
vlan classifier rule proto

vlan classifier rule ipv4

Use this command to create an IPv4 subnet-based VLAN classifier rule and map it to a specific VLAN. Use the no variant of this command to delete the VLAN classifier rule.

Syntax

```
vlan classifier rule <1-256> ipv4 <ip-addr/prefix-length>  vlan
    <1-4094>

no vlan classifier rule <1-256>
```

Parameter	Description
<1-256>	Specify the VLAN Classifier Rule identifier.
<ip-addr/prefix-length>	Specify the IP address and prefix length.
<1-4094>	Specify a VLAN ID to which an untagged packet is mapped in the range *<1-4094>*.

Mode Global Configuration

Usage If the source IP address matches the IP subnet specified in the VLAN classifier rule, the received packets are mapped to the specified VLAN.

You can set up to twelve IPv4 subnet-based VLAN classifier rules. If you attempt to set more than twelve rules, the following error message is displayed:

```
%% Maximum number (12) of ipv4 classifier rules already reached
```

Note

The subnet VLAN classifier only matches IPv4 packets. It does not match ARP packets. To ensure ARP traffic is classified into the correct subnet VLAN, you can use a hardware based policy map that sends ARP packets to the CPU, which will then process them appropriately. This means that if you use subnet-based VLANs, you should also configure the following:

```
!
vlan database
 vlan 10 state enable
!
vlan classifier rule 1 ipv4 192.168.10.0/24 vlan 10
vlan classifier group 1 add rule 1
!
mls qos enable
access-list 4000 send-to-cpu any any
!
class-map 1
 match access-group 4000
 match eth-format ethii-untagged protocol 0806
!
policy-map 1
 class default
 class 1
```

Note

The policy map should be applied to each port that uses a subnet based VLAN using the service-policy input command:

```
!
interface port2.0.1
 switchport
 switchport mode access
 vlan classifier activate 1
 service-policy input 1
```

Example

```
awplus# configure terminal
awplus(config)# vlan classifier rule 3 ipv4 3.3.3.3/8 vlan 5
```

Related Commands

show vlan classifier rule
vlan classifier activate
vlan classifier rule proto

vlan classifier rule proto

Use this command to create a protocol type-based VLAN classifier rule, and map it to a specific VLAN.

The no variant of this command destroys the rule.

Syntax

```
vlan classifier rule <1-256> proto <protocol>
   encap {ethv2|nosnapllc|snapllc} vlan <1-4094>

no vlan classifier rule <1-256>
```

Parameter	Description	
<1-256>	VLAN Classifier identifier	
proto	Protocol type	
<protocol>	Specify a protocol either by its decimal number (0-65535) or by one of the following protocol names:	
	[arp|2054]	Address Resolution protocol
	[atalkaarp|33011]	Appletalk AARP protocol
	[atalkddp|32923]	Appletalk DDP protocol
	[atmmulti|34892]	MultiProtocol Over ATM protocol
	[atmtransport|34948]	Frame-based ATM Transport protocol
	[dec|24576]	DEC Assigned protocol
	[deccustom|24582]	DEC Customer use protocol
	[decdiagnostics|24581]	DEC Systems Comms Arch protocol
	[decdnadumpload|24577]	DEC DNA Dump/Load protocol
	[decdnaremoteconsole|24578]	DEC DNA Remote Console protocol
	[decdnarouting|24579]	DEC DNA Routing protocol
	[declat|24580]	DEC LAT protocol
	[decsyscomm|24583]	DEC Systems Comms Arch protocol
	[g8bpqx25|2303]	G8BPQ AX.25 protocol
	[ieeeaddrtrans|2561]	Xerox IEEE802.3 PUP Address

Parameter(cont.)	Description(cont.)	
	`[ieeepup|2560]`	Xerox IEEE802.3 PUP protocol
	`[ip|2048]`	IP protocol
	`[ipx|33079]`	IPX protocol
	`[netbeui|61680]`	IBM NETBIOS/NETBEUI protocol
	`[netbeui|61681]`	IBM NETBIOS/NETBEUI protocol
	`[pppdiscovery|34915]`	PPPoE discovery protocol
	`[pppsession|34916]`	PPPoE session protocol
	`[rarp|32821]`	Reverse Address Resolution protocol
	`[x25|2056]`	CCITT .25 protocol
	`[xeroxaddrtrans|513]`	Xerox PUP Address Translation protocol
	`[xeroxpup|512]`	Xerox PUP protocol
`ethv2`	Ethernet Version 2 encapsulation	
`nosnapllc`	LLC without SNAP encapsulation	
`snapllc`	LLC SNAP encapsulation	
`<1-4094>`	Specify a VLAN ID to which an untagged packet is mapped in the range *`<1-4094>`*	

Mode Global Configuration

Usage If the protocol type matches the protocol specified in the VLAN classifier rule, the received packets are mapped to the specified VLAN. Ethernet Frame Numbers may be entered in place of the protocol names listed. For a full list please refer to the IANA list online: http://www.iana.org/assignments/ethernet-numbers.

You can set up to twelve protocol type-based VLAN classifier rules. If you attempt to set more than twelve rules, the following error message is displayed:

```
%% Maximum number (12) of protocol classifier rules already
reached
```

Example

```
awplus# configure terminal
awplus(config)# vlan classifier rule 1 proto x25 encap ethv2
vlan 2
awplus(config)# vlan classifier rule 2 proto 512 encap ethv2
vlan 2
awplus(config)# vlan classifier rule 3 proto 2056 encap ethv2
vlan 2
awplus(config)# vlan classifier rule 4 proto 2054 encap ethv2
vlan 2
```

Validation Output

```
awplus# show vlan classifier rule
```

```
vlan classifier rule 16 proto rarp encap ethv2 vlan 2
vlan classifier rule 8 proto  encap ethv2 vlan 2
vlan classifier rule 4 proto arp encap ethv2 vlan 2
vlan classifier rule 2 proto xeroxpup encap ethv2 vlan 2
```

Related Commands

show vlan classifier rule
vlan classifier activate
vlan classifier group

vlan database

Use this command to enter the VLAN Configuration mode.

Syntax `vlan database`

Mode Global Configuration

Usage Use this command to enter the VLAN configuration mode. You can then add or delete a VLAN, or modify its values.

Example In the following example, note the change to VLAN configuration mode from Configure mode:

```
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)#
```

Related Commands vlan

Chapter 18: Spanning Tree Introduction: STP, RSTP, and MSTP

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Configuring MSTP 18.19

Introduction

This chapter describes and provides configuration procedures for:

- Spanning Tree Protocol (STP)
- Rapid Spanning Tree Protocol (RSTP)
- Multiple Spanning Tree Protocol (MSTP)

For detailed information about the commands used to configure spanning trees, see Chapter 19, Spanning Tree Commands.

Overview of Spanning Trees

The concept of the spanning tree protocol was devised to address broadcast storming. The spanning tree algorithm itself is defined by the IEEE standard 802.1D and its later revisions.

The IEEE Standard 802.1 uses the term “bridge” to define the spanning tree operation and uses terms such as Bridge Protocol Data Units, Root Bridge etc., when defining spanning tree protocol functions.

When a bridge receives a frame, it reads the source and destination address fields. The bridge then enters the frame’s source address in its forwarding database. In doing this the bridge associates the frame’s source address with the network attached to the port on which the frame was received. The bridge also reads the destination address and if it can find this address in its forwarding database, it forwards the frame to the appropriate port. If the bridge does not recognize the destination address, it forwards the frame out from all its ports except for the one on which the frame was received, and then waits for a reply. This process is known as “flooding”.

A significant problem arises where bridges connect via multiple paths. A frame that arrives with an unknown destination address is flooded over all available paths. The arrival of these frames at another network via different paths and bridges produces major problems. The bridges can become confused about the location of the send and receive devices and begin sending frames in the wrong directions. This process feeds on itself and produces a condition known as a broadcast storm, where the increase of circulating frames can eventually overload the network.

Spanning tree operation

Where a LAN’s topology results in more than one path existing between bridges, frames transmitted onto the extended LAN circulate in increasing numbers around the loop, decreasing performance and potentially overloading the network. However, multiple paths through the extended LAN are often required in order to provide redundancy and backup in the event of a bridge or link failure.

The spanning tree is created through the exchange of Bridge Protocol Data Units (BPDUs) between the bridges in the LAN. The spanning tree algorithm operates by:

- Automatically computing a loop-free portion of the topology, called a *spanning tree*. The topology is dynamically pruned to the spanning tree by declaring certain ports on a switch to be redundant, and placing them into a ‘Blocking’ state.
- Automatically recovering from a switch failure that would partition the extended LAN by reconfiguring the spanning tree to use redundant paths, if available.

The logical tree computed by the spanning tree algorithm has the following properties:

- A single bridge is selected to become the spanning tree's unique *root bridge*. This is the device that advertises the lowest Bridge ID. Each bridge is uniquely identified by its Bridge ID, which comprises the bridge's *root priority* (a spanning tree parameter) followed by its MAC address.
- Each bridge or LAN in the tree, except the root bridge, has a unique parent, known as the *designated bridge*. Each LAN has a single bridge, called the *designated bridge*, that connects it to the next LAN on the path towards the root bridge.
- Each port connecting a bridge to a LAN has an associated *cost*, called the *root path cost*. This is the sum of the costs for each path between the particular bridge port and the root bridge. The designated bridge for a LAN is the one that advertises the lowest *root path cost*. If two bridges on the same LAN have the same lowest root path cost, then the switch with the lowest bridge ID becomes the designated bridge.

The spanning tree computation is a continuous, distributed process to establish and maintain a spanning tree (Table 18-1). The basic algorithm is similar for STP, RSTP and MSTP modes.

Table 18-1: Spanning tree process

The spanning tree algorithm ...	By ...
Selects a root bridge	It selects as the root bridge for the spanning tree the device with the (numerically) lowest bridge identifier (that is, the device with lowest root bridge priority value, or if they have the same priority, the bridge with the lowest MAC address).
Selects root ports	On each device, it selects the root port according to: ■ the port with the lowest path cost to the root bridge ■ the port connected to the bridge with the lowest root identifier ■ MSTP and RSTP only: the port with the lowest port priority value ■ the port with the lowest port number[1]
Blocks alternate ports	In order to prevent loops, it blocks alternate ports (Discarding state) that provide higher cost paths to the root bridge.
Blocks backup ports	Where a second port connects one switch back to itself, it blocks the backup port that has the highest path cost or port number.
Selects designated ports	All other ports that are not disabled are selected as designated ports and are eventually made active (Forwarding state).
Maintains the spanning tree	If a switch or port fails, the spanning tree configures a new active topology, changing some port states, to reestablish connectivity and block loops. Depending on where the failure occurs, the changes may be widespread (e.g., if the root bridge fails), or local (e.g., if a designated port fails).

1. The whole three part port number (D.M.P) is used to find the lowest port number; where: D is the device number within a stack (1 for a non stacked device), M is the module number (XEM number) within the device - note that 0 is used for all base-board connected ports, and P is the number of the port within the XEM or base-board.

The logical spanning tree, sometimes called the *active topology*, includes the root bridge and all designated bridges, meaning all ports that are to be used for communication within the spanning tree. These ports are in the forwarding state. Ports removed from the logical spanning tree are not in the forwarding state. To implement the spanning tree algorithm, devices communicate with one another using the Spanning Tree Protocol.

Spanning tree modes

STP can run in one of three modes: STP, RSTP or MSTP. A device running RSTP is compatible with other devices running STP; a device running MSTP is compatible with other devices running RSTP or STP. By default, on a device in MSTP mode each port automatically detects the mode of the device connected to it (MSTP, RSTP or STP), and responds in the appropriate mode by sending messages (BPDUs) in the corresponding format. Ports on a device in RSTP mode can automatically detect and respond to connected devices in RSTP and STP mode. Particular ports can also be forced to only operate in a particular mode (spanning-tree force-version command on page 19.41).

STP The Spanning Tree Protocol (STP) is the original protocol defined by IEEE standard 802.1D-1988. It creates a single spanning tree over a network.

STP mode may be useful for supporting applications and protocols whose frames may arrive out of sequence or duplicated, for example NetBeui.

RSTP Rapid Spanning Tree Protocol (RSTP) also creates a single spanning tree over a network. Compared with STP, RSTP provides for more rapid convergence to an active spanning tree topology. RSTP is defined in IEEE standard 802.1D-2004.

By default, the device operates in RSTP mode.

MSTP The Multiple Spanning Tree Protocol (MSTP) addresses the limitations in the previous spanning tree protocols, STP and RSTP, within networks that use multiple VLANs with topologies that employ alternative physical links. It supports multiple spanning tree instances on any given link within a network, and supports large networks by grouping bridges into regions that appear as a single bridge to other devices.

MSTP is defined in IEEE standard 802.1Q-2005. The protocol builds on, and remains compatible with, the previous IEEE standards defining STP and RSTP.

Spanning Tree Protocol (STP)

STP uses the process described in Table 18-1 to avoid loops.

STP port states

In STP mode, each switch port can be in one of five spanning tree states, and one of two switch states. The state of a switch port is taken into account by STP. The STP port states (Table 18-2) affect the behavior of ports whose switch state is enabled.

Table 18-2: STP port states

State	Meaning
DISABLED	STP operations are disabled on the port. The port does not participate in the operation of the Spanning Tree Algorithm and Protocol. The port can still switch if its switch state is enabled.
BLOCKING	The forwarding process discards received frames and does not submit forwarded frames for transmission. This is the “standby” mode.The port does not participate in frame relay.
LISTENING	The port is enabled for receiving frames only. The port is preparing to participate in frame relay. The forwarding process discards received frames and does not submit forwarded frames for transmission.
LEARNING	The port is enabled for receiving frames only, and the Learning Process can add new source address information to the Forwarding Database.
FORWARDING	The normal state for a switch port. The forwarding process and the Spanning Tree entity are enabled for transmit and receive operations on the port.

Configuring STP

By default, RSTP is enabled on all switch ports. This section provides a procedure for configuring STP (Table 18-3).

To configure other modes, see "Configuring RSTP" on page 18.9 or "Configuring MSTP" on page 18.19.

Table 18-3: Configuration procedure for STP

Command	Description
Configure STP	
RSTP is enabled by default with default settings on all switch ports to prevent Layer 2 loops in your network.	
`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`spanning-tree mode stp`	By default, the device is in RSTP mode. Change to STP mode.
`awplus(config)#`	
`spanning-tree enable`	By default, spanning tree is enabled on all switch ports. If it has been disabled, enable it for STP.
`awplus(config)#`	
`spanning-tree priority <priority>`	By default, all devices have the same root bridge priority, 32768 (8000 in hexadecimal), so the device with the lowest MAC address becomes the root bridge. If you want the device to be the root bridge, set the root bridge priority to a value lower than 32768. Enter a value in the range 0 to 61440. If you enter a number that is not a multiple of 4096, the switch rounds the number down.
Configure Root Guard	
The Root Guard feature makes sure that the port on which it is enabled is a designated port. If the Root Guard enabled port receives a superior BPDU, it goes to a Listening state (for STP) or discarding state (for RSTP and MSTP).	
`awplus(config)#`	
`interface <port-list>`	Enter Interface Configuration mode for the switch ports you want to enable Root Guard for.
`awplus(config-if)#`	
`spanning-tree guard root`	Enable the Guard Root feature for these ports.
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`exit`	Return to Privileged Exec mode.

Table 18-3: Configuration procedure for STP(cont.)

Check STP configuration	
`awplus#` `show spanning-tree [interface <port-list>]`	Display the spanning tree configuration for the device, and confirm the new root bridge priority (Bridge Priority). Note that the Bridge ID is in a form like this: 80000000cd240331, and that other IDs follow the same pattern. This is made up of: 8000—the devices' root bridge priority in hexadecimal 0000cd240331—the devices' MAC address.

Advanced configuration: For most networks the default settings for path costs will be suitable, however, you can configure them if required (spanning-tree path-cost).

Rapid Spanning Tree Protocol (RSTP)

RSTP uses the process described in Table 18-1 to avoid loops.

A spanning tree running in STP mode can take up to one minute to rebuild after a topology or configuration change. The RSTP algorithm provides for a faster recovery of connectivity following the failure of a bridge, bridge port, or a LAN. RSTP provides rapid recovery by including port roles in the computation of port states, and by allowing neighboring bridges to explicitly acknowledge signals on a point-to-point link that indicate that a port wants to enter the forwarding mode.

In rapid mode, the rapid transition of a port to the forwarding state is possible when the port is considered to be part of a point-to-point link, or when the port is considered to be an *edge* port. An edge port is one that attaches to a LAN that has no other bridges attached.

Table 18-4: RSTP port states

State	Meaning
DISABLED	STP operations are disabled on the port.
DISCARDING	The port does not participate in frame relay. The forwarding process discards received frames and does not submit forwarded frames for transmission.
LEARNING	The port is enabled for receiving frames only, and the learning process can add new source address information to the forwarding database. The port does not forward any frames.
FORWARDING	The normal state for a switch port. The forwarding process and the Spanning Tree entity are enabled for transmit and receive operations on the port.

Configuring RSTP

RSTP is enabled by default with default settings on all switch ports to prevent Layer 2 loops in your network. No further configuration is required if you want to use RSTP with these default settings. For further RSTP configuration, see Table 18-5 below.

To configure other modes, see "Configuring MSTP" on page 18.19 or "Configuring STP" on page 18.6.

For detailed configuration examples, see the How To Note *How To Configure Basic Switching Functionality*, available from http://www.alliedtelesis.com.

Table 18-5: Configuration procedure for RSTP

Command	Description
Configure RSTP	
RSTP is enabled by default with default settings on all switch ports to prevent Layer 2 loops in your network. No further configuration is required if you want to use RSTP with these default settings. If you need to restore the device to RSTP after it has been set to another mode, or modify the default RSTP settings, follow the procedure below.	
`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`spanning-tree mode rstp`	By default, the device is in RSTP mode. If it has been changed to STP or MSTP mode, change it back to RSTP.
`awplus(config)#`	
`spanning-tree enable`	By default, spanning tree is enabled on all switch ports. If it has been disabled, enable it for RSTP.
`awplus(config)#`	
`spanning-tree priority <priority>`	By default, all devices have the same root bridge priority, 32768 (8000 in hexadecimal), so the device with the lowest MAC address becomes the root bridge. If you want the device to be the root bridge, set the root bridge priority to a value lower than 32768. Enter a value in the range 0 to 61440. If you enter a number that is not a multiple of 4096, the switch rounds the number down.
Configure edge ports	
If some switch ports are connected to devices that cannot generate BPDUs (such as workstations), you can set particular switch ports as edge ports, or set them to automatically detect whether they are edge ports.	
`awplus(config)#`	
`interface <port-list>`	Enter Interface Configuration mode for these switch ports.
`awplus(config-if)#`	
`spanning-tree edgeport (RSTP and MSTP)`	Set these ports to be edge ports,
or	or
`awplus(config-if)#`	
`spanning-tree autoedge (RSTP and MSTP)`	set these ports to automatically detect whether they are edge ports.

Table 18-5: Configuration procedure for RSTP(cont.)

Configure Root Guard	
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`interface <port-list>`	Enter Interface Configuration mode for the switch ports you want to enable Root Guard for.
`awplus(config-if)#`	
`spanning-tree guard root`	The Root Guard feature makes sure that the port on which it is enabled is a designated port. If the Root Guard enabled port receives a superior BPDU, it goes to a Listening state (for STP) or discarding state (for RSTP and MSTP). Enable the Guard Root feature if required.
Configure BPDU Guard	
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`spanning-tree portfast bpdu-guard`	If required, enable the BPDU Guard feature.
`awplus(config)#`	
`spanning-tree errdisable-timeout enable`	Set a timeout for ports that are disabled due to the BPDU guard feature.
`awplus(config)#`	
`spanning-tree errdisable-timeout interval`	Specify the time interval after which a port is brought back up when it has been disabled by the BPDU guard feature.
Check RSTP configuration	
`awplus(config)#`	
`exit`	Return to Privileged Exec mode.
`awplus#`	
`show spanning-tree [interface <port-list>]`	Display the spanning tree configuration for the device, and confirm the new root bridge priority (Bridge Priority). Note that the Bridge ID is in a form like this: 80000000cd240331, and that other IDs follow the same pattern. This is made up of: 8000—the devices' root bridge priority in hexadecimal 0000cd240331—the devices' MAC address.

Advanced configuration: For most networks the default settings for path costs will be suitable, however, you can configure them if required (spanning-tree path-cost).

Multiple Spanning Tree Protocol (MSTP)

Conceptually, MSTP views the total bridged network as one that comprises a number of *Multiple Spanning Tree Regions* (MSTRs), where each region can contain up to 64 spanning trees, which operate locally, called *Multiple Spanning Tree Instances* (MSTIs). AlliedWare Plus™ supports up to 15 MSTIs. The regions are linked by the *Common Internal Spanning Tree* (CIST).

MSTP uses BPDUs to exchange information between spanning-tree compatible devices, to prevent loops in each MSTI and also in the CIST, by selecting active and blocked paths. This process is described in Table 18-1.

If multiple ports are aggregated together into a dynamic (LACP) or static channel group, then the spanning-tree process is aware of the link aggregation and treats the aggregated ports as a single logical path.

Advantage of MSTP over RSTP

MSTP is similar to RSTP, in that it provides loop resolution and rapid convergence. However, RSTP can keep track of only one spanning-tree. MSTP can track many spanning-trees, referred to as *instances*. MSTP makes it possible to have different forwarding paths for different MST instances. This enables load balancing of network traffic across redundant links, so that all the links in a network can be used by at least one MSTI, and no link is left completely idle. That is to say that no link is unnecessarily shut down by spanning-tree.

Essentially, MSTP is VLAN aware and RSTP is not VLAN aware. MSTP BPDUs and RSTP BPDUs are compatible, so a network can have a mixture of MSTP and RSTP areas.

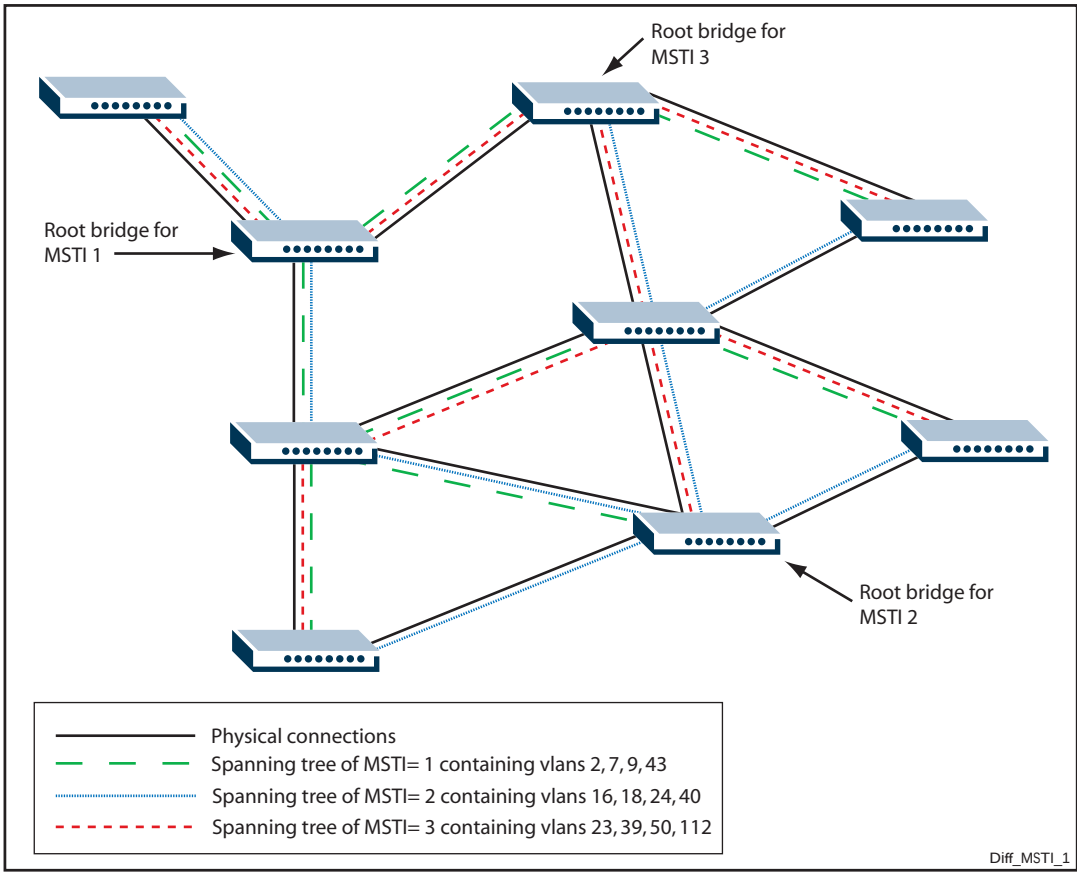
Multiple Spanning Tree Instances (MSTI)

MSTP enables the grouping and mapping of VLANs to different spanning tree instances. So, an MST Instance (MSTI) is a particular set of VLANs that are all using the same spanning tree.

In a network where all VLANs span all links of the network, judicious choice of bridge priorities for different MSTIs can result in different switches becoming root bridges for different MSTIs. That will result in the different MSTIs choosing different active topologies on the network. An example of how different MSTIs can choose different active topologies on the same physical set of links is illustrated in Figure 18-1.

MSTP is compatible with RSTP and STP—see "Common and Internal Spanning Tree (CIST)" on page 18.15.

Figure 18-1: Different spanning trees created by different MSTIs on the same physical layout



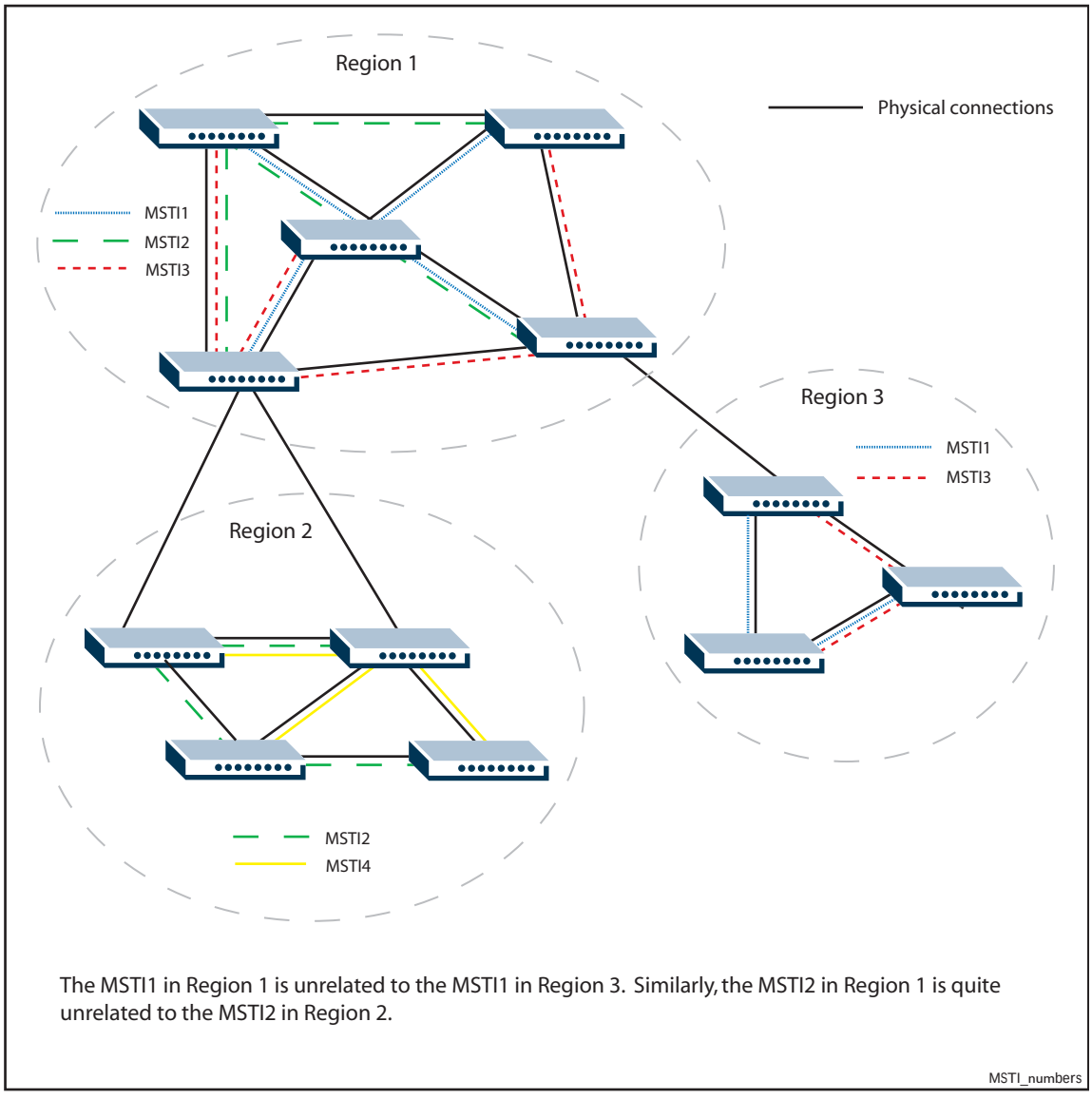
MSTP Regions

An MST region is a set of interconnected switches that all have the same values for the following MST configuration identification elements:

- MST configuration name - the name of the MST region
- Revision level - the revision number of configuration
- Configuration Digest - the mapping of which VLANs are mapped to which MST instances

Each of the MST instances created are identified by an MSTI number. This number is locally significant within the MST region. Therefore, an MSTI will not span across MST regions.

Figure 18-2: MSTIs in different regions



The task of assigning each bridge to a particular region is achieved by the member bridges each comparing their *MST Configuration Identifiers*. More information on configuration identifiers is provided in Table 18-6, but for the moment an *MST Configuration Identifier* can simply be thought of as an identifier that represents the mapping of VLANs to MSTIs within each bridge. Therefore, bridges with identical *MST Configuration Identifiers*, must have identical MSTI mapping tables.

While each MSTI can have multiple VLANs, each VLAN can be associated with only one MSTI. Once these associations have been made, the bridges in each region can transmit their spanning tree BPDUs and advertise their MSTIs. This in turn establishes the active data paths between the bridges for each group of VLANs (that is, for each MSTI) and block any duplicate paths within each instance. A particular advantage of this enhancement applies where a large number of VLANs share a few internetwork paths. In this situation there need only be as many Multiple Spanning Tree Instances (MSTIs) as there are source and destination bridge pairs, remembering that a pair of bridges probably has multiple paths between them.

In order to ensure that each bridge within a region maintains the same configuration information (particularly their VID to MSTI mappings) and to ensure each bridge's membership of a particular region, the bridges exchange configuration information in the form of *MST Configuration Identifiers*. Table 18-6 provides a breakdown of an *MST Configuration Identifier*. A detailed explanation of bridge configuration identifiers can be found in Section 13.7 of the IEEE 802.1Q-2003 standard.

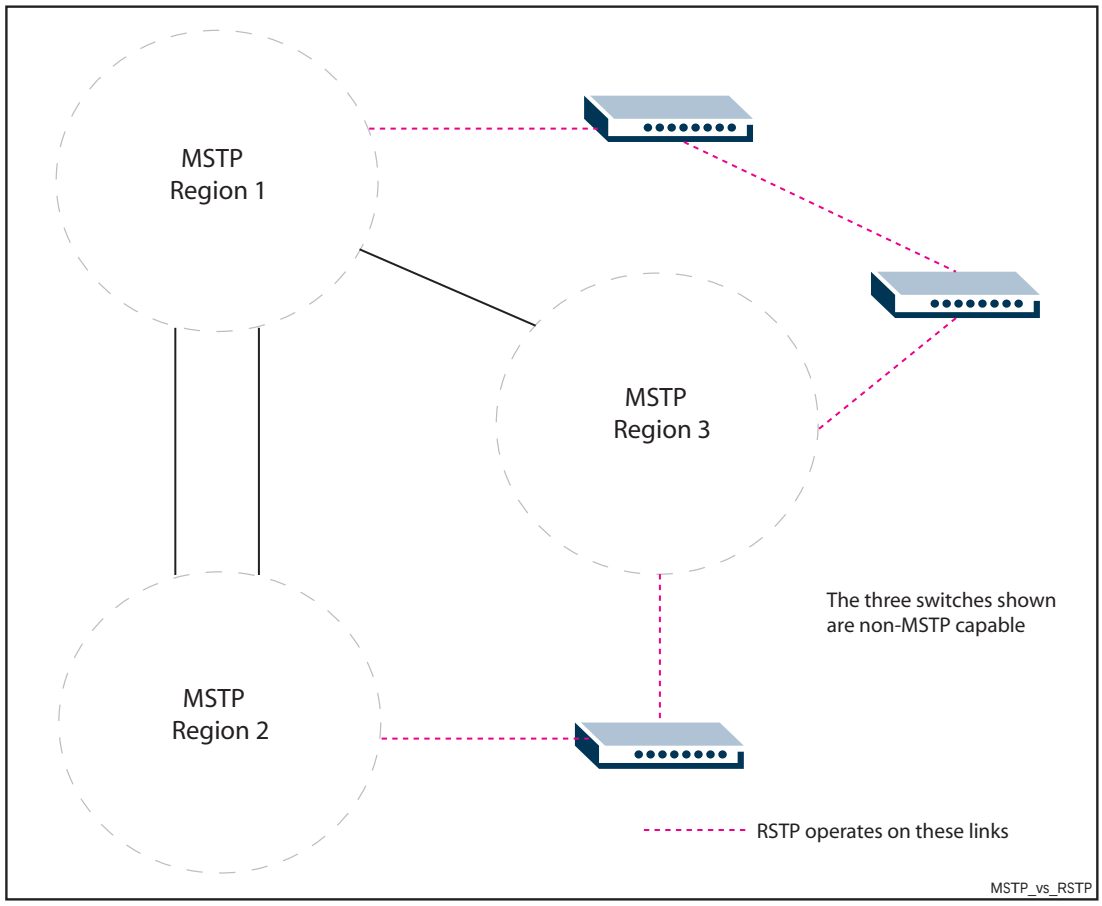
Table 18-6: MST Configuration Identifier

Field Name	Description
Format Selector	A single octet field whose value of 0 indicates MSTP operation
Region Name	A name (up to 32 characters long) that identifies a particular MST region, defined using the region (MSTP) command on page 19.11
Revision Level	A number representing the region's revision level, defined using the revision (MSTP) command on page 19.12.
Configuration Digest	A 16 octet (HMAC-MD5 based) signature created from the MST configuration table.

Common and Internal Spanning Tree (CIST)

The CIST is the default spanning tree instance of MSTP, i.e. all VLANs that are not members of particular MSTIs are members of the CIST. Also, an individual MST region can be regarded as a single virtual bridge by other MST regions. The spanning tree that runs between regions is the CIST. The CIST is also the spanning tree that runs between MST regions and Single Spanning Tree (SST) entities. So, in Figure 18-3, the STP that is running between the regions, and to the SST bridges, is the CIST.

Figure 18-3: The CIST operates on links between regions and to SST devices



Compatibility with Previous Spanning Tree Protocols

MSTP provides for compatibility with older spanning tree protocols in several ways. In addition to the MST region described in the previous section, the protocol provides for single spanning tree systems by employing a Common and Internal Spanning Tree (CIST). The CIST applies a common and internal spanning tree protocol to the whole of the bridged network and is a direct equivalent to the internal spanning tree (IST) protocol of earlier versions.

In common with legacy spanning tree systems, the CIST protocol first determines its root bridge from all the bridges on the network. This is the bridge that contains the lowest bridge identifier. The protocol then selects a regional root bridge for each MSTR. This is the bridge that provides the best path to the CIST root. After the MSTR root bridges have been chosen, they then act on the region's behalf in such a way that the region appears to the Common Spanning Tree (CST) as a virtual bridge. So in addition to having multiple MSTIs, each region operates as a bridge in a CST.

CIST

In addition to the individual MSTIs within each MSTP region, the MSTP region is a member of a network-wide spanning tree called the Common and Internal Spanning Tree (CIST). Conceptually, each region represents a virtual bridge. Internal and external bridge connectivity are two independent functions.

Frames with VIDs allocated to the CIST are subject to the rules and path costs of the complete bridged LAN as determined by the CIST's vectors. Frames other than these are subject to the CIST when travelling outside their region, and subject to its particular MSTI inside the region.

The following operational rules apply:

- Each bridge can be a member of only one region.
- A data frame is associated with a single VID.
- Data frames with a given VID are associated with either the CIST or their particular MSTI, but not both.

The role of the Common Spanning Tree (CST) in a network, and the Common and Internal Spanning Tree (CIST) configured on each device, is to prevent loops within a wider network that may span more than one MSTP region and parts of the network running in legacy STP or RSTP mode.

CIST first allocates root and designated bridges by selecting the bridge with the lowest identifier as the root. MSTP then deals with any loops between the regions in the CST. It does this by considering the CIST "vectors" in the following order:

1. CIST External Root Path Cost
2. CIST Regional Root Identifier
3. CIST Internal Root Path Cost
4. CIST Designated Bridge Identifier
5. CIST Designated Port Identifier
6. CIST Receiving Port Identifier

MSTP Bridge Protocol Data Units (BPDUs)

The main function of bridge protocol data units is to enable MSTP to select its root bridges for the CIST ("Common and Internal Spanning Tree (CIST)" on page 18.15) and each MSTI. MSTP is compatible with earlier spanning tree versions; its Bridge Protocol Data Unit (BPDU) formats build on earlier versions ("Compatibility with Previous Spanning Tree Protocols" on page 18.15).

Table 18-7 shows the standardized format for MSTP BPDU messages. The general format of the BPDUs comprise a common generic portion—octets 1 to 36—that are based on those defined in IEEE Standard 802.1D, 1998, followed by components that are specific to CIST—octets 37 to 102. Components specific to each MSTI are added to this BPDU data block.

Table 18-7: MSTP Bridge Protocol Data Units (BPDUs)

Field Name	Octets	Description
Protocol Identifier	1–2	Protocol being used. The value 0000 0000 0000 0000 identifies the spanning tree algorithm and protocol.
Protocol Version Identifier	3	Identifies the protocol version used.
BPDU Type	4	Value 0000 0000 specifies a configuration BPDU.
CIST Flags	5	Bit 1 is the topology change flag. Bit 2 conveys the CIST proposal flag in RST and MST BPDUs - unused in STP. Bits 3 & 4 convey the CIST port role in RST, and MST BPDUs - unused in STP. Bit 5 conveys the CIST learning flag in RST and MST BPDUs - unused in STP. Bit 6 conveys the CIST forwarding flag in RST and MST BPDUs - unused in STP. Bit 7 conveys the CIST agreement flag in RST and MST BPDUs - unused in STP. Bit 8 conveys the topology change acknowledge flag in STP configuration BPDUs - unused in RSTP and MSTP BPDUs.
CIST Root Identifier	6–13	The Bridge identifier of the CIST Root
CIST External Path Cost	14–17	The path cost between MST regions from the transmitting bridge to the CIST root.
CIST Regional Root Identifier	18–25	ID of the current CIST regional root bridge.
CIST Port Identifier	26–27	CIST port identifier of the transmitting bridge port.
Message Age	28–29	Message age timer value.
Max Age	30–31	Timeout value to be used by all bridges in the bridged network. This value is set by the root. Some implementations of MSTP may choose not to use this value.
Hello Time	32–33	Time interval between the generation of configuration BPDUs by the root bridge.
Forward Delay	34–35	A timeout value used to ensure forward delay timer consistency when transferring a port to the forwarding state. It is also used for ageing filtering database dynamic entries following changes in the active topology.

Table 18-7: MSTP Bridge Protocol Data Units (BPDUs)(cont.)

Field Name	Octets	Description
Version 1 Length	36	Used to convey the Version 1 length. It is always transmitted as 0.
Version 3 Length	37–38	Used to convey the Version 3 length. It is the number of octets taken by the parameters that follow in the BPDU.
MST Configuration Identifier	39–89	An identifier comprising elements of the following: Format Selector Configuration Name Revision Level Configuration Digest.
CIST Internal Root Path Cost	90–93	Path cost to the CIST regional root.
CIST Bridge Identifier	94–101	CIST bridge identifier of the transmitting bridge.
CIST Remaining Hops	102	Remaining hops which limits the propagation and longevity of received spanning tree information for the CIST.
MSTI Configuration Messages (may be absent)	103–39 plus Version 3 Length	See Table 18-8.

Table 18-8: MSTI configuration messages

Field Name	Octets	Description
MSTI Flags	1	Bits 1 through 8, convey the topology change flag, proposal flag, port role (two bits), Learning flag, forwarding flag, agreement flag, and master flag for this MSTI.
MSTI Regional Root Identifier	2–9	This includes the value of the MSTID for this configuration message encoded in bits 4 through 1 of octet 1, and bits 8 through 1 of octet 2.
MSTI Internal Root Path Cost	10-13	Internal Root Path Cost.
MSTI Bridge Priority	14	Bits 5 through 8 convey the value of the bridge identifier priority for this MSTI. Bits 1 through 4 of Octet 14 are transmitted as 0, and ignored on receipt.
MSTI Port Priority	15	Bits 5 through 8 are used to convey the value of the port identifier priority for this MSTI. Bits 1 through 4 are transmitted as 0, and ignored on receipt.
MSTI Remaining Hops	16	Value of remaining hops for this MSTI.

Configuring MSTP

By default, RSTP is enabled with default settings on all switch ports. To configure MSTP, see the configuration procedure in Table 18-9.

To configure other modes, see "Configuring RSTP" on page 18.9 or "Configuring STP" on page 18.6.

For detailed configuration examples, see the How To Note *How To Configure Basic Switching Functionality*, available from website at http://www.alliedtelesis.com.

Configuration guidelines for MSTP

- Switches must have the same MST configuration identification elements (region name, revision level and VLAN to MSTI mapping) to be in the same MST region. When configuring multiple MST regions for MSTP, MSTIs are locally significant within an MST region. MSTIs will not span from one region to another region.
- Common and Internal Spanning Tree (CIST) is the default spanning tree instance for MSTP. This means that all VLANs that are not explicitly configured into another MSTI are members of the CIST.
- The software supports a single instance of the MSTP Algorithm consisting of the CIST and up to 15 MSTIs.
- A VLAN can only be mapped to one MSTI or to the CIST. One VLAN mapped to multiple spanning trees is not allowed. All the VLANs are mapped to the CIST by default. Once a VLAN is mapped to a specified MSTI, it is removed from the CIST.
- An MSTI is locally significant within an MST region. An MSTI cannot span across multiple MST regions. The CIST is the spanning tree instance for connecting different MST regions and single spanning tree entities, such as RSTP and STP switches.
- MSTP is compatible with RSTP and STP. An MST region appears as a virtual bridge connecting to single spanning tree entities.
- To avoid unnecessary STP processing, a port that attaches to a LAN that is known to have no other bridges/switches attached can be configured as an edge port.

Before configuring MSTP

Before configuring MSTP, configure VLANs and associate them with switch ports (Chapter 16, VLAN Introduction and Chapter 17, VLAN Commands), and determine for your network:

- which MSTP regions, revision level and instances are required
- which VLANs and switch ports will belong to which MSTIs,
- which devices you want to be root bridges for each MSTI

Table 18-9: Configuration procedure for MSTP

Command	Description
`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`spanning-tree mode mstp`	By default, the device is in RSTP mode. Change to MSTP mode.
`awplus(config)#`	
`spanning-tree enable`	By default, spanning tree is enabled on all switch ports. If it has been disabled, enable it for MSTP.

Table 18-9: Configuration procedure for MSTP(cont.)

Configure MSTP region, revision, and instances	
All MSTP devices in this region of the network must have the same region name, revision number, and VLAN to MSTI mappings.	
`awplus(config)#`	
`spanning-tree mst configuration`	Enter MST Configuration mode.
`awplus(config-mst)#`	
`region <region-name>`	Specify the MSTP region. The region-name parameter is an arbitrary string that specifies the name you want to assign to the MST region for identification.
`awplus(config-mst)#`	
`revision <revision-number>`	The revision-number parameter specifies the revision of the current MST configuration. The revision is an arbitrary number that you assign to an MST region. It can be used to keep track of the number of times that MST configuration has been updated for the network. Specify the MST revision number in the range 0 to 255.
`awplus(config-mst)#`	
`instance <msti-id> vlan {<vid>|<vid-list>}`	To allow MSTP to block traffic for different VLANs in different places in a loop, create multiple MSTP instances and associate VLANs with them. Each VLAN can only be in one instance. Specify the MST instance ID in the range 1 to 15.
Advanced configuration	
The commands above are the minimum required to configure MSTP. The following commands allow more advanced configuration.	
Assign root bridge priorities	
MSTP lets you distribute traffic more efficiently across a network by blocking different links for different VLANs. You do this by making different devices into the root bridge for each MSTP instance, and for the CIST, so that each instance blocks a different link. By default, all devices have the same root bridge priority, 32768 (8000 in hexadecimal), so the device with the lowest MAC address becomes the root bridge. If you want the device to be the root bridge for an instance or for the CIST, set the priority to a lower value (a higher priority) than other devices for this instance. (If you enter a number that is not a multiple of 4096, the device rounds the number down.)	
`awplus(config)#`	
`spanning-tree mst configuration`	Enter MST Configuration mode.
`awplus(config-mst)#`	
`instance <msti-id> priority <priority>`	Set the priority for the device to become the root bridge for each instance. Specify the MST instance ID in the range 1 to 15. Specify the root bridge priority in the range 0 to 61440. If you enter a number that is not a multiple of 4096, the switch rounds the number down.
`awplus(config-mst)#`	
`exit`	Return to Global Configuration mode.

Table 18-9: Configuration procedure for MSTP(cont.)

`awplus(config)#`	
`spanning-tree priority <priority>`	Set the priority for the device to become the root bridge for the CIST. Specify the bridge priority in the range 0 to 61440. If you enter a number that is not a multiple of 4096, the switch rounds the number down.
Configure edge ports	
If some switch ports are connected to devices that cannot generate BPDUs (such as workstations), you can set particular switch ports as edge ports, or set them to automatically detect whether they are edge ports.	
`awplus(config)#`	
`interface <port-list>`	Enter Interface Configuration mode for these switch ports.
`awplus(config-if)#`	
`spanning-tree edgeport (RSTP and MSTP)`	Set these ports to be edge ports,
or	or
`awplus(config-if)#`	
`spanning-tree autoedge (RSTP and MSTP)`	set these ports to automatically detect whether they are edge ports.
Configure Root Guard	
`awplus(config-if)#`	
`spanning-tree guard root`	The Root Guard feature makes sure that the port on which it is enabled is a designated port. If the Root Guard enabled port receives a superior BPDU, it goes to a Listening state (for STP) or discarding state (for RSTP and MSTP). Enable the Guard Root feature if required.
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
Configure BPDU Guard	
`awplus(config)#`	
`spanning-tree portfast bpdu-guard`	If required, enable the BPDU Guard feature.
`awplus(config)#`	
`spanning-tree errdisable-timeout enable`	Set a timeout for ports that are disabled due to the BPDU guard feature.
`awplus(config)#`	
`spanning-tree errdisable-timeout interval <10-1000000>`	Specify the time interval after which a port is brought back up when it has been disabled by the BPDU guard feature.

Table 18-9: Configuration procedure for MSTP(cont.)

Check MSTP configuration	
`awplus(config)#`	
`exit`	Return to Privileged Exec mode.
`awplus#`	
`show spanning-tree mst config`	Check that the digest is the same on this device as for all other devices in the same region.
`awplus#`	
`show spanning-tree mst`	Check the MST to VLAN and port mapping.
`awplus#`	
`show spanning-tree mst instance <instance>`	Check the detailed information for a particular instance, and all switch ports associated with that instance. Specify the MST instance ID in the range 1 to 15.
`awplus#`	
`show spanning-tree mst interface <port>`	Check general information about MSTP, and the CIST settings.

Advanced configuration: For most networks, the default settings of the following will be suitable. However, you can also configure them.

- path costs for ports in an MSTI (spanning-tree mst instance path-cost) or for the CIST (spanning-tree path-cost)
- port priority for ports in an MSTI (spanning-tree mst instance priority) or for the CIST (spanning-tree priority (port priority))

Chapter 19: Spanning Tree Commands

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Command List

This chapter provides an alphabetical reference for commands used to configure RSTP, STP or MSTP. For information about spanning trees, including configuration procedures, see Chapter 18, Spanning Tree Introduction: STP, RSTP, and MSTP

clear spanning-tree statistics

Use this command to clear all the STP BPDU (Bridge Protocol Data Unit) statistics.

Syntax

```
clear spanning-tree statistics

clear spanning-tree statistics [instance <mstp-instance>]

clear spanning-tree statistics
   [interface <port> [instance <mstp-instance>]]
```

Parameter	Description
<port>	The port to clear STP BPDU statistics for. The port may be a switch port (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).
<mstp-instance>	The MSTP instance (MSTI - Multiple Spanning Tree Instance) to clear MSTP BPDU statistics.

Mode User Exec and Privileged Exec

Usage Use this command with the instance parameter in MSTP mode. Specifying this command with the interface parameter only not the instance parameter will work in STP and RSTP mode.

Examples

```
awplus# clear spanning-tree statistics

awplus# clear spanning-tree statistics instance 1

awplus# clear spanning-tree statistics interface port1.0.2

awplus# clear spanning-tree statistics interface port1.0.2
       instance 1
```

clear spanning-tree detected protocols (RSTP and MSTP)

Use this command to clear the detected protocols for a specific port, or all ports.

Use this command in RSTP or MSTP mode only.

Syntax `clear spanning-tree detected protocols [interface <port>]`

Parameter	Description
<port>	The port to clear detected protocols for. The port may be a switch port (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).

Mode Privileged Exec

Example

```
awplus# clear spanning-tree detected protocols
```

debug mstp (RSTP and STP)

Use this command to enable debugging for the configured spanning tree mode, and echo data to the console, at various levels. Note that although this command uses the keyword mstp it displays debugging output for RSTP and STP protocols as well the MSTP protocol.

Use the no variant of this command to disable spanning tree debugging.

Syntax

```
debug mstp {all|cli|protocol [detail]|timer [detail]}
debug mstp {packet {rx|tx} [decode] [interface <interface>]}
debug mstp {topology-change [interface <interface>]}
no debug mstp {all|cli|protocol [detail]|timer [detail]}
no debug mstp {packet {rx|tx} [decode] [interface <interface>]}
no debug mstp {topology-change [interface <interface>]}
```

Parameter	Description
`all`	Echoes all spanning tree debugging levels to the console.
`cli`	Echoes spanning tree commands to the console.
`packet`	Echoes spanning tree packets to the console.
`rx`	Received packets.
`tx`	Transmitted packets.
`protocol`	Echoes protocol changes to the console.
`timer`	Echoes timer information to the console.
`detail`	Detailed output.
`decode`	Interprets packet contents
`topology-change`	Interprets topology change messages
`interface`	Keyword before *<interface>* placeholder to specify an interface to debug
<interface>	Placeholder used to specify the name of the interface to debug.

Mode Privileged Exec and Global Configuration mode

Usage 1 Use the debug mstp topology-change interface command to generate debugging messages when the switch receives an indication of a topology change in a BPDU from another device. The debugging can be activated on a per-port basis. Although this command uses the keyword mstp, it displays debugging output for RSTP and STP protocols as well as the MSTP protocol.

Due to the likely volume of output, these debug messages are best viewed using the terminal monitor command on page 8.76 before issuing the relevant debug mstp command. The default terminal monitor filter will select and display these messages. Alternatively, the messages can be directed to any of the other log outputs by adding a filter for the MSTP application using log buffered (filter) command on page 10.9:

```
awplus# configure terminal
awplus(config)# log buffered program mstp
```

Output 1

```
awplus#terminal monitor
awplus#debug mstp topology-change interface port1.0.19
10:09:09 awplus MSTP[1409]: Topology change rcvd on port1.0.19 (internal)
10:09:09 awplus MSTP[1409]: Topology change rcvd on MSTI 1 port1.0.19
aawplus#debug mstp topology-change interface port1.0.21
10:09:29 awplus MSTP[1409]: Topology change rcvd on port1.0.21 (external)
10:09:29 awplus MSTP[1409]: Topology change rcvd on MSTI 1 port1.0.21
```

Usage 2 Use the debug mstp packet rx|tx decode interface command to generate debugging messages containing the entire contents of a BPDU displayed in readable text for transmitted and received xSTP BPDUs. The debugging can be activated on a per-port basis and transmit and receive debugging is controlled independently. Although this command uses the keyword mstp, it displays debugging output for RSTP and STP protocols as well as the MSTP protocol.

Due to the likely volume of output, these debug messages are best viewed using the terminal monitor command on page 8.76 before issuing the relevant debug mstp command. The default terminal monitor filter will select and display these messages. Alternatively, the messages can be directed to any of the other log outputs by adding a filter for the MSTP application using the log buffered (filter) command on page 10.9:

```
awplus(config)# log buffered program mstp
```

Output 2 In MSTP mode - an MSTP BPDU with 1 MSTI:

```
awplus#terminal monitor
awplus#debug mstp packet rx decode interface port1.0.19
17:23:42 awplus MSTP[1417]: port1.0.19 xSTP BPDU rx - start
17:23:42 awplus MSTP[1417]: Protocol version: MSTP, BPDU type: RST
17:23:42 awplus MSTP[1417]: CIST Flags:  Agree Forward Learn role=Desig
17:23:42 awplus MSTP[1417]: CIST root id      : 0000:0000cd1000fe
17:23:42 awplus MSTP[1417]: CIST ext pathcost : 0
17:23:42 awplus MSTP[1417]: CIST reg root id  : 0000:0000cd1000fe
17:23:42 awplus MSTP[1417]: CIST port id      : 8001 (128:1)
17:23:42 awplus MSTP[1417]: msg age: 0 max age: 20 hellotime: 2 fwd delay: 15
17:23:42 awplus MSTP[1417]: Version 3 length : 80
17:23:42 awplus MSTP[1417]: Format id      : 0
17:23:42 awplus MSTP[1417]: Config name    : test
17:23:42 awplus MSTP[1417]: Revision level : 0
17:23:42 awplus MSTP[1417]: Config digest  : 3ab68794d602fdf43b21c0b37ac3bca8
17:23:42 awplus MSTP[1417]: CIST int pathcost : 0
17:23:42 awplus MSTP[1417]: CIST bridge id    : 0000:0000cd1000fe
17:23:42 awplus MSTP[1417]: CIST hops remaining : 20
17:23:42 awplus MSTP[1417]: MSTI flags           : Agree Forward Learn role=Desig
17:23:42 awplus MSTP[1417]: MSTI reg root id     : 8001:0000cd1000fe
17:23:42 awplus MSTP[1417]: MSTI pathcost        : 0
17:23:42 awplus MSTP[1417]: MSTI bridge priority : 32768 port priority : 128
17:23:42 awplus MSTP[1417]: MSTI hops remaining  : 20
17:23:42 awplus MSTP[1417]: port1.0.19 xSTP BPDU rx - finish
```

In STP mode transmitting a TCN BPDU:

```
awplus#terminal monitor
awplus#debug mstp packet tx decode interface port1.0.19
17:28:09 awplus MSTP[1417]: port1.0.19 xSTP BPDU tx - start
17:28:09 awplus MSTP[1417]: Protocol version: STP, BPDU type: TCN
17:28:09 awplus MSTP[1417]: port1.0.19 xSTP BPDU tx - finish
```

In STP mode receiving an STP BPDU:

```
awplus#terminal monitor
awplus#debug mstp packet rx decode interface port1.0.19
17:31:36 awplus MSTP[1417]: port1.0.19 xSTP BPDU rx - start
17:31:36 awplus MSTP[1417]: Protocol version: STP, BPDU type: Config
17:31:36 awplus MSTP[1417]: Flags:  role=none
17:31:36 awplus MSTP[1417]: Root id      : 8000:0000cd1000fe
17:31:36 awplus MSTP[1417]: Root pathcost : 0
17:31:36 awplus MSTP[1417]: Bridge id  : 8000:0000cd1000fe
17:31:36 awplus MSTP[1417]: Port id      : 8001 (128:1)
17:31:36 awplus MSTP[1417]: msg age: 0 max age: 20 hellotime: 2 fwd delay: 15
17:31:36 awplus MSTP[1417]: ort1.0.19 xSTP BPDU rx - finish
```

In RSTP mode receiving an RSTP BPDU:

```
awplus#terminal monitor
awplus#debug mstp packet rx decode interface port1.0.19
awplus#17:30:17 awplus MSTP[1417]: port1.0.19 xSTP BPDU rx - start
17:30:17 awplus MSTP[1417]: Protocol version: RSTP, BPDU type: RST
17:30:17 awplus MSTP[1417]: CIST Flags:  Forward Learn role=Desig
17:30:17 awplus MSTP[1417]: CIST root id      : 8000:0000cd1000fe
17:30:17 awplus MSTP[1417]: CIST ext pathcost : 0
17:30:17 awplus MSTP[1417]: CIST reg root id  : 8000:0000cd1000fe
17:30:17 awplus MSTP[1417]: CIST port id      : 8001 (128:1)
17:30:17 awplus MSTP[1417]: msg age: 0 max age: 20 hellotime: 2 fwd delay: 15
17:30:17 awplus MSTP[1417]: port1.0.19 xSTP BPDU rx - finish
```

Examples

```
awplus# debug mstp all

awplus# debug mstp cli

awplus# debug mstp packet rx

awplus# debug mstp protocol detail

awplus# debug mstp timer

awplus# debug mstp packet rx decode interface port1.0.2

awplus# debug mstp packet tx decode interface port1.0.12
```

Related commands

log buffered (filter)
show debugging mstp
terminal monitor
undebug mstp

instance priority (MSTP)

Use this command to set the priority for this device to become the root bridge for the specified MSTI (Multiple Spanning Tree Instance).

Use this command for MSTP only.

Use the no variant of this command to restore the root bridge priority of the device for the instance to the default.

Syntax

```
instance <msti-id> priority <priority>
no instance <msti-id> priority
```

Parameter	Description
<msti-id>	Specify the The MST instance ID in the range <1-63>.
<priority>	Specify the root bridge priority for the device for the MSTI in the range <0-61440>. Note that a lower priority number indicates a greater likelihood of the device becoming the root bridge. The priority values can be set only in increments of 4096. If you specify a number that is not a multiple of 4096, it will be rounded down. The default priority is 32768.

Default The default priority value for all instances is 32768.

Mode MST Configuration Mode

Usage MSTP lets you distribute traffic more efficiently across a network by blocking different links for different VLANs. You do this by making different devices into the root bridge for each MSTP instance, so that each instance blocks a different link.

If all devices have the same root bridge priority for the instance, MSTP selects the device with the lowest MAC address to be the root bridge. Give the device a higher priority for becoming the root bridge for a particular instance by assigning it a lower priority number, or vice versa.

Examples To set the root bridge priority for MSTP instance 2 to be the highest (0), so that it will be the root bridge for this instance when available, use the commands:

```
awplus# configure terminal
awplus(config)# spanning-tree mst configuration
awplus(config-mst)# instance 2 priority 0
```

To reset the root bridge priority for instance 2 to the default (32768), use the commands:

```
awplus# configure terminal
awplus(config)# spanning-tree mst configuration
awplus(config-mst)# no instance 2 priority
```

Related Commands

region (MSTP)
revision (MSTP)
show spanning-tree mst config
spanning-tree mst instance
spanning-tree mst instance priority

instance vlan (MSTP)

Use this command to create an MST Instance (MSTI), and associate the specified VLANs with it. An MSTI is a spanning tree instance that exists within an MST region (MSTR). An MSTR can contain up to 63 MSTIs.

When a VLAN is associated with an MSTI the member ports of the VLAN are automatically configured to send and receive spanning-tree information for the associated MSTI. You can disable this automatic configuration of member ports of the VLAN to the associated MSTI by using a no spanning-tree mst instance command to remove the member port from the MSTI.

Use the instance vlan command for MSTP only.

Use the no variant of this command to remove the specified VLANs from the MSTI.

Syntax

```
instance <msti-id> vlan {<vid>|<vid-list>}
no instance <msti-id> vlan {<vid>|<vid-list>}
```

Parameter	Description
<msti-id>	Specify the MST instance ID <1-63>.
<vid>	Specify a VLAN identifier (VID) in the range <1-4094> to be associated with the MSTI specified.
<vid-list>	A hyphen-separated range or a comma-separated list of VLAN IDs

Mode MST Configuration mode

Usage The VLANs must be created before being associated with an MST instance (MSTI). If the VLAN range is not specified, the MSTI will not be created.

This command removes the specified VLANs from the CIST and adds them to the specified MSTI. If you use the no variant of this command to remove the VLAN from the MSTI, it returns it to the CIST. To move a VLAN from one MSTI to another, you must first use the no variant of this command to return it to the CIST.

Ports in these VLANs will remain in the control of the CIST until you associate the ports with the MSTI using the spanning-tree mst instance command.

Example

```
awplus# configure terminal
awplus(config)# spanning-tree mode mstp
awplus(config)# spanning-tree mst configuration
awplus(config-mst)# instance 2 vlan 30
```

Related Commands

region (MSTP)
revision (MSTP)
show spanning-tree mst config
spanning-tree mst instance
vlan

region (MSTP)

Use this command to assign a name to the device's MST Region. MST Instances (MSTI) of a region form different spanning trees for different VLANs.

Use this command for MSTP only.

Use the no variant of this command to remove this region name and reset it to the default.

Syntax

```
region <region-name>
no region
```

Parameter	Description
<region-name>	Specify the name of the region, up to 32 characters. Valid characters are upper-case, lower-case, digits, underscore.

Default By default, the region name is My Name.

Mode MST Configuration mode

Usage The region name, the revision number, and the digest of the VLAN to MSTI configuration table must be the same on all devices that are intended to be in the same MST region.

Example

```
awplus# configure terminal
awplus(config)# spanning-tree mst configuration
awplus(config-mst)# region ATL
```

Related Commands revision (MSTP)
show spanning-tree mst config

revision (MSTP)

Use this command to specify the MST revision number to be used in the configuration identifier.

Use this command for MSTP only.

Syntax `revision <revision-number>`

Parameter	Description
<revision-number>	<0-255> Revision number.

Default The default of revision number is 0.

Mode MST Configuration Mode

Usage The region name, the revision number, and the digest of the VLAN to MSTI configuration table must be the same on all devices that are intended to be in the same MST region.

Example

```
awplus# configure terminal
awplus(config)# spanning-tree mst configuration
awplus(config-mst)# revision 25
```

Related Commands region (MSTP)
show spanning-tree mst config
instance vlan (MSTP)

show debugging mstp

Use this command to show the MSTP debugging options set.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show debugging mstp`

Mode User Exec and Privileged Exec mode

Example To display the MSTP debugging options set, enter the command:

```
awplus# show debugging mstp
```

Output Figure 19-1: Example output from the **show debugging mstp** command

```
MSTP debugging status:
  MSTP receiving packet debugging is on
```

Related Commands debug mstp (RSTP and STP)

show spanning-tree

Use this command to display detailed spanning tree information on the specified port or on all ports. Use this command for RSTP, MSTP or STP.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show spanning-tree [interface <port-list>]`

Parameter	Description
`interface`	Display information about the following port only.
`<port-list>`	The ports to display information about. A port-list can be: ■ a switch port (e.g. `port1.0.12`) a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po3`) ■ a continuous range of ports separated by a hyphen, e.g. `port1.0.1-1.0.24`, or `sa1-2`, or `po1-4` ■ a comma-separated list of ports and port ranges, e.g. `port1.0.1,port1.0.4-1.2.24`. Do not mix switch ports, static channel groups, and dynamic (LACP) channel groups in the same list

Mode User Exec, Privileged Exec and Interface Configuration mode

Usage Note that any list of interfaces specified must not span any interfaces that are not installed.

A topology change counter has been included for RSTP and MSTP. You can see the topology change counter for RSTP by using the show spanning-tree command. You can see the topology change counter for MSTP by using the show spanning-tree mst instance command.

Example To display spanning tree information about `port1.0.23`, use the command:

```
awplus# show spanning-tree interface port1.0.23
```

Output Figure 19-2: Example output from the **show spanning-tree** command

```
% 1: Bridge up - Spanning Tree Enabled
% 1: Root Path Cost 0 - Root Port 0 -  Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20
% 1: Root Id 80000000cd20f093
% 1: Bridge Id 80000000cd20f093
% 1: last topology change Sun Nov 20 12:24:24 1977
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
%   port1.0.23: Port 5023 - Id 839f - Role Designated - State Forwarding
%   port1.0.23: Designated Path Cost 0
%   port1.0.23: Configured Path Cost 200000  - Add type Explicit ref count 1
%   port1.0.23: Designated Port Id 839f - Priority 128  -
%   port1.0.23: Root 80000000cd20f093
%   port1.0.23: Designated Bridge 80000000cd20f093
%   port1.0.23: Message Age 0 - Max Age 20
%   port1.0.23: Hello Time 2 - Forward Delay 15
%   port1.0.23: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 1 - topo change
timer 0
%   port1.0.23: forward-transitions 32
%   port1.0.23: Version Rapid Spanning Tree Protocol - Received None - Send RSTP
%   port1.0.23: No portfast configured - Current  portfast off
%   port1.0.23: portfast bpdu-guard  default  - Current portfast bpdu-guard off
%   port1.0.23: portfast bpdu-filter default  - Current portfast bpdu-filter off
%   port1.0.23: no root guard configured     - Current root guard off
%   port1.0.23: Configured Link Type point-to-point - Current point-to-point
.
.
```

The following example output is for the show spanning-tree command in RSTP mode.

Figure 19-3: Example output from the **show spanning-tree** command

```
awplus#show spanning-tree
% 1: Bridge up - Spanning Tree Enabled
% 1: Root Path Cost 0 - Root Port 0 -  Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20
% 1: Root Id 80000000cd24ff2d
% 1: Bridge Id 80000000cd24ff2d
% 1: last topology change Thu Jul 26 02:06:26 2007
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
%   port1.0.1: Port 5001 - Id 8389 - Role Disabled - State Discarding
%   port1.0.1: Designated Path Cost 0
%   port1.0.1: Configured Path Cost 20000000  - Add type Explicit ref count 1
%   port1.0.1: Designated Port Id 8389 - Priority 128  -
%   port1.0.1: Root 80000000cd24ff2d
%   port1.0.1: Designated Bridge 80000000cd24ff2d
%   port1.0.1: Message Age 0 - Max Age 20
%   port1.0.1: Hello Time 2 - Forward Delay 15
%   port1.0.1: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change
timer 0
%   port1.0.1: forward-transitions 0
%   port1.0.1: Version Rapid Spanning Tree Protocol - Received None - Send STP
%   port1.0.1: No portfast configured - Current  portfast off
%   port1.0.1: portfast bpdu-guard  default  - Current portfast bpdu-guard off
%   port1.0.1: portfast bpdu-filter default  - Current portfast bpdu-filter off
%   port1.0.1: no root guard configured     - Current root guard off
%   port1.0.1: Configured Link Type point-to-point - Current  shared
%
%   port1.0.2: Port 5002 - Id 838a - Role Disabled - State Discarding
%   port1.0.2: Designated Path Cost 0
%   port1.0.2: Configured Path Cost 20000000  - Add type Explicit ref count 1
%   port1.0.2: Designated Port Id 838a - Priority 128  -
%   port1.0.2: Root 80000000cd24ff2d
%   port1.0.2: Designated Bridge 80000000cd24ff2d
%   port1.0.2: Message Age 0 - Max Age 20
%   port1.0.2: Hello Time 2 - Forward Delay 15
%   port1.0.2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo change
timer 0
%   port1.0.2: forward-transitions 0
%   port1.0.2: Version Rapid Spanning Tree Protocol - Received None - Send STP
%   port1.0.2: No portfast configured - Current  portfast off
%   port1.0.2: portfast bpdu-guard  default  - Current portfast bpdu-guard off
%   port1.0.2: portfast bpdu-filter default  - Current portfast bpdu-filter off
%   port1.0.2: no root guard configured     - Current root guard off
%   port1.0.2: Configured Link Type point-to-point - Current  shared
%
```

show spanning-tree brief

Use this command to display a summary of spanning tree status information on all ports. Use this command for RSTP, MSTP or STP.

Syntax `show spanning-tree brief`

Parameter	Description
`brief`	A brief summary of spanning tree information.

Mode User Exec, Privileged Exec and Interface Configuration

Usage Note that any list of interfaces specified must not span any interfaces that are not installed.

A topology change counter has been included for RSTP and MSTP. You can see the topology change counter for RSTP by using the show spanning-tree command. You can see the topology change counter for MSTP by using the show spanning-tree mst instance command.

Example To display a summary of spanning tree status information, use the command:

```
awplus# show spanning-tree brief
```

Output Figure 19-4: Example output from the **show spanning-tree brief** command

```
Default: Bridge up - Spanning Tree Enabled
Default: Root Path Cost 40000 - Root Port 4501 -  Bridge Priority 32768
Default: Root Id 8000:0000cd250001
Default: Bridge Id 8000:0000cd296eb1

Port            Designated Bridge    Port Id    Role          State
sa1             8000:001577c9744b    8195       Rootport      Forwarding
po1             8000:0000cd296eb1    81f9       Designated    Forwarding
port1.0.1       8000:0000cd296eb1    8389       Disabled      Discarding
port1.0.2       8000:0000cd296eb1    838a       Disabled      Discarding
port1.0.3       8000:0000cd296eb1    838b       Disabled      Discarding
port1.0.4       8000:0000cd296eb1    838c       Disabled      Discarding
port1.0.5       8000:0000cd296eb1    838d       Disabled      Discarding
port1.0.6       8000:0000cd296eb1    838e       Disabled      Discarding
port1.0.9       8000:0000cd296eb1    8391       Disabled      Discarding
port1.0.10      8000:0000cd296eb1    8392       Disabled      Discarding
port1.0.11      8000:0000cd296eb1    8393       Disabled      Discarding
port1.0.12      8000:0000cd296eb1    8394       Disabled      Discarding%
```

Related Commands show spanning-tree

show spanning-tree mst

This command displays bridge-level information about the CIST and VLAN to MSTI mappings.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show spanning-tree mst`

Mode User Exec, Privileged Exec and Interface Configuration

Example To display bridge-level information about the CIST and VLAN to MSTI mappings, enter the command:

```
awplus# show spanning-tree mst
```

Output Figure 19-5: Example output from the **show spanning-tree mst** command

```
% 1: Bridge up - Spanning Tree Enabled
% 1: CIST Root Path Cost 0 - CIST Root Port 0 - CIST Bridge
Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Max-hops 20
% 1: CIST Root Id 8000000475e93ffe
% 1: CIST Reg Root Id 8000000475e93ffe
% 1: CST Bridge Id 8000000475e93ffe
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
%
%   Instance        VLAN
%   0:              1
%   2:              4
```

Related Commands show spanning-tree mst interface

show spanning-tree mst config

Use this command to display MSTP configuration identifier for the device.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show spanning-tree mst config`

Mode User Exec, Privileged Exec and Interface Configuration

Usage The region name, the revision number, and the digest of the VLAN to MSTI configuration table must be the same on all devices that are intended to be in the same MST region.

Example To display MSTP configuration identifier information, enter the command:

```
awplus# show spanning-tree mst config
```

Output Figure 19-6: Example output from the **show spanning-tree mst config** command

```
awplus#show spanning-tree mst config
%
%  MSTP Configuration Information:
%-----------------------------------------------------
%  Format Id      : 0
%  Name           : My Name
%  Revision Level : 0
%  Digest         : 0x80DEE46DA92A98CF21C603291B22880A
%-----------------------------------------------------
```

Related Commands
instance vlan (MSTP)
region (MSTP)
revision (MSTP)

show spanning-tree mst detail

This command displays detailed information about each instance, and all interfaces associated with that particular instance.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show spanning-tree mst detail`

Mode User Exec, Privileged Exec and Interface Configuration

Example To display detailed information about each instance, and all interfaces associated with them, enter the command:

```
awplus# show spanning-tree mst detail
```

Output Figure 19-7: Example output from the **show spanning-tree mst detail** command

```
% 1: Bridge up - Spanning Tree Enabled
% 1: CIST Root Path Cost 0 - CIST Root Port 0 -  CIST Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Max-hops 20
% 1: CIST Root Id 80000000cd24ff2d
% 1: CIST Reg Root Id 80000000cd24ff2d
% 1: CIST Bridge Id 80000000cd24ff2d
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
%   port1.0.1: Port 5001 - Id 8389 - Role Disabled - State Discarding
%   port1.0.1: Designated External Path Cost 0 -Internal Path Cost 0
%   port1.0.1: Configured Path Cost 20000000  - Add type Explicit ref count 1
%   port1.0.1: Designated Port Id 8389 - CIST Priority 128  -
%   port1.0.1: CIST Root 80000000cd24ff2d
%   port1.0.1: Regional Root 80000000cd24ff2d
%   port1.0.1: Designated Bridge 80000000cd24ff2d
%   port1.0.1: Message Age 0 - Max Age 20
%   port1.0.1: CIST Hello Time 2 - Forward Delay 15
%   port1.0.1: CIST Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo
change timer 0
.
.
%   port1.0.2: forward-transitions 0
%   port1.0.2: Version Multiple Spanning Tree Protocol - Received None - Send STP
%   port1.0.2: No portfast configured - Current  portfast off
%   port1.0.2: portfast bpdu-guard  default  - Current portfast bpdu-guard off
%   port1.0.2: portfast bpdu-filter default  - Current portfast bpdu-filter off
%   port1.0.2: no root guard configured     - Current root guard off
%   port1.0.2: Configured Link Type point-to-point - Current  shared
%
%   port1.0.3: Port 5003 - Id 838b - Role Disabled - State Discarding
%   port1.0.3: Designated External Path Cost 0 -Internal Path Cost 0
%   port1.0.3: Configured Path Cost 20000000  - Add type Explicit ref count 1
%   port1.0.3: Designated Port Id 838b - CIST Priority 128  -
%   port1.0.3: CIST Root 80000000cd24ff2d
%   port1.0.3: Regional Root 80000000cd24ff2d
%   port1.0.3: Designated Bridge 80000000cd24ff2d
%   port1.0.3: Message Age 0 - Max Age 20
%   port1.0.3: CIST Hello Time 2 - Forward Delay 15
%   port1.0.3: CIST Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo
change timer 0
%   port1.0.3: forward-transitions 0
%   port1.0.3: Version Multiple Spanning Tree Protocol - Received None - Send STP
%   port1.0.3: No portfast configured - Current  portfast off
%   port1.0.3: portfast bpdu-guard  default  - Current portfast bpdu-guard off
%   port1.0.3: portfast bpdu-filter default  - Current portfast bpdu-filter off
%   port1.0.3: no root guard configured     - Current root guard off
%   port1.0.3: Configured Link Type point-to-point - Current  shared
```

show spanning-tree mst detail interface

This command prints detailed information about the specified switch port, and the MST instances associated with it.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show spanning-tree mst detail interface <port>`

Parameter	Description
<port>	The port to display information about. The port may be a switch port (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).

Mode User Exec, Privileged Exec and Interface Configuration

Example To display detailed information about `port1.0.3` and the instances associated with it, enter the command:

```
awplus# show spanning-tree mst detail interface port1.0.3
```

Output Figure 19-8: Example output from the **show spanning-tree mst detail interface** command

```
% 1: Bridge up - Spanning Tree Enabled
% 1: CIST Root Path Cost 0 - CIST Root Port 0 -  CIST Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Max-hops 20
% 1: CIST Root Id 80000000cd24ff2d
% 1: CIST Reg Root Id 80000000cd24ff2d
% 1: CIST Bridge Id 80000000cd24ff2d
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
%   port1.0.2: Port 5002 - Id 838a - Role Disabled - State Discarding
%   port1.0.2: Designated External Path Cost 0 -Internal Path Cost 0
%   port1.0.2: Configured Path Cost 20000000  - Add type Explicit ref count 2
%   port1.0.2: Designated Port Id 838a - CIST Priority 128  -
%   port1.0.2: CIST Root 80000000cd24ff2d
%   port1.0.2: Regional Root 80000000cd24ff2d
%   port1.0.2: Designated Bridge 80000000cd24ff2d
%   port1.0.2: Message Age 0 - Max Age 20
%   port1.0.2: CIST Hello Time 2 - Forward Delay 15
%   port1.0.2: CIST Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo
change timer 0
%   port1.0.2: forward-transitions 0
%   port1.0.2: Version Multiple Spanning Tree Protocol - Received None - Send STP
%   port1.0.2: No portfast configured - Current  portfast off
%   port1.0.2: portfast bpdu-guard  default  - Current portfast bpdu-guard off
%   port1.0.2: portfast bpdu-filter default  - Current portfast bpdu-filter off
%   port1.0.2: no root guard configured     - Current root guard off
%   port1.0.2: Configured Link Type point-to-point - Current  shared
%
% Instance  2:  Vlans: 2
% 1: MSTI Root Path Cost 0 -MSTI Root Port 0 - MSTI Bridge Priority 32768
% 1: MSTI Root Id 80020000cd24ff2d
% 1: MSTI Bridge Id 80020000cd24ff2d
%   port1.0.2: Port 5002 - Id 838a - Role Disabled - State Discarding
%   port1.0.2: Designated Internal Path Cost 0  - Designated Port Id 838a
%   port1.0.2: Configured Internal Path Cost 20000000
%   port1.0.2: Configured CST External Path cost 20000000
%   port1.0.2: CST Priority 128  - MSTI Priority 128
%   port1.0.2: Designated Root 80020000cd24ff2d
%   port1.0.2: Designated Bridge 80020000cd24ff2d
%   port1.0.2: Message Age 0 - Max Age 0
%   port1.0.2: Hello Time 2 - Forward Delay 15
%   port1.0.2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0
```

show spanning-tree mst instance

This command displays detailed information for the specified instance, and all switch ports associated with that instance.

A topology change counter has been included for RSTP and MSTP. You can see the topology change counter for RSTP by using the show spanning-tree command. You can see the topology change counter for MSTP by using the show spanning-tree mst instance command.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show spanning-tree mst instance <instance>`

Parameter	Description
<instance>	Specify an MSTP instance in the range <1-63>.

Mode User Exec, Privileged Exec, and Interface Configuration

Usage To display detailed information for instance 2, and all switch ports associated with that instance, use the command:

```
awplus# show spanning-tree mst instance 2
```

Output Figure 19-9: Example output from the **show spanning-tree mst instance** command

```
% 1: MSTI Root Path Cost 0 - MSTI Root Port 0 - MSTI Bridge Priority 32768
% 1: MSTI Root Id 80020000cd24ff2d
% 1: MSTI Bridge Id 80020000cd24ff2d
%   port1.0.2: Port 5002 - Id 838a - Role Disabled - State Discarding
%   port1.0.2: Designated Internal Path Cost 0  - Designated Port Id 838a
%   port1.0.2: Configured Internal Path Cost 20000000
%   port1.0.2: Configured CST External Path cost 20000000
%   port1.0.2: CST Priority 128  - MSTI Priority 128
%   port1.0.2: Designated Root 80020000cd24ff2d
%   port1.0.2: Designated Bridge 80020000cd24ff2d
%   port1.0.2: Message Age 0 - Max Age 0
%   port1.0.2: Hello Time 2 - Forward Delay 15
%   port1.0.2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0
%
```

show spanning-tree mst instance interface

This command displays detailed information for the specified MST (Multiple Spanning Tree) instance, and the specified switch port associated with that MST instance.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show spanning-tree mst instance <instance> interface <port>`

Parameter	Description
<instance>	Specify an MSTP instance in the range `<1-63>`.
<port>	The port to display information about. The port may be a switch port (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).

Mode User Exec, Privileged Exec, and Interface Configuration

Example To display detailed information for `instance 2`, interface `port1.0.2`, use the command

```
awplus# show spanning-tree mst instance 2 interface port1.0.2
```

Output Figure 19-10: Example output from the **show spanning-tree mst instance** command

```
% 1: MSTI Root Path Cost 0 - MSTI Root Port 0 - MSTI Bridge Priority 32768
% 1: MSTI Root Id 80020000cd24ff2d
% 1: MSTI Bridge Id 80020000cd24ff2d
%   port1.0.2: Port 5002 - Id 838a - Role Disabled - State Discarding
%   port1.0.2: Designated Internal Path Cost 0  - Designated Port Id 838a
%   port1.0.2: Configured Internal Path Cost 20000000
%   port1.0.2: Configured CST External Path cost 20000000
%   port1.0.2: CST Priority 128  - MSTI Priority 128
%   port1.0.2: Designated Root 80020000cd24ff2d
%   port1.0.2: Designated Bridge 80020000cd24ff2d
%   port1.0.2: Message Age 0 - Max Age 0
%   port1.0.2: Hello Time 2 - Forward Delay 15
%   port1.0.2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0
%
```

show spanning-tree mst interface

This command displays the number of instances created, and VLANs associated with it for the specified switch port.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show spanning-tree mst interface <port>`

Parameter	Description
<port>	The port to display information about. The port may be a switch port (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).

Mode User Exec, Privileged Exec, and Interface Configuration

Example To display detailed information about each instance, and all interfaces associated with them, for `port1.0.4`, use the command:

```
awplus# show spanning-tree mst interface port1.0.4
```

Output Figure 19-11: Example output from the **show spanning-tree mst interface** command

```
% 1: Bridge up - Spanning Tree Enabled
% 1: CIST Root Path Cost 0 - CIST Root Port 0 - CIST Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Max-hops 20
% 1: CIST Root Id 80000008c73a2b22
% 1: CIST Reg Root Id 80000008c73a2b22
% 1: CST Bridge Id 80000008c73a2b22
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 1 sec
%
%   Instance        VLAN
%   0:              1
%   1:              2-3
%   2:              4-5
```

show spanning-tree mst detail interface

This command displays detailed information about the specified switch port, and the MST instances associated with it.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show spanning-tree mst detail interface <port>`

Parameter	Description
<port>	The port to display information about. The port may be a switch port (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).

Mode User Exec, Privileged Exec and Interface Configuration

Example To display detailed information about `port1.0.3` and the instances associated with it, enter the command:

```
awplus# show spanning-tree mst detail interface port1.0.3
```

Output Figure 19-12: Example output from the **show spanning-tree mst detail interface** command

```
% 1: Bridge up - Spanning Tree Enabled
% 1: CIST Root Path Cost 0 - CIST Root Port 0 -  CIST Bridge Priority 32768
% 1: Forward Delay 15 - Hello Time 2 - Max Age 20 - Max-hops 20
% 1: CIST Root Id 80000000cd24ff2d
% 1: CIST Reg Root Id 80000000cd24ff2d
% 1: CIST Bridge Id 80000000cd24ff2d
% 1: portfast bpdu-filter disabled
% 1: portfast bpdu-guard disabled
% 1: portfast errdisable timeout disabled
% 1: portfast errdisable timeout interval 300 sec
%   port1.0.2: Port 5002 - Id 838a - Role Disabled - State Discarding
%   port1.0.2: Designated External Path Cost 0 -Internal Path Cost 0
%   port1.0.2: Configured Path Cost 20000000  - Add type Explicit ref count 2
%   port1.0.2: Designated Port Id 838a - CIST Priority 128  -
%   port1.0.2: CIST Root 80000000cd24ff2d
%   port1.0.2: Regional Root 80000000cd24ff2d
%   port1.0.2: Designated Bridge 80000000cd24ff2d
%   port1.0.2: Message Age 0 - Max Age 20
%   port1.0.2: CIST Hello Time 2 - Forward Delay 15
%   port1.0.2: CIST Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0 - topo
change timer 0
%   port1.0.2: forward-transitions 0
%   port1.0.2: Version Multiple Spanning Tree Protocol - Received None - Send STP
%   port1.0.2: No portfast configured - Current  portfast off
%   port1.0.2: portfast bpdu-guard  default  - Current portfast bpdu-guard off
%   port1.0.2: portfast bpdu-filter default  - Current portfast bpdu-filter off
%   port1.0.2: no root guard configured     - Current root guard off
%   port1.0.2: Configured Link Type point-to-point - Current  shared
%
% Instance  2:  Vlans: 2
% 1: MSTI Root Path Cost 0 -MSTI Root Port 0 - MSTI Bridge Priority 32768
% 1: MSTI Root Id 80020000cd24ff2d
% 1: MSTI Bridge Id 80020000cd24ff2d
%   port1.0.2: Port 5002 - Id 838a - Role Disabled - State Discarding
%   port1.0.2: Designated Internal Path Cost 0  - Designated Port Id 838a
%   port1.0.2: Configured Internal Path Cost 20000000
%   port1.0.2: Configured CST External Path cost 20000000
%   port1.0.2: CST Priority 128  - MSTI Priority 128
%   port1.0.2: Designated Root 80020000cd24ff2d
%   port1.0.2: Designated Bridge 80020000cd24ff2d
%   port1.0.2: Message Age 0 - Max Age 0
%   port1.0.2: Hello Time 2 - Forward Delay 15
%   port1.0.2: Forward Timer 0 - Msg Age Timer 0 - Hello Timer 0
```

show spanning-tree statistics

This command displays BPDU (Bridge Protocol Data Unit) statistics for all spanning-tree instances, and all switch ports associated with all spanning-tree instances. For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show spanning-tree statistics`

Mode Privileged Exec

Usage To display BPDU statistics for all spanning-tree instances, and all switch ports associated with all spanning-tree instances, use the command:

```
awplus# show spanning-tree statistics
```

Output Figure 19-13: Example output from the **show spanning-tree statistics** command

```
Port number = 915 Interface = port1.0.11
                ================================
% BPDU Related Parameters
% ------------------------
% Port Spanning Tree                  : Disable
% Spanning Tree Type                  : Rapid Spanning Tree Protocol
% Current Port State                  : Discarding
% Port ID                             : 8393
% Port Number                         : 393
% Path Cost                           : 20000000
% Message Age                         : 0
% Designated Root                     : ec:cd:6d:20:c0:ed
% Designated Cost                     : 0
% Designated Bridge                   : ec:cd:6d:20:c0:ed
% Designated Port Id                  : 8393
% Top Change Ack                      : FALSE
% Config Pending                      : FALSE
% PORT Based Information & Statistics
% ----------------------------------
% Config Bpdu's xmitted               : 0
% Config Bpdu's received              : 0
% TCN Bpdu's xmitted                  : 0
% TCN Bpdu's received                 : 0
% Forward Trans Count                 : 0
% STATUS of Port Timers
% ---------------------
% Hello Time Configured               : 2
% Hello timer                         : INACTIVE
% Hello Time Value                    : 0
% Forward Delay Timer                 : INACTIVE
% Forward Delay Timer Value           : 0
% Message Age Timer                   : INACTIVE
% Message Age Timer Value             : 0
% Topology Change Timer               : INACTIVE
% Topology Change Timer Value         : 0
% Hold Timer                          : INACTIVE
% Hold Timer Value                    : 0
% Other Port-Specific Info
  ------------------------
% Max Age Transitions                 : 1
% Msg Age Expiry                      : 0
% Similar BPDUS Rcvd                  : 0
% Src Mac Count                       : 0
% Total Src Mac Rcvd                  : 0
% Next State                          : Learning
% Topology Change Time                : 0
```

show spanning-tree statistics instance

This command displays BPDU (Bridge Protocol Data Unit) statistics for the specified MST (Multiple Spanning Tree) instance, and all switch ports associated with that MST instance. For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show spanning-tree statistics instance <instance>`

Parameter	Description
<instance>	Specify an MSTP instance in the range <1-63>.

Mode Privileged Exec

Usage To display BPDU statistics information for MST instance 2, and all switch ports associated with that MST instance, use the command:

```
awplus# show spanning-tree statistics instance 2
```

Output Figure 19-14: Example output from the **show spanning-tree statistics instance** command:

```
% % INST_PORT port1.0.3 Information & Statistics
% ----------------------------------------
% Config Bpdu's xmitted (port/inst)    : (0/0)
% Config Bpdu's received (port/inst)   : (0/0)
% TCN Bpdu's xmitted (port/inst)       : (0/0)
% TCN Bpdu's received (port/inst)      : (0/0)
% Message Age(port/Inst)               : (0/0)
% port1.0.3: Forward Transitions                : 0
% Next State                           : Learning
% Topology Change Time                 : 0
% INST_PORT port1.0.4 Information & Statistics
% ----------------------------------------
% Config Bpdu's xmitted (port/inst)    : (0/0)
% Config Bpdu's received (port/inst)   : (0/0)
% TCN Bpdu's xmitted (port/inst)       : (0/0)
% TCN Bpdu's received (port/inst)      : (0/0)
% Message Age(port/Inst)               : (0/0)
% port1.0.4: Forward Transitions                : 0
% Next State                           : Learning
% Topology Change Time                 : 0
% INST_PORT port1.0.5 Information & Statistics
% ----------------------------------------
% Config Bpdu's xmitted (port/inst)    : (0/0)
% Config Bpdu's received (port/inst)   : (0/0)
% TCN Bpdu's xmitted (port/inst)       : (0/0)
% TCN Bpdu's received (port/inst)      : (0/0)
% Message Age(port/Inst)               : (0/0)
% port1.0.5: Forward Transitions                : 0
% Next State                           : Learning
% Topology Change Time                 : 0%
```

Related commands show spanning-tree statistics

show spanning-tree statistics instance interface

This command displays BPDU (Bridge Protocol Data Unit) statistics for the specified MST (Multiple Spanning Tree) instance and the specified switch port associated with that MST instance.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show spanning-tree statistics instance <instance> interface <port>`

Parameter	Description
`<instance>`	Specify an MSTP instance in the range `<1-63>`.
`<port>`	The port to display information about. The port may be a switch port (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).

Mode Privileged Exec

Example To display BPDU statistics for MST `instance 2`, interface `port1.0.2`, use the command

```
awplus# show spanning-tree statistics instance 2 interface
       port1.0.2
```

Output Figure 19-15: Example output from the **show spanning-tree statistics instance interface** command

```
awplus#sh spanning-tree statistics interface port1.0.2 instance 1
        Spanning Tree Enabled for Instance : 1
        ==================================
% INST_PORT port1.0.2 Information & Statistics
% ---------------------------------------
% Config Bpdu's xmitted (port/inst)     : (0/0)
% Config Bpdu's received (port/inst)    : (0/0)
% TCN Bpdu's xmitted (port/inst)        : (0/0)
% TCN Bpdu's received (port/inst)       : (0/0)
% Message Age(port/Inst)                : (0/0)
% port1.0.2: Forward Transitions                  : 0
% Next State                            : Learning
% Topology Change Time                  : 0

% Other Inst/Vlan Information & Statistics
% ---------------------------------------
% Bridge Priority                     : 0
% Bridge Mac Address                  : ec:cd:6d:20:c0:ed
% Topology Change Initiator           : 5023
% Last Topology Change Occured        : Mon Aug 22 05:42:06 2011
% Topology Change                     : FALSE
% Topology Change Detected            : FALSE
% Topology Change Count               : 1
% Topology Change Last Recvd from     : 00:00:00:00:00:00
```

Related commands show spanning-tree statistics

show spanning-tree statistics interface

This command displays BPDU (Bridge Protocol Data Unit) statistics for the specified switch port, and all MST instances associated with that switch port.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show spanning-tree statistics interface <port>`

Parameter	Description
<port>	The port to display information about. The port may be a switch port (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).

Mode Privileged Exec

Example To display BPDU statistics about each MST instance for `port1.0.4`, use the command:

```
awplus# show spanning-tree statistics interface port1.0.4
```

Output Figure 19-16: Example output from the **show spanning-tree statistics interface** command

```
awplus#show spanning-tree statistics interface port1.0.2

                Port number = 906 Interface = port1.0.2
                ================================
% BPDU Related Parameters
% ------------------------
% Port Spanning Tree                  : Disable
% Spanning Tree Type                  : Multiple Spanning Tree Protocol
% Current Port State                  : Discarding
% Port ID                             : 838a
% Port Number                         : 38a
% Path Cost                           : 20000000
% Message Age                         : 0
% Designated Root                     : ec:cd:6d:20:c0:ed
% Designated Cost                     : 0
% Designated Bridge                   : ec:cd:6d:20:c0:ed
% Designated Port Id                  : 838a
% Top Change Ack                      : FALSE
% Config Pending                      : FALSE

% PORT Based Information & Statistics
% -----------------------------------
% Config Bpdu's xmitted               : 0
% Config Bpdu's received              : 0
% TCN Bpdu's xmitted                  : 0
% TCN Bpdu's received                 : 0
% Forward Trans Count                 : 0

% STATUS of Port Timers
% ---------------------
% Hello Time Configured               : 2
% Hello timer                         : INACTIVE
% Hello Time Value                    : 0
% Forward Delay Timer                 : INACTIVE
% Forward Delay Timer Value           : 0
% Message Age Timer                   : INACTIVE
% Message Age Timer Value             : 0
% Topology Change Timer               : INACTIVE
% Topology Change Timer Value         : 0
% Hold Timer                          : INACTIVE
% Hold Timer Value                    : 0

% Other Port-Specific Info
  ------------------------
% Max Age Transitions                 : 1
% Msg Age Expiry                      : 0
% Similar BPDUS Rcvd                  : 0
% Src Mac Count                       : 0
% Total Src Mac Rcvd                  : 0
% Next State                          : Learning
% Topology Change Time                : 0


% Other Bridge information & Statistics
  -------------------------------------
% STP Multicast Address               : 01:80:c2:00:00:00
% Bridge Priority                     : 32768
% Bridge Mac Address                  : ec:cd:6d:20:c0:ed
% Bridge Hello Time                   : 2
% Bridge Forward Delay                : 15
% Topology Change Initiator           : 5023
% Last Topology Change Occured        : Mon Aug 22 05:41:20 2011
% Topology Change                     : FALSE
% Topology Change Detected            : TRUE
% Topology Change Count               : 1
% Topology Change Last Recvd from     : 00:00:00:00:00:00
```

Related commands show spanning-tree statistics

show spanning-tree vlan range-index

Use this command to display information about MST (Multiple Spanning Tree) instances and the VLANs associated with them including the VLAN range-index value for the switch.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show spanning-tree vlan range-index`

Mode Privileged Exec

Example To display information about MST instances and the VLANs associated with them for the switch, including the VLAN range-index value, use the following command:

```
awplus# show spanning-tree vlan range-index
```

Output Figure 19-17: Example output from the **show spanning-tree vlan range-index** command

```
awplus#show spanning-tree vlan range-index
% MST Instance  VLAN       RangeIdx
%      1        1          1
%
```

Related commands show spanning-tree statistics

spanning-tree autoedge (RSTP and MSTP)

Use this command to enable the autoedge feature on the port.

The autoedge feature allows the port to automatically detect that it is an edge port. If it does not receive any BPDUs in the first three seconds after linkup, enabling, or entering RSTP or MSTP mode, it sets itself to be an edgeport and enters the forwarding state.

Use this command for RSTP or MSTP.

Use the no variant of this command to disable this feature.

Syntax

```
spanning-tree autoedge
no spanning-tree autoedge
```

Default Disabled

Mode Interface Configuration

Example

```
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# spanning-tree autoedge
```

Related commands spanning-tree edgeport (RSTP and MSTP)

spanning-tree cisco-interoperability (MSTP)

Use this command to enable/disable Cisco-interoperability for MSTP.

Use this command for MSTP only.

Syntax `spanning-tree cisco-interoperability {enable|disable}`

Parameter	Description
`enable`	Enable Cisco interoperability for MSTP.
`disable`	Disable Cisco interoperability for MSTP.

Default If this command is not used, Cisco interoperability is disabled.

Mode Global Configuration

Usage For compatibility with certain Cisco devices, all devices in the switched LAN running the AlliedWare Plus™ Operating System must have Cisco-interoperability enabled. When the AlliedWare Plus™ Operating System is interoperating with Cisco, the only criteria used to classify a region are the region name and revision level. VLAN to instance mapping is not used to classify regions when interoperating with Cisco.

Examples To enable Cisco interoperability on a Layer 2 switch:

```
awplus# configure terminal
awplus(config)# spanning-tree cisco-interoperability enable
```

To disable Cisco interoperability on a Layer 2 switch:

```
awplus# configure terminal
awplus(config)# spanning-tree cisco-interoperability disable
```

spanning-tree edgeport (RSTP and MSTP)

Use this command to set a port as an edge-port.

Use this command for RSTP or MSTP.

This command has the same effect as the spanning-tree portfast (STP) command, but the configuration displays differently in the output of some show commands.

Use the no variant of this command to set a port to its default state (not an edge-port).

Syntax

```
spanning-tree edgeport
no spanning-tree edgeport
```

Default Not an edge port.

Mode Interface Configuration

Usage Use this command on a switch port connected to a LAN that has no other bridges attached. If a BPDU is received on the port that indicates that another bridge is connected to the LAN, then the port is no longer treated as an edge port.

Example

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree edgeport
```

Related commands spanning-tree autoedge (RSTP and MSTP)

spanning-tree enable

Use this command to enable the specified spanning tree protocol on the device. Note that this must be the spanning tree protocol that is configured on the device by the spanning-tree mode command.

Use the no variant of this command to disable the configured spanning tree protocol. This places all ports in the forwarding state.

Syntax

```
spanning-tree {mstp|rstp|stp} enable
no spanning-tree {mstp|rstp|stp} enable
```

Parameter	Description
mstp	Enables or disables MSTP.
rstp	Enables or disables RSTP.
stp	Enables or disables STP.

Default The configured spanning tree mode is enabled by default.

Mode Global Configuration

Usage With no configuration, spanning tree is enabled, and the spanning tree mode is set to RSTP. To change the mode, see spanning-tree mode command on page 19.48.

Examples

```
awplus# configure terminal
awplus(config)# spanning-tree mstp enable
```

```
awplus# configure terminal
awplus(config)# no spanning-tree mstp enable
```

Related commands spanning-tree mode

spanning-tree errdisable-timeout enable

Use this command to enable the errdisable-timeout facility, which sets a timeout for ports that are disabled due to the BPDU guard feature.

Use this command for RSTP or MSTP.

Use the no variant of this command to disable the errdisable-timeout facility.

Syntax

```
spanning-tree errdisable-timeout enable
no spanning-tree errdisable-timeout enable
```

Default By default, the errdisable-timeout is disabled.

Mode Global Configuration

Usage The BPDU guard feature shuts down the port on receiving a BPDU on a BPDU-guard enabled port. This command associates a timer with the feature such that the port is re-enabled without manual intervention after a set interval. This interval can be configured by the user using the spanning-tree errdisable-timeout interval command.

Example

```
awplus# configure terminal
awplus(config)# spanning-tree errdisable-timeout enable
```

Related Commands

show spanning-tree
spanning-tree errdisable-timeout interval
spanning-tree portfast bpdu-guard

spanning-tree errdisable-timeout interval

Use this command to specify the time interval after which a port is brought back up when it has been disabled by the BPDU guard feature.

Use this command for RSTP or MSTP.

Syntax

```
spanning-tree errdisable-timeout interval <10-1000000>
no spanning-tree errdisable-timeout interval
```

Parameter	Description
<10-1000000>	Specify the errdisable-timeout interval in seconds.

Default By default, the port is re-enabled after 300 seconds.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# spanning-tree errdisable-timeout interval 34
```

Related Commands

show spanning-tree
spanning-tree errdisable-timeout enable
spanning-tree portfast bpdu-guard

spanning-tree force-version

Use this command in Interface Configuration mode for a switch port interface only to force the protocol version for the switch port. Use this command for RSTP or MSTP only.

Syntax

```
spanning-tree force-version <version>
no spanning-tree force-version
```

Parameter	Description	
<version>	<0-3> Version identifier.	
	0	Forces the port to operate in STP mode.
	1	Not supported.
	2	Forces the port to operate in RSTP mode. If it receives STP BPDUs, it can automatically revert to STP mode.
	3	Forces the port to operate in MSTP mode (this option is only available if MSTP mode is configured). If it receives RSTP or STP BPDUs, it can automatically revert to RSTP or STP mode.

Default By default, no version is forced for the port. The port is in the spanning tree mode configured for the device, or a lower version if it automatically detects one.

Mode Interface Configuration mode for a switch port interface only.

Examples Set the value to enforce the spanning tree protocol (STP):

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree force-version 0
```

Set the default protocol version:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no spanning-tree force-version
```

Related Commands show spanning-tree

spanning-tree forward-time

Use this command to set the forward delay value. Use the no variant of this command to reset the forward delay value to the default setting of 15 seconds.

The forward delay sets the time (in seconds) to control how fast a port changes its spanning tree state when moving towards the forwarding state. If the mode is set to STP, the value determines how long the port stays in each of the listening and learning states which precede the forwarding state. If the mode is set to RSTP or MSTP, this value determines the maximum time taken to transition from discarding to learning and from learning to forwarding.

This value is used only when the switch is acting as the root bridge. Switches not acting as the Root Bridge use a dynamic value for the forward delay set by the root bridge. The forward delay, max-age, and hello time parameters are interrelated.

Syntax

```
spanning-tree forward-time <forward-delay>
no spanning-tree forward-time
```

Parameter	Description
<forward-delay	<4-30> The forwarding time delay in seconds.

Default The default is 15 seconds.

Mode Global Configuration

Usage The allowable range for forward-time is 4-30 seconds.

The forward delay, max-age, and hello time parameters should be set according to the following formulae, as specified in IEEE Standard 802.1d:

2 x (forward delay - 1.0 seconds) >= max-age

max-age >= 2 x (hello time + 1.0 seconds)

Example

```
awplus# configure terminal
awplus(config)# spanning-tree forward-time 6
```

Related Commands

show spanning-tree
spanning-tree forward-time <forward-delay>
spanning-tree hello-time <hello-time>
spanning-tree mode

spanning-tree guard root

Use this command in Interface Configuration mode for a switch port only to enable the Root Guard feature for the switch port. The root guard feature disables reception of superior BPDUs. You can use this command for RSTP, STP or MSTP.

Use the no variant of this command to disable the root guard feature for the port.

Syntax

```
spanning-tree guard root
no spanning-tree guard root
```

Mode Interface Configuration mode for a switch port interface only.

Usage The Root Guard feature makes sure that the port on which it is enabled is a designated port. If the Root Guard enabled port receives a superior BPDU, it goes to a Listening state (for STP) or discarding state (for RSTP and MSTP).

Example

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree guard root
```

spanning-tree hello-time

Use this command to set the hello-time. This sets the time in seconds between the transmission of switch spanning tree configuration information when the switch is the Root Bridge of the spanning tree or is trying to become the Root Bridge.

Use this command for RSTP, STP or MSTP.

Use the no variant of this command to restore the default of the hello time.

Syntax

```
spanning-tree hello-time <hello-time>
no spanning-tree hello-time
```

Parameter	Description
<hello-time>	<1-10> The hello BPDU interval in seconds.

Default Default is 2 seconds.

Mode Global Configuration and Interface Configuration for switch ports.

Usage The allowable range of values is 1-10 seconds.

The forward delay, max-age, and hello time parameters should be set according to the following formulae, as specified in IEEE Standard 802.1d:

2 x (forward delay - 1.0 seconds) >= max-age

max-age >= 2 x (hello time + 1.0 seconds)

Example

```
awplus# configure terminal
awplus(config)# spanning-tree hello-time 3
```

Related Commands

spanning-tree forward-time <forward-delay>
spanning-tree max-age <max-age>
show spanning-tree

spanning-tree link-type

Use this command in Interface Configuration mode for a switch port interface only to enable or disable point-to-point or shared link types on the switch port.

Use this command for RSTP or MSTP only.

Use the no variant of this command to return the port to the default link type.

Syntax

```
spanning-tree link-type {point-to-point|shared}
no spanning-tree link-type
```

Parameter	Description
`shared`	Disable rapid transition.
`point-to-point`	Enable rapid transition.

Default The default link type is point-to-point.

Mode Interface Configuration mode for a switch port interface only.

Usage You may want to set link type to shared if the port is connected to a hub with multiple switches connected to it.

Examples

```
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# spanning-tree link-type point-to-point
```

spanning-tree max-age

Use this command to set the max-age. This sets the maximum age, in seconds, that dynamic spanning tree configuration information is stored in the switch before it is discarded.

Use this command for RSTP, STP or MSTP.

Use the no variant of this command to restore the default of max-age.

Syntax

```
spanning-tree max-age <max-age>
no spanning-tree max-age
```

Parameter	Description
<max-age>	<6-40> The maximum time, in seconds.

Default The default of spanning-tree max-age is 20 seconds.

Mode Global Configuration

Usage Max-age is the maximum time in seconds for which a message is considered valid.

Configure this value sufficiently high, so that a frame generated by the root bridge can be propagated to the leaf nodes without exceeding the max-age.

The forward delay, max-age, and hello time parameters should be set according to the following formulae, as specified in IEEE Standard 802.1d:

2 x (forward delay - 1.0 seconds) >= max-age

max-age >= 2 x (hello time + 1.0 seconds)

Example

```
awplus# configure terminal
awplus(config)# spanning-tree max-age 12
```

Related Commands

show spanning-tree
spanning-tree forward-time <forward-delay>
spanning-tree hello-time <hello-time>

spanning-tree max-hops (MSTP)

Use this command to specify the maximum allowed hops for a BPDU in an MST region. This parameter is used by all the instances of the MST region.

Use the no variant of this command to restore the default.

Use this command for MSTP only.

Syntax

```
spanning-tree max-hops <hop-count>
no spanning-tree max-hops <hop-count>
```

Parameter	Description
<hop-count>	Specify the maximum hops the BPDU will be valid for in the range <1-40>.

Default The default max-hops in a MST region is 20.

Mode Global Configuration

Usage Specifying the max hops for a BPDU prevents the messages from looping indefinitely in the network. The hop count is decremented by each receiving port. When a switch receives an MST BPDU that has a hop count of zero, it discards the BPDU.

Examples

```
awplus# configure terminal
awplus(config)# spanning-tree max-hops 25

awplus# configure terminal
awplus(config)# no spanning-tree max-hops
```

spanning-tree mode

Use this command to change the spanning tree protocol mode on the switch. The spanning tree protocol mode on the switch can be configured to either STP, RSTP or MSTP.

Syntax `spanning-tree mode {stp|rstp|mstp}`

Default The default spanning tree protocol mode on the switch is RSTP.

Mode Global Configuration

Usage With no configuration, the switch will have spanning tree enabled, and the spanning tree mode will be set to RSTP. Use this command to change the spanning tree protocol mode on the device. MSTP is VLAN aware, but RSTP and STP are not VLAN aware. To enable or disable spanning tree operation, see the spanning-tree enable command on page 19.38.

Examples To change the spanning tree mode from the default of RSTP to MSTP, use the following commands:

```
awplus# configure terminal
awplus(config)# spanning-tree mode mstp
```

Related commands spanning-tree enable

spanning-tree mst configuration

Use this command to enter the MST Configuration mode to configure the Multiple Spanning-Tree Protocol.

Syntax `spanning-tree mst configuration`

Mode Global Configuration

Examples The following example uses this command to enter MST configuration mode. Note the change in the command prompt.

```
awplus# configure terminal
awplus(config)# spanning-tree mst configuration
awplus(config-mst)#
```

spanning-tree mst instance

Use this command in Interface Configuration mode to assign a Multiple Spanning Tree instance (MSTI) to a switch port or channel group.

Note that ports are automatically configured to send and receive spanning-tree information for the associated MSTI when VLANs are assigned to MSTIs using the instance vlan (MSTP) command.

Use the no variant of this command in Interface Configuration mode to remove the MSTI from the specified switch port or channel group.

Syntax

```
spanning-tree mst instance <instance-id>
no spanning-tree mst instance <instance-id>
```

Parameter	Description
<instance-id>	<1-63> Specify the MST instance ID. The MST instance must have already been created using the instance vlan (MSTP) command.

Default A port automatically becomes a member of an MSTI when it is assigned to a VLAN.

Mode Interface Configuration mode for a switch port or channel group.

Usage You can disable automatic configuration of member ports of a VLAN to an associated MSTI by using a no spanning-tree mst instance command to remove the member port from the MSTI. Use the spanning-tree mst instance command to add a VLAN member port back to the MSTI.

Examples

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree mst instance 3

awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no spanning-tree mst instance 3
```

Related Commands

instance vlan (MSTP)
spanning-tree mst instance path-cost
spanning-tree mst instance priority
spanning-tree mst instance restricted-role
spanning-tree mst instance restricted-tcn

spanning-tree mst instance path-cost

Use this command in Interface Configuration mode for a switch port interface only to set the cost of a path associated with a switch port, for the specified MSTI (Multiple Spanning Tree Instance) identifier.

This specifies the switch port's contribution to the cost of a path to the MSTI regional root via that port. This applies when the port is the root port for the MSTI.

Use the no variant of this command to restore the default cost value of the path.

Syntax

```
spanning-tree mst instance <instance-id> path-cost <path-cost>
no spanning-tree mst instance <instance-id> path-cost
```

Parameter	Description
<instance-id>	Specify the MSTI identifier in the range <1-63>.
<path-cost>	Specify the cost of path in the range of <1-200000000>, where a lower path-cost indicates a greater likelihood of the specific interface becoming a root.

Default The default path cost values and the range of recommended path cost values depend on the port speed, as shown in the following table from the IEEE 802.1q-2003 standard.

Port speed	Default path cost	Recommended path cost range
Less than 100 Kb/s	200,000,000	20,000,000-200,000,000
1Mbps	20,000,000	2,000,000-20,000,000
10Mbps	2,000,000	200,000-2,000,000
100 Mbps	200,000	20,000-200,000
1 Gbps	20,000	2,000-20,000
10 Gbps	2,000	200-2, 000
100 Gbps	200	20-200
1Tbps	20	2-200
10 Tbps	2	2-20

Mode Interface Configuration mode for a switch port interface only.

Usage Before you can use this command to set a path-cost in a VLAN configuration, you must explicitly add an MST instance to a port using the `spanning-tree instance` command.

Examples

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree mst instance 3 path-cost 1000
```

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no spanning-tree mst instance 3 path-cost
```

Related Commands

instance vlan (MSTP)
spanning-tree mst instance
spanning-tree mst instance priority
spanning-tree mst instance restricted-role
spanning-tree mst instance restricted-tcn

spanning-tree mst instance priority

Use this command in Interface Configuration mode for a switch port interface only to set the port priority for an MST instance (MSTI).

Use the no variant of this command to restore the default priority value (128).

Syntax

```
spanning-tree mst instance <instance-id> priority <priority>
no spanning-tree mst instance <instance-id> [priority]
```

Parameter	Description
<instance-id>	Specify the MSTI identifier in the range <1-63>.
<priority>	This must be a multiple of 16 and within the range <0-240>. A lower priority indicates greater likelihood of the port becoming the root port.

Default The default is 128.

Mode Interface Configuration mode for a switch port interface.

Usage This command sets the value of the priority field contained in the port identifier. The MST algorithm uses the port priority when determining the root port for the switch in the MSTI. The port with the lowest value is considered to have the highest priority and will be chosen as root port over a port - equivalent in all other aspects - but with a higher priority value.

Examples

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree mst instance 3 priority 121

awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no spanning-tree mst instance 3 priority
```

Related Commands

instance vlan (MSTP)
spanning-tree priority (port priority)
spanning-tree mst instance
spanning-tree mst instance path-cost
spanning-tree mst instance restricted-role
spanning-tree mst instance restricted-tcn

spanning-tree mst instance restricted-role

Use this command in Interface Configuration mode for a switch port interface only to enable the restricted role for an MSTI (Multiple Spanning Tree Instance) on a switch port. Configuring the restricted role for an MSTI on a switch port prevents the switch port from becoming the root port in a spanning tree topology.

Use the no variant of this command to disable the restricted role for an MSTI on a switch port. Removing the restricted role for an MSTI on a switch port allows the switch port to become the root port in a spanning tree topology.

Syntax

```
spanning-tree mst instance <instance-id> restricted-role
no spanning-tree mst instance <instance-id> restricted-role
```

Parameter	Description
<instance-id>	<1-63> Specify the MST instance ID. The MST instance must have already been created using the instance vlan (MSTP) command.

Default The restricted role for an MSTI instance on a switch port is disabled by default.

Mode Interface Configuration mode for a switch port interface only.

Usage The root port is the port providing the best path from the bridge to the root bridge. Use this command to disable a port from becoming a root port. Use the no variant of this command to enable a port to become a root port. See Spanning tree operation for root port information.

Examples

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree mst instance 3
restricted-role

awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no spanning-tree mst instance 3
restricted-role
```

Related Commands

instance vlan (MSTP)
spanning-tree priority (port priority)
spanning-tree mst instance
spanning-tree mst instance path-cost
spanning-tree mst instance restricted-tcn

spanning-tree mst instance restricted-tcn

Use this command in Interface Configuration mode for a switch port interface only to set the restricted TCN (Topology Change Notification) value to TRUE for the specified MSTI (Multiple Spanning Tree Instance).

Use the no variant of this command in Interface Configuration mode to reset the restricted TCN for the specified MSTI to the default value of FALSE.

Syntax

```
spanning-tree mst instance <instance-id> restricted-tcn
no spanning-tree mst instance <instance-id> restricted-tcn
```

Parameter	Description
<instance-id>	<1-63> Specify the MST instance ID. The MST instance must have already been created using the instance vlan (MSTP) command.

Default The default value for restricted TCNs is FALSE, as reset with the no variant of this command.

Mode Interface Configuration mode for a switch port interface only.

Usage A Topology Change Notification (TCN) is a simple Bridge Protocol Data Unit (BPDU) that a bridge sends out to its root port to signal a topology change. You can configure restricted TCN between TRUE and FALSE values with this command and the no variant of this command.

If you configure restricted TCN to TRUE with this command then this stops the switch port from propagating received topology change notifications and topology changes to other switch ports.

If you configure restricted TCN to FALSE with the no variant of this command then this enables the switch port to propagate received topology change notifications and topology changes to other switch ports.

Examples

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree mst instance 3 restricted-tcn

awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no spanning-tree mst instance 3
                   restricted-tcn
```

Related Commands

instance vlan (MSTP)
spanning-tree priority (port priority)
spanning-tree mst instance
spanning-tree mst instance path-cost
spanning-tree mst instance restricted-role

spanning-tree path-cost

Use this command in Interface Configuration mode for a switch port interface only to set the cost of a path for the specified port. This value then combines with others along the path to the root bridge in order to determine the total cost path value from the particular port, to the root bridge. The lower the numeric value, the higher the priority of the path. This applies when the port is the root port.

Use this command for RSTP, STP or MSTP. When MSTP mode is configured, this will apply to the port's path cost for the CIST.

Syntax

```
spanning-tree path-cost <pathcost>
no spanning-tree path-cost
```

Parameter	Description
<pathcost>	<1-200000000> The cost to be assigned to the port.

Default The default path cost values and the range of recommended path cost values depend on the port speed, as shown in the following table from the IEEE 802.1q-2003 and IEEE 802.1d-2004 standards.

Port speed	Default path cost	Recommended path cost range
Less than 100 Kb/s	200,000,000	20,000,000-200,000,000
1Mbps	20,000,000	2,000,000-20,000,000
10Mbps	2,000,000	200,000-2,000,000
100 Mbps	200,000	20,000-200,000
1 Gbps	20,000	2,000-20,000
10 Gbps	2,000	200-2, 000
100 Gbps	200	20-200
1Tbps	20	2-200
10 Tbps	2	2-20

Mode Interface Configuration mode for switch port interface only.

Example

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree path-cost 123
```

spanning-tree portfast (STP)

Use this command in Interface Configuration mode for a switch port interface only to set a port as an edge-port. The portfast feature enables a port to rapidly move to the forwarding state, without having first to pass through the intermediate spanning tree states. This command has the same effect as the spanning-tree edgeport (RSTP and MSTP) command, but the configuration displays differently in the output of some show commands.

Note

You can run either of two additional parameters with this command. To simplify the syntax these are documented as separate commands. See the following additional portfast commands:

- spanning-tree portfast bpdu-filter command on page 19.59
- spanning-tree portfast bpdu-guard command on page 19.61.

You can obtain the same effect by running the spanning-tree edgeport (RSTP and MSTP) command. However, the configuration output may display differently in some show commands.

Use the no variant of this command to set a port to its default state (not an edge-port).

Syntax

```
spanning-tree portfast

no spanning-tree portfast
```

Default

Not an edge port.

Mode

Interface Configuration mode for a switch port interface only.

Usage

Portfast makes a port move from a blocking state to a forwarding state, bypassing both listening and learning states. The portfast feature is meant to be used for ports connected to end-user devices not switches. Enabling portfast on ports that are connected to a workstation or server allows devices to connect to the network without waiting for spanning-tree to converge. For example, you may need hosts to receive a DHCP address quickly and waiting for STP to converge would cause the DHCP request to time out. Ensure you do not use portfast on any ports connected to another switch to avoid creating a spanning-tree loop on the network.

Use this command on a switch port that connects to a LAN with no other bridges attached. An edge port should never receive BPDUs. Therefore if an edge port receives a BPDU, the portfast feature takes one of three actions.

- Cease to act as an edge port and pass BPDUs as a member of a spanning tree network (spanning-tree portfast (STP) command disabled).
- Filter out the BPDUs and pass only the data and continue to act as a edge port (spanning-tree portfast bpdu-filter command enabled)
- Block the port to all BPDUs and data (spanning-tree portfast bpdu-guard command enabled).

Example

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree portfast
```

Related Commands

spanning-tree edgeport (RSTP and MSTP)
show spanning-tree
spanning-tree portfast bpdu-filter
spanning-tree portfast bpdu-guard

spanning-tree portfast bpdu-filter

This command sets the portfast bpdu-filter feature and applies a filter to any BPDUs received. Enabling this feature ensures that portfast configured ports will not transmit any BPDUs and will ignore (filter out) any BPDUs received. BPDU Filter is not enabled on a port by default.

Using the no variant of this command to turn off the bpdu-filter, but retain the port's status as a portfast enabled port. If the port then receives a BPDU it will change its role from an edge-port to a non edge-port.

Syntax (Global Configuration)

```
spanning-tree portfast bpdu-filter
no spanning-tree portfast bpdu-filter
```

Syntax (Interface Configuration)

```
spanning-tree portfast bpdu-filter {default|disable|enable}
no spanning-tree portfast bpdu-filter
```

Parameter	Description	
`portfast`	A port that behaves as an edge-port. Note that an edge-port should never receive BPDUs. If a port does receive a BPDU then it will filter any received.	
`bpdu-filter`	A portfast port that has bpdu-filter enabled will not transmit any BPDUs and will ignore any BPDUs received. This port type has one of the following parameters (in Interface Configuration mode):	
	`default`	Takes the setting that has been configured for the whole switch, i.e. the setting made from the Global configuration mode.
	`disable`	Turns off BPDU filter.
	`enable`	Turns on BPDU filter.

Default BPDU Filter is not enabled on any ports by default.

Mode Global Configuration and Interface Configuration

Usage This command filters the BPDUs and passes only data to continue to act as an edge port. Using this command in Global Configuration mode applies the portfast bpdu-filter feature to all ports on the switch. Using it in Interface mode applies the portfast feature to a specific port, or range of ports.The command will operate in both RSTP and MSTP networks.

Use the show spanning-tree command to display status of the bpdu-filter parameter for the switch ports.

Example

```
awplus# configure terminal
awplus(config)# spanning-tree portfast bpdu-filter

awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree portfast bpdu-filter enable
```

Related Commands

spanning-tree edgeport (RSTP and MSTP)
show spanning-tree
spanning-tree portfast (STP)
spanning-tree portfast bpdu-guard

spanning-tree portfast bpdu-guard

This command sets the portfast feature and applies a BPDU guard to the port. A port with the portfast bpdu-guard feature enabled will block all traffic (BPDUs and user data), if it starts receiving BPDUs.

Use this command in Global Configuration mode to set the portfast feature and apply BPDU guard to all ports on the switch. Use this command in Interface mode to for an individual interface or a range of interfaces specified. BPDU Guard is not enabled on a port by default.

Use the no variant of this command to disable the BPDU Guard feature on a switch in Global Configuration mode or to disable the BPDU Guard feature on a port in Interface mode.

Syntax (Global Configuration)

```
spanning-tree portfast bpdu-guard
no spanning-tree portfast bpdu-guard
```

Syntax (Interface Configuration)

```
spanning-tree portfast bpdu-guard {default|disable|enable}
no spanning-tree portfast bpdu-guard
```

Parameter	Description	
`portfast`	A port that behaves as an edge-port. Note that an edge port should never receive BPDUs. If a port does receive a BPDU then it will cease to act as an edge port.	
`bpdu-guard`	A portfast port that has bpdu-guard turned on will enter the STP blocking state if it receives a BPDU. This port type has one of the following parameters (in Interface Configuration mode):	
	`default`	Takes the setting that has been configured for the whole switch, i.e. the setting made from the Global configuration mode.
	`disable`	Turns off BPDU guard.
	`enable`	Turns on BPDU guard and will also set the port as an edge port.

Default BPDU Guard is not enabled on any ports by default.

Mode Global Configuration or Interface Configuration

Usage This command blocks the port(s) to all BPDUs and data when enabled. BPDU Guard is a port-security feature that changes how a portfast-enabled port behaves if it receives a BPDU. When bpdu-guard is set, then the port shuts down if it receives a BPDU. It does not process the BPDU as it is considered suspicious. When bpdu-guard is not set, then the port will negotiate spanning-tree with the device sending the BPDUs. By default, bpdu-guard is not enabled on a port. If a port with portfast enabled receives a BPDU, the port will be moved to the disabled state. This stops the port being connected to another port that is configured with portfast, so guards against spanning-tree loops forming on the network.

You can configure a port disabled by the bpdu-guard to re-enable itself after a specific time interval. This interval is set with the spanning-tree errdisable-timeout interval command on page 19.40. If you do not use the errdisable-timeout feature, then you will need to manually re-enable the port by using the no shutdown command.

Use the show spanning-tree command on page 19.14 to display the switch and port configurations for the BPDU Guard feature. It shows both the administratively configured and currently running values of bpdu-guard.

Example

```
awplus# configure terminal
awplus(config)# spanning-tree portfast bpdu-guard

awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree portfast bpdu-guard enable
```

Related Commands

spanning-tree edgeport (RSTP and MSTP)
show spanning-tree
spanning-tree portfast (STP)
spanning-tree portfast bpdu-guard

spanning-tree priority (bridge priority)

Use this command to set the bridge priority for the switch. A lower priority value indicates a greater likelihood of the switch becoming the root bridge.

Use this command for RSTP, STP or MSTP. When MSTP mode is configured, this will apply to the CIST.

Use the no variant of this command to reset it to the default.

Syntax

```
spanning-tree priority <priority>
no spanning-tree priority
```

Parameter	Description
<priority>	<0-61440> The bridge priority, which will be rounded to a multiple of 4096.

Default The default priority is 32678.

Mode Global Configuration

Usage To force a particular switch to become the root bridge use a lower value than other switches in the spanning tree.

Example

```
awplus# configure terminal
awplus(config)# spanning-tree priority 4096
```

Related Commands spanning-tree mst instance priority
show spanning-tree

spanning-tree priority (port priority)

Use this command in Interface Configuration mode for a switch port interface only to set the port priority for port. A lower priority value indicates a greater likelihood of the port becoming part of the active topology.

Use this command for RSTP, STP, or MSTP. When the device is in MSTP mode, this will apply to the CIST.

Use the no variant of this command to reset it to the default.

Syntax

```
spanning-tree priority <priority>
no spanning-tree priority
```

Parameter	Description
<priority>	<0-240>, in increments of 16. The port priority, which will be rounded down to a multiple of 16.

Default The default priority is 128.

Mode Interface Configuration mode for a switch port interface only.

Usage To force a port to be part of the active topology (for instance, become the root port or a designated port) use a lower value than other ports on the device. (This behavior is subject to network topology, and more significant factors, such as bridge ID.)

Example

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree priority 16
```

Related Commands

spanning-tree mst instance priority
spanning-tree priority (bridge priority)
show spanning-tree

spanning-tree restricted-role

Use this command in Interface Configuration mode for a switch port interface only to restrict the port from becoming a root port.

Use the no variant of this command to disable the restricted role functionality.

Syntax

```
spanning-tree restricted-role
no spanning-tree restricted-role
```

Default The restricted role is disabled.

Mode Interface Configuration mode for a switch port interface only.

Example

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree restricted-role
```

spanning-tree restricted-tcn

Use this command in Interface Configuration mode for a switch port interface only to prevent TCN (Topology Change Notification) BPDUs (Bridge Protocol Data Units) from being sent on a port. If this command is enabled, after a topology change a bridge is prevented from sending a TCN to its designated bridge.

Use the no variant of this command to disable the restricted TCN functionality.

Syntax

```
spanning-tree restricted-tcn
no spanning-tree restricted-tcn
```

Default The restricted TCN is disabled.

Mode Interface Configuration mode for a switch port interface only.

Example

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree restricted-tcn
```

spanning-tree transmit-holdcount

Use this command to set the maximum number of BPDU transmissions that are held back.

Use the no variant of this command to restore the default transmit hold-count value.

Syntax

```
spanning-tree transmit-holdcount <1-10>
no spanning-tree transmit-holdcount <1-10>
```

Parameter	Description
<1-10>	Transmit hold-count value.

Default Transmit hold-count default is 3.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# spanning-tree transmit-holdcount 5
```

undebug mstp

This command applies the functionality of the no debug mstp (RSTP and STP) command.

Chapter 20: Link Aggregation Introduction and Configuration

Introduction 20.2
Link Aggregation Control Protocol (LACP) 20.2
Static and Dynamic (LACP) Link Aggregation 20.4
Static Channel Groups 20.4
Dynamic (LACP) Channel Groups 20.4
Configuring an LACP Channel Group 20.5
Configuring a Static Channel Group 20.8
Configuring a Dynamic Channel Group 20.9

Introduction

This chapter contains a sample Link Aggregation Control Protocol (LACP), or dynamic channel group, configuration and a sample static channel group configuration.

To see details about the commands used to configure dynamic (LACP) and static Link aggregation, see Chapter 21, Link Aggregation Commands.

For a brief overview of static and dynamic link aggregation (LACP), see Static and Dynamic (LACP) Link Aggregation.

Link Aggregation Control Protocol (LACP)

LACP is based on the IEEE Standard 802.3ad. It allows bundling of several physical ports to form a single logical channel providing enhanced performance and resiliency. The aggregated channel is viewed as a single link by each switch. Spanning tree also views the channel as one interface and not as multiple interfaces. When there is a failure in one physical port, the other ports stay up and there is no disruption.

This device supports the aggregation of a maximum of eight physical ports into a single channel group.

Note

AlliedWare Plus™ supports IEEE 802.3ad link aggregation and uses the Link Aggregation Control Protocol (LACP). LACP does not interoperate with devices that use Port Aggregation Protocol (PAgP).

Note

Link aggregation does not necessarily achieve exact load balancing across the links. The load sharing algorithm is designed to ensure that any given data flow always goes down the same link. It also aims to spread data flows across the links as evenly as possible.

Link aggregation hashes the source and destination MAC address, IP address and UDP/TCP ports to select a link on which to send a packet. So packet flow between a pair of hosts always takes the same link inside the Link Aggregation Group (LAG). The net effect is that the bandwidth for a given packet stream is restricted to the speed of one link in the LAG.

For example, for a 2 Gbps LAG that is a combination of two 1 Gbps ports, one flow of traffic can only ever reach a maximum throughput of 1 Gbps. However, the hashing algorithm should spread the flows across the links so that when many flows are operating, the full 2 Gbps can be utilized.

For information about load balancing see the platform load-balancing command.

LACP operates where systems are connected over multiple communications links. Once LACP has been initially configured and enabled, it automatically aggregates the ports that have been assigned to a channel group, if possible. LACP continues to monitor these groups and dynamically adds or removes links to them as network changes occur.

LACP achieves this by determining:

- which ports are under LACP control (channel-group command on page 21.3)
- whether each port is in LACP active or LACP passive mode (channel-group command on page 21.3)
- which system has the highest LACP priority (lacp system-priority command on page 21.7)
- the LACP priority of ports (lacp port-priority command on page 21.6)
- whether the LACP timeout is short or long (lacp timeout command on page 21.8)

Channel group identification

In order to identify particular channel groups, each group is assigned a link aggregation identifier called a lag ID. The lag ID comprises the following components for both the local system (called the Actor) followed by their equivalent components for the remote system (called the Partner):

- system identifier - the MAC address of the system
- port key - An identifier - created by the LACP software
- port priority - set by the lacp port-priority command on page 21.6
- port number - determined by the device connection

The lag ID can be displayed for each aggregated link by entering the show etherchannel command on page 21.11.

Static and Dynamic (LACP) Link Aggregation

Channels, either static or dynamic LACP, increase reliability by distributing the data path over more than one physical link. Channels must be configured on both ends of a link or network loops may result. Ports in a channel group need not be contiguous. A mirror port cannot be a member of either a static or a dynamic channel group.

Aggregation criteria

For individual links to be aggregated into a channel group they must:

- originate on the same device or stack
- terminate on the same device or stack
- be members of the same VLANs (vlan command on page 17.31)
- have the same data rate (speed command on page 15.64)
- share the same admin port key (assigned by using the channel-group command on page 21.3 command)
- be operating in full duplex mode (duplex command on page 15.11)

The hardware must also be capable and have the capacity to handle the number of links to be aggregated.

Static Channel Groups

A static channel group, also known as a static aggregator, enables a number of ports to be manually configured to form a single logical connection of higher bandwidth. By using static channel groups you increase channel reliability by distributing the data path over more than one physical link.

Dynamic (LACP) Channel Groups

A LACP channel group, also known as an etherchannel, a LACP aggregator, or a dynamic channel group, enables a number of ports to be dynamically combined to form a single higher bandwidth logical connection.

For LACP configuration examples see Configuring an LACP Channel Group, Configuring a Static Channel Group, and Configuring a Dynamic Channel Group sections in this chapter.

For details of LACP channel group commands, see Chapter 21, Link Aggregation Commands.

Configuring an LACP Channel Group

The following example shows how to configure three links between two Allied Telesis managed Layer 3 Switches. The three links are assigned the same administrative key (1), so that they aggregate to form a single channel (1). They are viewed by the STP as one interface.

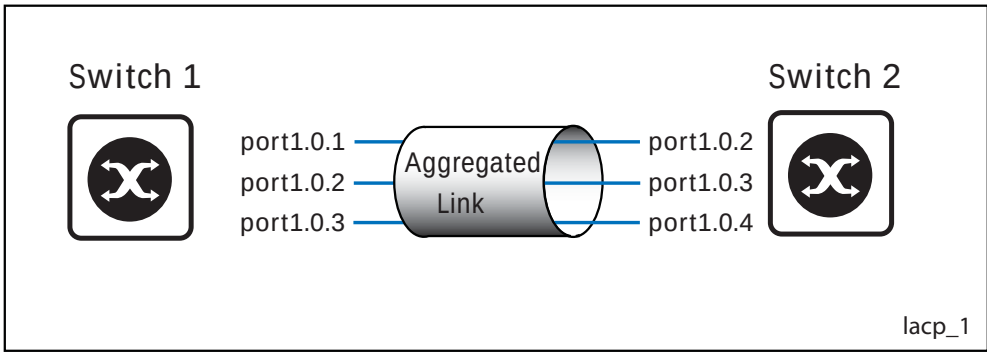

Table 20-1: Switch 1 configuration

awplus#	
configure terminal	Enter the Global Configuration mode.
awplus(config)#	
lacp system-priority 20000	Set the system priority of this switch. This priority is used to determine which switch in the system is responsible for resolving conflicts in the choice of aggregation groups. A lower numerical value has a higher priority. Switch 1 has a higher priority than Switch 2 in this configuration.
awplus(config)#	
interface port1.0.1	Enter the Interface Configuration mode to configure port 1.0.1.
awplus(config-if)#	
channel-group 1 mode active	Add this interface to a channel group 1 and enable link aggregation so that it may be selected for aggregation by the local system.
awplus(config-if)#	
exit	Exit the Interface Configuration mode and return to the Global Configure mode.
awplus(config)#	
interface port1.0.2	Enter the Interface Configuration mode to configure port 1.0.2.
awplus(config-if)#	
channel-group 1 mode active	Add this interface to a channel group 1 and enable link aggregation so that it may be selected for aggregation by the local system.
awplus(config-if)#	
exit	Exit the Interface Configuration mode and return to the Global Configure mode.

Table 20-1: Switch 1 configuration (cont.)

`awplus(config)#`	
`interface port1.0.3`	Enter the Interface Configuration mode to configure port `1.0.3`.
`awplus(config-if)#`	
`channel-group 1 mode active`	Add this interface to a channel group `1` and enable link aggregation so that it may be selected for aggregation by the local system.
`awplus(config-if)#`	
`interface po1`	Select the dynamic aggregator logical interface created for channel-group 1 named `po1`.

Table 20-2: Switch 2 configuration

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`lacp system-priority 3000`	Set the system priority of this switch. This priority is used to determine which switch in the system is responsible for resolving conflicts in the choice of aggregation groups. A lower numerical value has a higher priority. Switch 2 has a lower priority than Switch 1 in this configuration.
`awplus(config)#`	
`interface port1.0.2`	Enter the Interface Configuration mode to configure port `1.0.2`.
`awplus(config-if)#`	
`channel-group 1 mode active`	Add this interface to a channel group `1` and enable link aggregation so that it may be selected for aggregation by the local system.
`awplus(config-if)#`	
`exit`	Exit the Interface mode and return to the Configure mode.
`awplus(config)#`	
`interface port1.0.3`	Enter the Interface mode to configure port `1.0.3`.
`awplus(config-if)#`	
`channel-group 1 mode active`	Add this interface to a channel group `1` and enable link aggregation so that it may be selected for aggregation by the local system.
`awplus(config-if)#`	
`exit`	Exit the Interface Configuration mode and return to the Global Configuration mode.

Table 20-2: Switch 2 configuration

`awplus(config)#`	
`interface port1.0.4`	Enter the Interface Configuration mode to configure port `1.0.4`.
`awplus(config-if)#`	
`channel-group 1 mode active`	Add this interface to a channel group `1` and enable link aggregation so that it may be selected for aggregation by the local system.
`awplus(config-if)#`	
`interface po1`	Select the dynamic aggregator logical interface created for channel-group 1 named `po1`.

Commands Used

lacp system-priority
channel-group

Validation Commands

show lacp sys-id
show port etherchannel
show etherchannel
show etherchannel detail

Configuring a Static Channel Group

For details of LACP channel group commands, see Chapter 21, Link Aggregation Commands.

The following example creates a static channel group and adds switch ports `1.0.1` and `1.0.2`.

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`interface port1.0.1`	Enter the Interface Configuration mode to configure port `1.0.1`.
`awplus(config-if)#`	
`static-channel-group 2`	Add port `1.0.1` to static-channel-group `2`.
`awplus(config-if)#`	
`exit`	Exit the Interface Configuration mode and return to the Global Configuration mode.
`awplus(config)#`	
`interface port1.0.2`	Enter the Interface Configuration mode to configure port `1.0.2`.
`awplus(config-if)#`	
`static-channel-group 2`	Add port `1.0.2` to static-channel-group `2`.
`awplus(config-if)#`	
`interface sa2`	Select the static aggregator logical interface created for static-channel-group 2 named `sa2`.

Commands Used static-channel-group

Validation Commands show static-channel-group

Configuring a Dynamic Channel Group

For details of LACP channel group commands, see Chapter 21, Link Aggregation Commands.

The following example creates LACP channel group 2 and enables link aggregation on switch ports `1.0.1` and `1.0.2` within this channel group. Note that all aggregated ports must belong to the same VLAN.

`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`interface port1.0.1-port1.0.2`	Enter the Interface Configuration mode for the switch ports to aggregate into the channel group.
`awplus(config-if)#`	
`channel-group 2 mode active`	Assign the switch ports to channel group `2` in active mode. This creates the channel group.
`awplus(config-if)#`	
`interface po2`	Select the dynamic aggregator logical interface created for channel-group 2 named `po2`.

Commands Used channel-group

Validation Commands show static-channel-group

Chapter 21: Link Aggregation Commands

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Command List 21.2
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static-channel-group 21.18
undebug lacp 21.20

Introduction

This chapter provides an alphabetical reference of commands used to configure a static channel group (static aggregator) and dynamic channel group (LACP channel group, etherchannel or LACP aggregator). Link aggregation is also sometimes referred to as channelling.

Note

AlliedWare Plus™ supports IEEE 802.3ad link aggregation and uses the Link Aggregation Control Protocol (LACP). LACP does not interoperate with devices that use Port Aggregation Protocol (PAgP).

Note

LACP does not perform load balancing. The LACP algorithm is based on the packet flow. Link aggregation (LAG) hashes the source and destination MAC address, IP address and UDP/TCP ports to select a port on which to send a packet. So packet flow between a pair of hosts always takes the same port inside the LAG. The net effect is that the bandwidth for one packet stream is restricted to the speed of one link in the LAG. For example, for a 2 Gbps LAG that is a combination of two 1 Gbps ports, one flow of traffic can only ever reach a maximum throughput of 1 Gbps.

For information about load balancing see the platform load-balancing command on page 15.29 command.

For a description of static and dynamic link aggregation (LACP), see "Static and Dynamic (LACP) Link Aggregation" on page 20.4. For an LACP configuration example, see Chapter 20, Link Aggregation Introduction and Configuration.

Command List

clear lacp counters

Use this command to clear all counters of all present LACP aggregators (channel groups) or a given LACP aggregator.

Syntax `clear lacp [<1-32>] counters`

Parameter	Description
<1-32>	Channel-group number.

Mode Privileged Exec

Example

```
awplus# clear lacp 2 counters
```

channel-group

Use this command to create an dynamic channel group containing the port, or add a port to an existing LACP channel group, to enable LACP link aggregation on the port so that it can be selected for aggregation by the local system, and to set the mode.

Use the no variant of this command to turn off link aggregation on the switch port.

Syntax

```
channel-group <dynamic-channel-group-number> mode {active|passive}

no channel-group
```

Parameter	Description
<dynamic-channel-group-number>	<1-32> Specify a dynamic channel group number for an LACP link. If the switch silicon profile is not set to extended, you can create up to 31 channel groups (dynamic and/or static channel groups). SBx908 only: If the switch's silicon profile is set to extended, you can create up to 32 dynamic (LACP) channel groups (as well as up to 96 static channel groups). Each channel group can include up to 8 ports. The silicon profiles are hardware dependent—see the platform silicon-profile command on page 15.34
`active`	Enables initiation of LACP negotiation on a port. The port will transmit LACP dialogue messages whether or not it receives them from the partner system.
`passive`	Disables initiation of LACP negotiation on a port. The port will only transmit LACP dialogue messages if the partner systems is transmitting them, i.e. the partner is in the active mode.

Mode Interface Configuration

Usage All the switch ports in a channel-group must belong to the same VLANs, have the same tagging status, and can only be operated on as a group. All switch ports within a channel group must have the same port speed and be in full duplex mode.

Once the LACP channel group has been created, it is treated as a switch port, and can be referred to in most other commands that apply to switch ports.

To refer to an LACP channel group in other LACP commands, use the channel group number. To specify an LACP channel group (LACP aggregator) in other commands, prefix the channel group number with po. For example, '`po4`' refers to the LACP channel group with channel group number `4`.

For more on LACP, see "Dynamic (LACP) Channel Groups" on page 20.4 and Chapter 20, Link Aggregation Introduction and Configuration.

Examples

To add switch `port1.0.10` to a newly created LACP channel group 4 use the commands below:

```
awplus# configure terminal
awplus(config)# interface port1.0.10
awplus(config-if)# channel-group 4 mode active
```

To remove switch `port1.0.8` from any created LACP channel groups use the command below:

```
awplus# configure terminal
awplus(config)# interface port1.0.8
awplus(config-if)# no channel-group
```

To reference the pre-defined LACP channel group 2 as an interface apply commands as below:

```
awplus# configure terminal
awplus(config)# interface port1.0.8
awplus(config-if)# channel-group 2 mode active
awplus(config-if)# exit
awplus(config)# interface port.1.0.10
awplus(config-if)# channel-group 2 mode active
awplus(config-if)# exit
awplus(config)# interface po2
awplus(config-if)#
```

Related Commands

platform silicon-profile
show etherchannel
show etherchannel detail
show etherchannel summary
show port etherchannel

debug lacp

Use this command to enable all LACP troubleshooting functions.

Use the no variant of this command to disable this function.

Syntax

```
debug lacp {all|cli|event|ha|packet|sync|timer[detail]}
no debug lacp {all|cli|event|ha|packet|sync|timer[detail]}
```

Parameter	Description
`all`	Turn on all debugging for LACP.
`cli`	Specifies debugging for CLI messages. Echoes commands to the console.
`event`	Specifies debugging for LACP events. Echoes events to the console.
`ha`	Specifies debugging for HA (High Availability) events. Echoes High Availability events to the console.
`packet`	Specifies debugging for LACP packets. Echoes packet contents to the console.
`sync`	Specified debugging for LACP synchronization. Echoes synchronization to the console.
`timer`	Specifies debugging for LACP timer. Echoes timer expiry to the console.
`detail`	Optional parameter for LACP timer-detail. Echoes timer start/stop details to the console.

Mode Privileged Exec and Global Configuration

Examples

```
awplus# debug lacp timer detail
awplus# debug lacp all
```

Related Commands show debugging lacp
undebug lacp

lacp port-priority

Use this command to set the priority of a switch port. Ports are selected for aggregation based on their priority, with the higher priority (numerically lower) ports selected first.

Use the no variant of this command to reset the priority of port to the default.

Syntax

```
lacp port-priority <1-65535>
no lacp port-priority
```

Parameter	Description
<1-65535>	Specify the LACP port priority.

Default The default is 32768.

Mode Interface Configuration

Example

```
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# lacp port-priority 34
```

lacp system-priority

Use this command to set the system priority of a local system. This is used in determining the system responsible for resolving conflicts in the choice of aggregation groups.

Use the no variant of this command to reset the system priority of the local system to the default.

Syntax

```
lacp system-priority <1-65535>
no lacp system-priority
```

Parameter	Description
<1-65535>	LACP system priority. Lower numerical values have higher priorities.

Default The default is 32768.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# lacp system-priority 6700
```

lacp timeout

Use this command to set the short or long timeout on a port. Ports will time out of the aggregation if three consecutive updates are lost.

Syntax `lacp timeout {short|long}`

Parameter	Description
`timeout`	Number of seconds before invalidating a received LACP data unit (DU).
`short`	LACP short timeout. The short timeout value is 1 second.
`long`	LACP long timeout. The long timeout value is 30 seconds.

Default The default is long timeout (30 seconds).

Mode Interface Configuration

Usage This command enables the switch to indicate the rate at which it expects to receive LACPDUs from its neighbor.

If the timeout is set to long, then the switch expects to receive an update every 30 seconds, and this will time a port out of the aggregation if no updates are seen for 90 seconds (i.e. 3 consecutive updates are lost).

If the timeout is set to short, then the switch expects to receive an update every second, and this will time a port a port out of the aggregation if no updates are seen for 3 seconds (i.e. 3 consecutive updates are lost).

The switch indicates its preference by means of the '`Timeout`' field in the '`Actor`' section of its LACPDUs. If the '`Timeout`' field is set to 1, then the switch has set the short timeout. If the '`Timeout`' field is set to 0, then the switch has set the long timeout.

Setting the short timeout enables the switch to be more responsive to communication failure on a link, and does not add too much processing overhead to the switch (1 packet per second).

Note It is not possible to configure the rate that the switch sends LACPDUs; the switch must send at the rate which the neighbor indicates it expects to receive LACPDUs.

Examples The following commands set the LACP long timeout period for 30 seconds on `port1.0.2`.

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# lacp timeout long
```

The following commands set the LACP short timeout for 1 second on `port1.0.2`.

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# lacp timeout short
```

show debugging lacp

Use this command to display the LACP debugging option set.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show debugging lacp`

Mode User Exec and Privileged Exec

Example

```
awplus# show debugging lacp
```

Output Figure 21-1: Example output from the **show debugging lacp** command

```
LACP debugging status:
 LACP timer debugging is on
 LACP timer-detail debugging is on
 LACP cli debugging is on
 LACP packet debugging is on
 LACP event debugging is on
 LACP sync debugging is on
```

Related Commands debug lacp

show diagnostic channel-group

This command displays dynamic and static channel group interface status information. The output of this command is useful for Allied Telesis authorized service personnel for diagnostic purposes.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show diagnostic channel-group`

Mode User Exec and Privileged Exec

Example

```
awplus# show diagnostic channel-group
```

Output Figure 21-2: Example output from the **show diagnostic channel-group** command

```
awplus#show diagnostic channel-group

Channel Group Info based on NSM:
Note: Pos - position in hardware table
-------------------------------------------------------------
Dev  Interface  IfIndex  Member port  IfIndex  Active  Pos
-------------------------------------------------------------
     sa3        4503     port1.0.15   5015     No
     sa3        4503     port1.0.18   5018     No
     po1        4601     port1.0.7    5007     No
     po1        4601     port1.0.8    5008     No
     po1        4601     port1.0.9    5009     No


Channel Group Info based on HSL:
Note: Pos - position in hardware table
-------------------------------------------------------------
Dev  Interface  IfIndex  Member port  IfIndex  Active  Pos
-------------------------------------------------------------
     sa3        4503                           N/a
     po1        4601                           N/a


Channel Group Info based on IPIFWD:
Note: Pos - position in hardware table
-------------------------------------------------------------
Dev  Interface  IfIndex  Member port  IfIndex  Active  Pos
-------------------------------------------------------------
     sa3        4503                           N/a
     po1        4601                           N/a


Channel Group Info based on HW:
Note: Pos - position in hardware table
      Only entries from first device are displayed.
-------------------------------------------------------------
Dev  Interface  IfIndex  Member port  IfIndex  Active  Pos
-------------------------------------------------------------
     sa3        4503                           N/a
     po1        4601                           N/a


No error found
```

Related Commands show tech-support

show etherchannel

Use this command to display information about a LACP channel specified by the channel group number.

The command output also shows the thrash limiting status. If thrash limiting is detected and the thrash limiting parameter of the thrash-limiting command on page 15.72 is set to vlan disable, the output will also show the VLANs on which thrashing is detected.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show etherchannel [<1-32>]`

Parameter	Description
<1-32>	Channel-group number.

Mode User Exec and Privileged Exec

Example

```
awplus# show etherchannel 5
```

Output Figure 21-3: Example output from the **show etherchannel** command

```
% Lacp Aggregator: po1
 Thrash-limiting
 Status Vlan Thrashing Detected, Action vlan-disable 60(s)
 Thrashing Vlans 1 2 3 4 5
% Member:
   port1.0.4
   port1.0.8
```

show etherchannel detail

Use this command to display detailed information about all LACP channels.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show etherchannel detail`

Mode User Exec and Privileged Exec

Example

```
awplus# show etherchannel detail
```

Output Figure 21-4: Example output from the **show etherchannel detail** command

```
% Aggregator po1 (4501)
%  Mac address: 00:00:cd:24:fd:29
%  Admin Key: 0001 - Oper Key 0001
%  Receive link count: 1 - Transmit link count: 0
%  Individual: 0 - Ready: 1
%  Partner LAG: 0x8000,00-00-cd-24-da-a7
%   Link: port1.0.1 (5001) disabled
%   Link: port1.0.2 (5002) sync: 1
% Aggregator po2 (4502)
%  Mac address: 00:00:cd:24:fd:29
%  Admin Key: 0002 - Oper Key 0002
%  Receive link count: 1 - Transmit link count: 0
%  Individual: 0 - Ready: 1
%  Partner LAG: 0x8000,00-00-cd-24-da-a7
%   Link: port1.0.7 (5007) disabled
```

show etherchannel summary

Use this command to display a summary of all LACP channels.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show etherchannel summary`

Mode User Exec and Privileged Exec

Example

```
awplus# show etherchannel summary
```

Output Figure 21-5: Example output from the **show etherchannel summary** command

```
% Aggregator po1
%  Admin Key: 0001 - Oper Key 0001
%   Link: port1.0.1 (5001) disabled
%   Link: port1.0.2 (5002) sync: 1
% Aggregator po2
%  Admin Key: 0002 - Oper Key 0002
%   Link: port1.0.7 (5007) disabled
```

show lacp-counter

Use this command to display the packet traffic on all ports of all present LACP aggregators, or a given LACP aggregator.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show lacp-counter [<1-32>]`

Parameter	Description
<1-32>	Channel-group number.

Mode User Exec and Privileged Exec

Example

```
awplus# show lacp-counter 2
```

Output Figure 21-6: Example output from the **show lacp-counter** command

```
% Traffic statistics
Port           LACPDUs          Marker          Pckt err
             Sent     Recv     Sent     Recv     Sent     Recv
% Aggregator po4 (4604)
port1.0.2    0        0        0        0        0        0
```

show lacp sys-id

Use this command to display the LACP system ID and priority.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show lacp sys-id`

Mode User Exec and Privileged Exec

Example

```
awplus# show lacp sys-id
```

Output Figure 21-7: Example output from the **show lacp sys-id** command

```
% System Priority: 0x8000 (32768)
% MAC Address: 00-00-cd-24-fd-29
```

show port etherchannel

Use this command to show LACP details of the switch port specified.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show port etherchannel <port>`

Parameter	Description
<port>	Name of the switch port to display LACP information about.

Mode User Exec and Privileged Exec

Example

```
awplus# show port etherchannel port1.0.1
```

Output Figure 21-8: Example output from the **show port etherchannel** command

```
% Link: port1.0.1 (5001)
% Aggregator: po1 (4501)
% Receive machine state: Current
% Periodic Transmission machine state: Fast periodic
% Mux machine state: Collecting/Distributing
% Actor Information:                      Partner Information:
%   Selected ................ Selected     Partner Sys Priority ............ 0
%   Physical Admin Key ............. 1     Partner System .. 00-00-00-00-00-00
%   Port Key ....................... 5     Port Key ........................ 0
%   Port Priority .............. 32768     Port Priority ................... 0
%   Port Number ..,,,,,.......... 5001     Port Number ..................... 0
%   Mode ...................... Active     Mode ...................... Passive
%   Timeout ...................... Long     Timeout ...................... Short
%   Individual .................. Yes     Individual .................... Yes
%   Synchronised ................ Yes     Synchronised .................. Yes
%   Collecting .................. Yes     Collecting .................... Yes
%   Distributing ................ Yes     Distributing .................. Yes
%   Defaulted ................... Yes     Defaulted ..................... Yes
%   Expired ......................... No    Expired ......................... No
```

show static-channel-group

Use this command to display all configured static channel groups and their corresponding member ports. Note that a static channel group is the same as a static aggregator.

The command output also shows the thrash limiting status. If thrash limiting is detected and the thrash limiting parameter of the thrash-limiting command on page 15.72 is set to vlan disable, the output will also show the VLANs on which thrashing is detected.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show static-channel-group`

Mode User Exec and Privileged Exec

Example

```
awplus#  show static-channel-group
```

Output Figure 21-9: Example output from the **show static-channel-group** command

```
% LAG Maximum        : 128
% LAG Static  Maximum: 96
% LAG Dynamic Maximum: 32
% LAG Static  Count  : 2
% LAG Dynamic Count  : 2
% LAG Total   Count  : 4
% Static Aggregator: sa2
% Member:
   port1.0.1
% Static Aggregator: sa3
% Member:
   port1.0.2
```

Related Commands static-channel-group

static-channel-group

Use this command to create a static channel group, also known as a static aggregator, or add a member port to an existing static channel group.

Use the no variant of this command to remove the switch port from the static channel group.

Syntax

```
static-channel-group <static-channel-group-number>
no static-channel-group
```

Parameter	Description
<static-channel-group-number>	<1-96> Static channel group number. If the switch silicon profile is not set to extended, you can create up to 31 channel groups (dynamic and/or static channel groups). If the switch's silicon profile is set to extended, you can create up to 96 static channel groups (as well as up to 32 dynamic (LACP) channel groups). Each channel group can include up to 8 ports. The silicon profiles are hardware dependent—see the platform silicon-profile command on page 15.34

Mode Interface Configuration

Usage This command adds the switch port to the static channel group with the specified channel group number. If the channel group does not exist, it is created, and the port is added to it. The no prefix detaches the port from the static channel group. If the port is the last member to be removed, the static channel group is deleted.

All the ports in a channel group must have the same VLAN configuration: they must belong to the same VLANs and have the same tagging status, and can only be operated on as a group.

Once the static channel group has been created, it is treated as a switch port, and can be referred to in other commands that apply to switch ports.

To refer to a static channel group in other static channel group commands, use the channel group number. To specify a static channel group in other commands, prefix the channel group number with sa. For example, 'sa3' refers to the static channel group with channel group number 3.

For more on static channel groups, see "Static Channel Groups" on page 20.4 and Chapter 20, Link Aggregation Introduction and Configuration.

Examples To define a static channel group on a switch port, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.6
awplus(config-if)# static-channel-group 3
```

To reference the pre-defined static channel group 2 as an interface apply the example commands as below:

```
awplus# configure terminal
awplus(config)# interface port1.0.8
awplus(config-if)# static-channel-group 2
awplus(config-if)# exit
awplus(config)# interface port.1.0.10
awplus(config-if)# static-channel-group 2
awplus(config-if)# exit
awplus(config)# interface sa2
awplus(config-if)#
```

Related Commands platform silicon-profile
show static-channel-group

undebug lacp

This command applies the functionality of the no debug lacp command on page 21.5.

Chapter 22: GVRP Introduction and Configuration

Introduction 22.2
- GVRP Example 22.3
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- GVRP and Network Security 22.5
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Configuring and validating GVRP 22.8

Introduction

GVRP enables the automatic VLAN configuration of switches in a network by allowing GVRP enabled switches to dynamically exchange VLAN configuration information with each other. GVRP is based on GARP, which defines how attributes, like VIDs, are registered and deregistered. This makes it easier to manage VLANs that span more than one switch. Without GVRP, you have to manually configure your switches to ensure that the various parts of the VLANs can communicate with each other across the different switches. With GVRP this is done for you automatically.

The switch uses GVRP protocol data units (PDUs) to share VLAN information among GVRP-active devices. The PDUs contain the VID numbers of all the VLANs on the switch. When the switch receives a GVRP PDU on a port, it examines the PDU to determine the VIDs of the VLANs on the device that sent it. It then does the following:

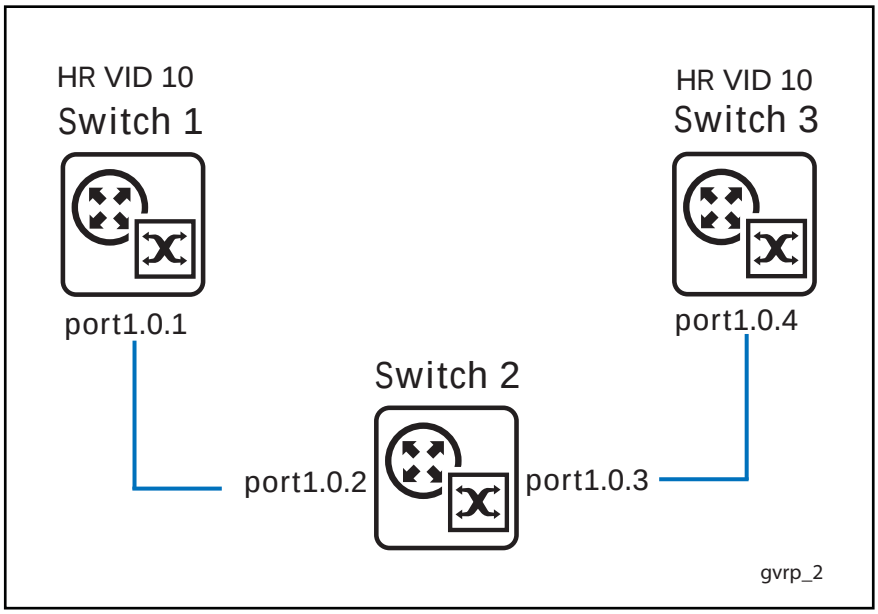
- If the PDU contains a VID of a VLAN that does not exist on the switch, it creates this VLAN and adds the port that received the PDU as a tagged member of the VLAN. A VLAN created by GVRP is called a dynamic GVRP VLAN.
- If the PDU contains a VID of a VLAN that already exists on the switch but the receiving port is not a member of it, the switch adds the port as a tagged member of the VLAN. A port that has been added by GVRP to a static VLAN (that is a user-created VLAN) is called a dynamic GVRP port.

Only GVRP can modify or delete dynamic GVRP VLANs. Dynamic GVRP VLANs exist only so long as the switch continues to receive GVRP PDUs that contain the VID of that VLAN. If there are no more relevant GVRP PDUs arriving, or there are no active links in the VLAN, GVRP deletes it from the switch.

A dynamic GVRP port in a static VLAN remains a member of the VLAN as long as the switch continues to receive GVRP PDUs that contain the VID of that VLAN. If the relevant GVRP PDUs are no longer being received on the port, then GVRP removes the dynamic port from the VLAN, but does not delete the VLAN if the VLAN is a static VLAN.

GVRP Example

The example consists of three switches. Switch 1 and Switch 3 have the HR VLAN 10, but Switch 2 is not configured with the HR VLAN 10. Consequently, the end nodes of the two parts of the HR VLAN 10 cannot communicate with each other because Switch 2 does not have VLAN 10.



Without GVRP, you would have to manually add the HR VLAN 10 to Switch 2. But with GVRP, the VLAN is added automatically. Here is how GVRP resolves this example.

1. Interface `port1.0.1` on Switch 1 sends a PDU (Protocol Data Unit) to interface `port1.0.2` on Switch 2 that contains the VIDs of all the VLANs on Switch 1, including VID 10 for the HR VLAN.

2. Switch 2 examines the PDU it receives on interface `port1.0.2` and finds that it does not have a VLAN with a VID 10. In response, it creates the VLAN as a dynamic GVRP VLAN, assigning it VID 10. Switch 2 then adds interface `port1.0.2`, the switch port that received the PDU, as a tagged member of HR VLAN 10.

3. Switch 2 sends a PDU from interface `port1.0.3` containing all the VIDs of the VLANs on the switch, including the new VID 10. Note at this point interface `port1.0.3` is not a member of VLAN 10. Ports are added to VLANs when they receive PDUs from other switches in the network, not when they transmit PDUs.

4. Switch 3 receives the PDU on interface port1.0.4 and, after examining it, finds that one of the VLANs on Switch 2 has the VID 10, which matches the VID of an already existing VLAN on the switch. So it does not create the VLAN because it already exists. It then determines whether the port that received the PDU, in this case interface `port1.0.4`, is a member of the VLAN. If it is not a member, it adds the port to the VLAN as a tagged dynamic GVRP port. If the port is already a member of the VLAN, then no change is made.

5. Switch 3 sends a PDU out interface `port1.0.4` to interface `port1.0.3` on Switch 2.

6. Switch 2 receives the PDU on interface `port1.0.3` and then adds the port as a tagged dynamic GVRP port to the dynamic GVRP VLAN 10.

There is now a communications path for the end nodes of the HR VLAN 10 on Switch 1 and Switch 3. GVRP created the new dynamic GVRP VLAN with a VID of 10 on Switch 2 and added interfaces `port1.0.2` and `port1.0.3` to HR VLAN 10 as tagged dynamic GVRP ports.

GVRP Guidelines

Here are the guidelines for configuring GVRP on your switch:

- All ports the constitute a network link between the switch and the other switches must be running GVRP.
- You cannot modify or delete dynamic GVRP VLANs.
- You cannot remove dynamic GVRP ports from static or dynamic VLANs.
- There is limit of 400 VLANs supported by the AlliedWare Plus GVRP implementation. VLANs may be numbered 1-4094, but a limit of 400 of these VLANs are supported.
- MSTP is not supported by the current AlliedWare Plus GVRP implementation. GVRP and MSTP are mutually exclusive. STP and RSTP are supported by GVRP.
- VCStack is not supported by the current AlliedWare Plus GVRP implementation.
- To be detected by GVRP, a VLAN must have at least one active port. GVRP cannot detect a VLAN that does not have any active nodes or valid port links.
- Rebooting the switch erases all dynamic GVRP VLANs and dynamic GVRP port assignments. The dynamic assignments are relearned by the switch as PDUs arrive on the ports from other switches.
- GVRP has three timers: join timer, leave timer, and leave all timer. The values for these timers must be set the same on all switches running GVRP. Timers with different values on different switches can result in GVRP compatibility problems.
- You can convert dynamic GVRP VLANs and dynamic GVRP port assignments to static VLANs and static port assignments.
- The default port settings on the switch for GVRP is inactive, meaning that the ports will not participate in GVRP until enabled on the switch globally and on the interface locally.
- Allied Telesis recommends disabling GVRP on those ports that are connected to GVRP-inactive devices, meaning any switches that do not have the GVRP feature enabled.
- PDUs are transmitted from only those switch ports where GVRP is enabled.
- Private VLAN trunk ports are not supported by the current AlliedWare Plus GVRP implementation. GVRP and private VLAN trunk ports are mutually exclusive.

GVRP and Network Security

GVRP should be used with caution because it can expose your network to unauthorized access. If a network intruder were to connect to a switch port running GVRP and transmit a bogus GVRP PDU containing VIDs of restricted VLANs, GVRP would make the port a member of the VLANs, giving the intruder access to restricted areas of your network.

Here are a few suggestions to protect against this type of unauthorized network intrusion:

- Activating GVRP only on those switch ports connected to other GVRP devices. Do not activate GVRP on ports that are connected to GVRP inactive devices.
- Converting all dynamic GVRP VLANs and dynamic GVRP ports to static assignments, and then turning off GVRP on all the switches. This preserves the new VLAN assignments while protecting against unauthorized network intrusion.

GVRP-inactive Intermediate Switches

If two GVRP-active devices are separated by a GVRP-inactive switch, the GVRP-active devices may not be able to share VLAN information. There are two issues involved.

The first is whether the intermediate switch forwards the GVRP PDUs that it receives from the GVRP-active switches. GVRP PDUs are management frames, intended for the switch's CPU. In all likelihood, a GVRP-inactive switch will discard the PDUs because it will not recognize them.

The second issue is that even if a GVRP-inactive switch forwards GVRP PDUs, it will not automatically create the VLANs. Consequently, even if GVRP-active switches receive the PDUs and create the necessary VLANs, an intermediate switch may block the VLAN traffic, unless you modify its VLANs and port assignments manually.

Enabling GVRP on the Switch

The command for enabling GVRP on the switch is found in the Global Configuration mode. It is the gvrp enable (global) command. After the command is entered, the switch immediately begins to transmit PDUs from those ports where GVRP is enabled.

Further, to enable the switch to create dynamic VLANs if it receives GVRP PDUs that contain VIDs for VLANs it does not currently have, use the command gvrp dynamic-vlan-creation.

Here are the commands to enable GVRP on the switch and enable to switch to create dynamic VLANs if it receives GVRP PDUs that contain VIDs for VLANs it does not currently have:

```
awplus>enable
awplus#configure terminal
awplus(config)#gvrp enable
awplus(config)#gvrp dynamic-vlan-creation
```

For reference information, refer to the gvrp enable (global) command and the gvrp dynamic-vlan-creation command in the GVRP Commands chapter.

Enabling GVRP on the Ports

To activate GVRP on the ports so that they transmit GVRP PDUs, use the gvrp registration and the gvrp (interface) commands in the Interface Configuration mode. Because the default setting for GVRP on the ports is disabled, you need to use these commands if you want to re-enable GVRP after disabling it on a port.

This example of these commands activates GVRP on interface `port1.0.12`, `port1.0.13`, and `port1.0.17`:

```
awplus>enable
awplus#configure terminal
awplus(config)#interface port1.0.12,port1.0.13,port1.0.17
awplus(config-if)#gvrp registration normal
awplus(config-if)#gvrp
```

For reference information, refer to the gvrp registration and gvrp (interface) commands in the GVRP Commands chapter.

Setting the GVRP Timers

The switch has a join timer, a leave timer, and a leave all timer. You should not change the timers unless you understand their functions. (Refer to the IEEE 802.1p standard for the timer definitions.) The timers have to be set the same on all GARP-active network devices and the join timer and the leave timer have to be set according to the following rule:

join timer <= (2 x (leave timer))

The commands for setting the timers are in the Interface Configuration mode. They are:

gvrp timer join
gvrp timer leave
gvrp timer leaveall

The timers are set in one hundredths of a second. This example sets the join timer to 0.2 seconds, the leave timer to 0.8 seconds and the leave all timer to 10 seconds for port1.0.2:

```
awplus>enable
awplus#configure terminal
awplus(config)#interface port1.0.2
awplus(config-if)#gvrp timer join 20
awplus(config-if)#gvrp timer leave 80
awplus(config-if)#gvrp timer leaveall 1000
```

For reference information, refer to gvrp timer command in the GVRP Commands chapter.

Disabling GVRP on the Ports

To disable GVRP on the ports, use the gvrp registration none and no gvrp (interface) commands in the Interface Configuration mode.

This example of the command deactivates GVRP on interfaces `port1.0.4` and

port1.0.5:

```
awplus>enable
awplus#configure terminal
awplus(config)#interface port1.0.4,port1.0.5
awplus(config-if)#gvrp registration none
awplus(config-if)#no gvrp
```

For reference information, refer to gvrp registration and gvrp (interface) command in the GVRP Commands chapter.

Disabling GVRP on the Switch

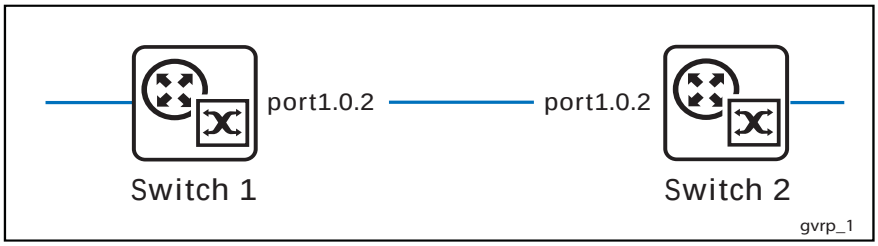
To disable GVRP to stop the switch from learning any further dynamic VLANs or GVRP ports, use the no gvrp (interface) enable command in the Global Configuration mode. Here is the command.

```
awplus>enable
awplus#configure terminal
awplus(config)#no gvrp enable
```

For reference information, refer to the gvrp (interface) command in the GVRP Commands chapter.

Configuring and validating GVRP

GVRP (GARP VLAN Registration Protocol) allows the exchange of VLAN information between switches in a network. If one switch is manually configured with multiple VLANs, other switches in the network learn about these VLANs dynamically through GVRP.



Switch 1: Configuring GVRP to receive VLANs from Switch 1

`awplus#` `configure terminal`	Enter the Global Configuration mode from the Privileged Exec mode.
`awplus(config)#` `gvrp enable`	Enter GVRP on Switch 1.
`awplus(config)#` `gvrp dynamic-vlan-creation`	Enable dynamic VLAN creation for GVRP. Note that GVRP is now enabled globally for Switch 1.
`awplus(config)#` `interface port1.0.2`	Specify an interface (`port1.0.2`) to be configured and enter Interface Configuration mode.
`awplus(config-if)#` `switchport mode trunk`	Set the switching characteristics of the interface as trunk and specify tagged frames only. Any frames not tagged as trunk frames are discarded.
`awplus(config-if)#` `switchport trunk allowed vlan all`	Apply to all VLANs on this interface.
`awplus(config-if)#` `gvrp`	Enable GVRP on switch port `port1.0.2`. Note that GVRP is now set up on interface `port1.0.2` as GVRP is also enabled globally for Switch 1.
`awplus(config-if)#` `exit`	Exit Interface Configuration mode and enter Global Configuration mode.
`awplus(config)#` `exit`	Exit Global Configuration mode and enter Privileged Exec mode.
`awplus#` `show gvrp configuration`	Show GVRP configuration on Switch 1 to confirm GVRP is ready to propagate VLANs.

Switch 2: Configuring GVRP & creating VLANs to propagate:

awplus# enable	Enter the Privileged Exec mode.
awplus# configure terminal	Enter the Global Configuration mode.
awplus(config)# gvrp enable	Enter GVRP on Switch 2.
awplus(config)# vlan database	Create VLANs to propagate between Switch 1 and Switch 2 with GVRP enabled on the Switches and on the interfaces on each Switch.
awplus(config-vlan)# vlan 20-30	Create 11 VLANs with VIDs 20 through 30 to propagate between interface port1.0.2 on Switch 1 and Switch 2.
awplus(config)# gvrp dynamic-vlan-creation	Enable dynamic VLAN creation for GVRP. Note that GVRP is now enabled globally for Switch 2.
awplus(config)# interface port1.0.2	Specify an interface (port1.0.2) to be configured and enter Interface Configuration mode.
awplus(config-if)# switchport mode trunk	Set the switching characteristics of the interface as trunk and specify tagged frames only. Any frames not tagged as trunk frames are discarded.
awplus(config-if)# switchport trunk allowed vlan all	Set this interface to be a tagged member of all VLANs.
awplus(config-if)# gvrp	Enable GVRP on switch port port1.0.2.
awplus(config-if)# exit	Exit Interface Configuration mode and enter Global Configuration mode.
awplus(config)# exit	Exit Global Configuration mode and enter Privileged Exec mode.
awplus# show gvrp configuration	Show GVRP configuration on Switch 2 to confirm GVRP is ready to propagate VLANs.

Switch 1: Validating VLANs have propagated from Switch 2:

`awplus#`	
`show vlan`	Confirm the VLANs are available from Switch 2 on Switch 1 by examining show output to confirm VLANs from Switch 2 are on Switch 1.

Names of Commands Used

gvrp (interface)
gvrp dynamic-vlan-creation
switchport mode trunk
vlan database
vlan

Validation Commands

show vlan

Chapter 23: GVRP Commands

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Command List

With GVRP enabled the switch can exchange VLAN configuration information with other GVRP enabled switches. VLANs can be dynamically created and managed through trunk ports.

- There is limit of 400 VLANs supported by the AlliedWare Plus GVRP implementation. VLANs may be numbered 1-4094, but a limit of 400 of these VLANs are supported.
- MSTP is not supported by the AlliedWare Plus GVRP implementation. GVRP and MSTP are mutually exclusive. STP and RSTP are supported by GVRP.
- VCStack is not supported by the current AlliedWare Plus GVRP implementation.

This chapter provides an alphabetical reference for commands used to configure GVRP. For information about GVRP, including configuration, see Chapter 22, GVRP Introduction and Configuration.

clear gvrp statistics

Use this command to clear the GVRP statistics for all switchports, or for a specific switchport.

Syntax `clear gvrp statistics {all|<interface>}`

Parameter	Description
`all`	Specify all switchports to clear GVRP statistics.
<interface>	Specify the switchport to clear GVRP statistics.

Mode Privileged Exec

Usage Use this command together with the show gvrp statistics command to troubleshoot GVRP.

Examples To clear all GVRP statistics for all switchport on the switch, enter the following command:

```
awplus#clear gvrp statistics all
```

To clear GVRP statistics for switchport interface `port1.0.3`, enter the following command:

```
awplus#clear gvrp statistics port1.0.3
```

Related Commands show gvrp statistics

debug gvrp

Use this command to debug GVRP packets and commands, sending output to the console.

Use the no variant of this command to turn off debugging for GVRP packets and commands.

Syntax

```
debug gvrp {all|cli|event|packet}
no debug gvrp {all|cli|event|packet}
```

Parameter	Description
`all`	Specifies debugging for all levels.
`cli`	Specifies debugging for commands.
`event`	Specified debugging for events.
`packet`	Specifies debugging for packets.

Mode Privileged Exec and Global Configuration

Examples To send debug output to the console for GVRP packets and GVRP commands, and to enable the display of debug output on the console first, enter the following commands:

```
awplus#terminal monitor
awplus#configure terminal
awplus(config)#debug gvrp all
```

To send debug output for GVRP packets to the console, enter the following commands:

```
awplus#terminal monitor
awplus#configure terminal
awplus(config)#debug gvrp packets
```

To send debug output for GVRP commands to the console, enter the following commands:

```
awplus#terminal monitor
awplus#configure terminal
awplus(config)#debug gvrp cli
```

To stop sending debug output for GVRP packets and GVRP commands to the console, and to stop the display of any debug output on the console, enter the following commands:

```
awplus#terminal no monitor
awplus#configure terminal
awplus(config)#no debug gvrp all
```

Related Commands show debugging gvrp
terminal monitor

gvrp (interface)

Use this command to enable GVRP for switchport interfaces.

Use the no variant of this command to disable GVRP for switchport interfaces.

Syntax

```
gvrp
no gvrp
```

Mode Interface Configuration (for switchport interfaces).

Default Disabled by default.

Usage Use this command to enable GVRP on switchport interfaces. Note this command does not enable GVRP for the switch. To enable GVRP on switchports use this command in Interface Configuration mode. You must issue a gvrp enable (global) command before issuing a gvrp (interface) command.

You must enable GVRP on both ends of a link for GVRP to propagate VLANs between links.

Note

MSTP is not supported by the current AlliedWare Plus GVRP implementation. GVRP and MSTP are mutually exclusive. STP and RSTP are supported by GVRP.

Private VLAN trunk ports are not supported by the current AlliedWare Plus GVRP implementation. GVRP and private VLAN trunk ports are mutually exclusive.

Examples To enable GVRP on interfaces `port1.0.1-port1.0.2`, enter the following commands:

```
awplus#configure terminal
awplus(config)#gvrp enable
awplus(config)#interface port1.0.1-port1.0.2
awplus(config-if)#gvrp
```

To disable GVRP on interfaces `port1.0.1-port1.0.2`, enter the following commands:

```
awplus#configure terminal
awplus(config)#interface port1.0.1-port1.0.2
awplus(config-if)#no gvrp
```

Validation Commands show gvrp configuration

Related Commands gvrp dynamic-vlan-creation
gvrp enable (global)

gvrp dynamic-vlan-creation

Use this command to enable dynamic VLAN creation globally for the switch.

Use the no variant of this command to disable dynamic VLAN creation globally for the switch.

Syntax

```
gvrp dynamic-vlan-creation
no gvrp dynamic-vlan-creation
```

Mode Global Configuration

Default Disabled by default.

Usage You must enable GVRP on both ends of a link for GVRP to propagate VLANs between links.

You must also enable GVRP globally in Global Configuration mode before enabling GVRP on an interface in Interface Configuration mode. Both of these tasks must occur to create VLANs.

Note

There is limit of 400 VLANs supported by the AlliedWare Plus GVRP implementation. VLANs may be numbered 1-4094, but a limit of 400 of these VLANs are supported.

.Examples To enable GVRP dynamic VLAN creation on the switch, enter the following commands:

```
awplus#configure terminal
awplus(config)#gvrp enable
awplus(config)#gvrp dynamic-vlan-creation
```

Enter the following commands for switches with hostnames `awplus_switch1` and `awplus_switch2` respectively, so `awplus_switch1` propagates VLANs to `awplus_switch2` and `awplus_switch2` propagates VLANs to `awplus_switch1`:

```
awplus_switch1#configure terminal
awplus_switch1(config)#gvrp enable
awplus_switch1(config)#gvrp dynamic-vlan-creation

awplus_switch2#configure terminal
awplus_switch2(config)#gvrp enable
awplus_switch2(config)#gvrp dynamic-vlan-creation
```

To disable GVRP dynamic VLAN creation on the switch, enter the following commands:

```
awplus#configure terminal
awplus(config)#no gvrp dynamic-vlan-creation
```

Validation Commands show gvrp configuration

Related Commands gvrp enable (global)

gvrp enable (global)

Use this command to enable GVRP globally for the switch.

Use the no variant of this command to disable GVRP globally for the switch.

Syntax

```
gvrp enable
no gvrp enable
```

Mode Global Configuration

Default Disabled by default.

Usage Use this command to enable GVRP on the switch. Note that this command does not enable GVRP on switchports. To enable GVRP on switchports use the gvrp (interface) command in Interface Configuration mode. You must issue a gvrp enable (global) command before issuing a gvrp (interface) command.

You must enable GVRP on both ends of a link for GVRP to propagate VLANs between links.

Note

MSTP is not supported by the current AlliedWare Plus GVRP implementation. GVRP and MSTP are mutually exclusive. STP and RSTP are supported by GVRP.

Private VLAN trunk ports are not supported by the current AlliedWare Plus GVRP implementation. GVRP and private VLAN trunk ports are mutually exclusive.

Examples To enable GVRP for the switch, before enabling GVRP on switchports, enter the following commands:

```
awplus#configure terminal
awplus(config)#gvrp enable
```

To disable GVRP on the switch, which will also disable GVRP enabled on switchports, enter the following commands:

```
awplus#configure terminal
awplus(config)#no gvrp enable
```

Validation Commands show gvrp configuration

Related Commands gvrp (interface)
gvrp dynamic-vlan-creation

gvrp registration

Use this command to set GVRP registration to normal, fixed, and forbidden registration modes.

Syntax

```
gvrp registration {normal|fixed|forbidden}
```

Parameter	Description
`normal`	Specify dynamic GVRP registration and deregistration of VLANs.
`fixed`	Specify fixed GVRP registration and deregistration of VLANs.
`forbidden`	Specify no GVRP registration of VLANs. VLANs are deregistered.

Mode

Interface Configuration

Default

Normal registration is the default.

Usage

Configuring a trunk port in normal registration mode allows dynamic creation of VLANs. Normal mode is the default mode. Validate using the show gvrp configuration command.

Configuring a trunk port in fixed registration mode allows manual creation of VLANs.

Configuring a trunk port in forbidden registration mode prevents VLAN creation on the port.

Examples

To configure GVRP registration to `fixed` on `port1.0.1`, enter these commands:

```
awplus#configure terminal
awplus(config)#interface port1.0.1
awplus(config-if)#gvrp registration fixed
```

To configure GVRP registration to `normal` on `port1.0.2`, enter these commands:

```
awplus#configure terminal
awplus(config)#interface port1.0.2
awplus(config-if)#gvrp registration normal
```

To configure GVRP registration to `forbidden` on `port1.0.3`, enter these commands:

```
awplus#configure terminal
awplus(config)#interface port1.0.3
awplus(config-if)#gvrp registration forbidden
```

Validation Commands

show gvrp configuration

gvrp timer

Use this command to set GVRP timers in Interface Configuration mode for a given interface.

Use the no variant of this command to reset the GVRP timers to the defaults specified in the table below.

Syntax

```
gvrp timer
   {join <timer-value>|leave <timer-value>|leaveall <timer-value>}

no gvrp timer {join|leave|leaveall}
```

Parameter	Description
`join`	Specifies the timer for joining the group (default is 20 centiseconds / hundredths of a second, or 200 milliseconds).
`leave`	Specifies the timer for leaving a group (default is 60 centiseconds / hundredths of a second, or 600 milliseconds).
`leaveall`	Specifies the timer for leaving all groups (default is 1000 centiseconds / hundredths of a second, or 10,000 milliseconds).
<timer-value>	<1-65535> The timer value in hundredths of a second (centiseconds).

Mode Interface Configuration

Defaults The default join time value is 20 centiseconds (200 milliseconds), the default leave timer value is 60 centiseconds (600 milliseconds), and the default leaveall timer value is 1000 centiseconds (10,000 milliseconds).

Usage When configuring the `join` timer, set it to less than or equal to twice the `leave` timer value. The settings for the `join` and `leave` timers must be the same for all GVRP enabled switches.

Use the show gvrp timer command to confirm GVRP timers set with this command.

Examples To set the GVRP `join` timer to 300 hundredths of a second for interface `port1.0.1`, enter the following commands:

```
awplus#configure terminal
awplus(config)#interface port1.0.1
awplus(config-if)#gvrp timer join 20
```

To set the GVRP `leave` timer to 600 hundredths of a second for interface `port1.0.2`, enter the following commands:

```
awplus#configure terminal
awplus(config)#interface port1.0.2
awplus(config-if)#gvrp timer leave 60
```

To set the GVRP `leaveall` timer to 1000 hundredths of a second for interface `port1.0.1`, enter the following commands:

```
awplus#configure terminal
awplus(config)#interface port1.0.1
awplus(config-if)#gvrp timer leaveall 1000
```

To reset the GVRP `join` timer to its default (200 milliseconds) for interface `port1.0.1`, enter the following commands:

```
awplus#configure terminal
awplus(config)#interface port1.0.1
awplus(config-if)#no gvrp timer join
```

To reset the GVRP `leave` timer to its default (600 milliseconds) for interface `port1.0.2`, enter the following commands:

```
awplus#configure terminal
awplus(config)#interface port1.0.2
awplus(config-if)#no gvrp timer leave
```

To reset the GVRP `leaveall` timer to its default (10,000 milliseconds) for interface `port1.0.3`, enter the following commands:

```
awplus#configure terminal
awplus(config)#interface port1.0.3
awplus(config-if)#no gvrp timer leaveall
```

Related Commands show gvrp timer

show debugging gvrp

Use this command to display the GVRP debugging option set.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show debugging gvrp`

Mode User Exec and Privileged Exec

Example Enter the following commands to display GVRP debugging output on the console:

```
awplus#configure terminal
awplus(config)#debug gvrp all
awplus(config)#exit
awplus#show debugging bgp
```

Output See sample output from the `show debugging gvrp` after entering `debug gvrp all`:

```
GVRP debugging status:
  GVRP Event debugging is on
  GVRP CLI debugging is on
  GVRP Timer debugging is on
  GVRP Packet debugging is on
```

Related Commands debug gvrp

show gvrp configuration

Use this command to display GVRP configuration data for a switch.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show gvrp configuration`

Mode User Exec and Privileged Exec

Example To show GVRP configuration for the switch, enter the following command:

```
awplus#show gvrp configuration
```

Output The following is an output of this command displaying the GVRP configuration for a switch:

```
awplus#show gvrp configuration
Global GVRP Configuration:
GVRP Feature: Enabled
Dynamic Vlan Creation: Disabled
Port based GVRP Configuration:
                                                  Timers(centiseconds)
Port    GVRP Status Registration  Applicant   Join   Leave
LeaveAll
-----------------------------------------------------------------
port1.0.1 Enabled   Normal        Normal      20      60    1000
port1.0.2 Enabled   Normal        Normal      200    600   10000
```

show gvrp machine

Use this command to display the state machine for GVRP.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show gvrp machine`

Mode User Exec and Privileged Exec

Example To show the GVRP state machine for the switch, enter the following command:

```
awplus#show gvrp machine
```

Output See the following output of this command displaying the GVRP state machine.

```
awplus show gvrp machine
  port = 1.0.1  applicant state = QA   registrar state = INN
  port = 1.0.2  applicant state = QA   registrar state = INN
```

show gvrp statistics

Use this command to display a statistical summary of GVRP information for the switch.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show gvrp statistics [<interface>]`

Parameter	Description
<interface>	The name of the switchport interface.

Mode User Exec and Privileged Exec

Usage Use this command together with the clear gvrp statistics command to troubleshoot GVRP.

Examples To show the GVRP statistics for all switchport interfaces, enter the following command:

```
awplus#show gvrp statistics
```

To show the GVRP statistics for switchport interfaces `port1.0.1` and `port1.0.2`, enter the following command:

```
awplus#show gvrp statistics port1.0.1-port1.0.2
```

Output The following is an output of this command displaying a statistical summary for `port1.0.1-port1.0.2`

```
awplus# show gvrp statistics port1.0.1-port1.0.2
Port      JoinEmpty    JoinIn   LeaveEmpty     LeaveIn      Empty
-----------------------------------------------------------------
1.0.1     RX           0          2          0         0        0
          TX           0          0          0         0        0
1.0.2     RX           0          1          0         0        1
          TX           0          0          0         0        0
```

Related Commands clear gvrp statistics

show gvrp timer

Use this command to display data for the GVRP timers set with the gvrp timer command.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show gvrp timer <interface>`

Parameter	Description
<interface>	The name of the switchport interface.

Mode User Exec and Privileged Exec

Examples To show the GVRP timers for all switchport interfaces, enter the following command:

```
awplus#show gvrp timer
```

To show the GVRP timers for switchport interface `port1.0.1`, enter the following command:

```
awplus#show gvrp timer port1.0.1
```

Output The following show output displays data for timers on the switchport interface `port1.0.1`

```
awplus# show gvrp timer port1.0.1
Timer           Timer Value (centiseconds)
----------------------------------------
Join                  20
Leave                 60
Leave All             1000
```

Related Commands gvrp timer

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Chapter 24: Internet Protocol (IP) Addressing and Protocols

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Introduction

This chapter describes how to configure IPv4 addressing and the protocols used to help IP function on your network.

As well as the familiar Internet, with uppercase “I”, the term internet (with lowercase “i”) can refer to any network (usually a wide area network) that uses the Internet Protocol. This chapter concentrates on this definition—a generalized network that uses IP as its transport protocol.

Assigning an IP Address

To configure your device to perform IP routing (for example, to access the Internet) you need to configure IP. You also need to configure IP if you want to manage your device from any IP-based management process (such as SSH, Telnet, or SNMP).

Add an IP address to each of the interfaces that you want to process IP traffic.

You can configure an interface on your device with a static IP address, or with a dynamic IP address assigned using your device’s DHCP client.

Static IP addresses

To add a static IP address to an interface, enter interface mode for the interface that you want to configure, then use the command:

```
awplus(config-if)# ip address <ip-addr/prefix-length>
                   [secondary [label <label>]]
```

where `<ip-address/m>` the IP address followed by a slash then the prefix length. Note that you cannot specify the mask in dotted decimal notation in this command.

For example, to give the interface vlan1 an address of 192.168.10.10, with a class C subnet mask, use the command:

```
awplus(config-if)# ip address 192.168.10.10/24
```

The secondary parameter allows you to add multiple IP addresses to an interface using this command. Each interface must have a primary IP address before you can add a secondary address. Your device treats secondary addresses the same as primary addresses in most instances, such as responding for ARP requests for the IP address. However, the only packets generated that have a secondary address as source address are routing updates. You can define up to 32 secondary addresses on a single interface.

DHCP dynamic addresses

When you use the DHCP client, it obtains the IP address and subnet mask for the interface, and other IP configuration parameters, from a DHCP server. To configure an interface to gain its IP configuration using the DHCP client, use the command:

```
awplus(config-if)# ip address dhcp [client-id <interface>]
                   [hostname <hostname>]
```

If an IP interface is configured to get its IP address and subnet mask from DHCP, the interface does not take part in IP routing until the IP address and subnet mask have been set by DHCP.

If you need to make a static entry in your DHCP server for the device, you need your device's MAC address, which you can display by using the command:

```
awplus# show interface
```

See Chapter 85, Dynamic Host Configuration Protocol (DHCP) Introduction for more information about DHCP.

Address Resolution Protocol (ARP)

Address Resolution Protocol (ARP) is used by your device to dynamically learn the Layer 2 address of devices in its networks. Most hosts also have a MAC physical address in addition to the assigned IP address. For Ethernet, this is a 6-byte, globally unique number. ARP enables your device to learn the physical address of the host that has a given IP address.

When your device needs to forward packets to a destination that it does not know the Layer 2 address of, it broadcasts an ARP request to determine where to send the packet. The ARP request is a broadcast packet and includes the target IP address. All stations on the LAN receive this broadcast but only one host recognizes its own IP address. It replies, thereby giving your device its physical address.

Your device creates a dynamic ARP entry in its ARP cache, to record the IP address to physical address mapping (also called a binding). It uses that ARP entry to forward further packets to that address.

The ARP protocol is described in RFC 826, *An Ethernet Address Resolution Protocol—or—Converting Network Protocol Addresses to 48 bit Ethernet Address for Transmission on Ethernet Hardware*.

Static ARP Entries

If your LAN includes hosts that do not support ARP, you can add a static ARP entry to the cache. However, it is rarely necessary to add an ARP entry this way. To add a static ARP entry, use the command:

```
awplus(config)# arp [vrf <vrf-name>] <ip-addr> <mac-address>
                [<port-number>] [alias]
```

Timing Out ARP Entries

Your device times out dynamic ARP entries to ensure that the cache does not fill with entries for hosts that are no longer active. If your device stops receiving traffic for a device specified in a dynamic ARP entry, it deletes the ARP entry after a configurable timeout period. Static ARP entries are not aged or automatically deleted.

Increasing the ARP timeout reduces the amount of network traffic. Decreasing the timeout makes your device more responsive to changes in network topology.

To set a timeout period, enter the interface mode, then use the command:

```
awplus(config-if)# arp-aging-timeout <0-432000>
```

Deleting ARP Entries

To remove a static ARP entry, use the command:

```
awplus(config)# no arp [vrf <vrf-name>] <ip-addr>
```

To clear the ARP cache of dynamic entries, use the command:

```
awplus# clear arp-cache
```

This removes the dynamic ARP entries for all interfaces.

To display the entries in the ARP cache, use the command:

```
awplus)# show arp
```

The ARP cache will be repopulated by the normal ARP learning mechanism. As long as the entries are relearned quickly enough, deleting dynamic ARP entries does not affect:

- routes
- OSPF neighbor status
- BGP peer status
- the TCP/UDP connection status
- VRRP status

Proxy ARP

Proxy ARP (defined in RFC 1027) allows hosts that do not support routing (i.e. they have no knowledge of the network structure) to determine the physical addresses of hosts on other networks. Your device intercepts ARP broadcast packets and substitutes its own physical address for that of the remote host. This occurs only if your device has the best route to the remote host. By responding to the ARP request, your device ensures that subsequent packets from the local host are directed to its physical address, and it can then forward these to the remote host. The process is symmetrical.

Proxy ARP is disabled by default. To enable proxy ARP on an interface, use the commands:

```
awplus(config)# interface <interface>
awplus(config-if)# ip proxy-arp
```

To disable Proxy ARP on an interface, use the command:

```
awplus(config-if)# no ip proxy-arp
```

To check Proxy ARP is enabled on an interface, use the show running-config command. If Proxy ARP has been enabled an entry shows ip proxy-arp below the interface it is enabled on. No ip proxy-arp entry below an interface in the config indicates Proxy ARP is disabled on it.

See the sample configuration commands and validation command with resulting output showing proxy ARP enabled on VLAN 2 below:

```
awplus#configure terminal
awplus(config)#interface vlan2
awplus(config-if)#ip proxy-arp
awplus(config-if)#end
awplus(config)#exit
awplus#show running-config
!
interface vlan2
 ip proxy-arp
 ip address 192.168.2.2/24
!
```

See the sample configuration commands and validation command with resulting output showing proxy ARP disabled on VLAN 2 below:

```
awplus#configure terminal
awplus(config)#interface vlan2
awplus(config-if)#no ip proxy-arp
awplus(config-if)#end
awplus(config)#exit
awplus#show running-config
!
interface vlan2
 ip address 192.168.2.2/24
!
```

Local Proxy ARP

Local Proxy ARP lets you stop MAC address resolution between hosts within an interface's subnet. This ensures that devices within a subnet cannot send traffic that bypasses Layer 3 routing on your device. This lets you monitor, filter, and control traffic between devices in the same subnet.

Local Proxy ARP extends proxy ARP by intercepting and responding to ARP requests between hosts within a subnet. Local proxy ARP responds to ARP requests with your device's own MAC address details instead of those from the destination host. This stops hosts from learning the MAC address of other hosts within its subnet.

When Local Proxy ARP is operating on an interface, your device does not generate or forward any ICMP-Redirect messages on that interface.

Local Proxy ARP is disabled by default. To enable local proxy ARP on an interface, use the commands:

```
awplus(config)# interface <interface>
awplus(config-if)# ip local-proxy-arp
```

To disable local proxy ARP on an interface, use the command:

```
awplus(config-if)# no ip local-proxy-arp
```

To check Local Proxy ARP is enabled on an interface, use the show running-config command. If Local Proxy ARP has been enabled an entry shows ip local-proxy-arp below the interface it is enabled on. No ip local-proxy-arp entry below an interface in the config indicates Local Proxy ARP is disabled on it.

See the sample configuration commands and validation command with resulting output showing local proxy ARP enabled on VLAN 1 below:

```
awplus#configure terminal
awplus(config)#interface vlan1
awplus(config-if)#ip local-proxy-arp
awplus(config-if)#end
awplus(config)#exit
awplus#show running-config
!
interface vlan1
 ip local-proxy-arp
 ip address 192.168.1.2/24
!
```

See the sample configuration commands and validation command with resulting output showing Local Proxy ARP disabled on VLAN 1 below:

```
awplus#configure terminal
awplus(config)#interface vlan1
awplus(config-if)#no ip local-proxy-arp
awplus(config-if)#end
awplus(config)#exit
awplus#show running-config
!
interface vlan1
 ip address 192.168.1.2/24
!
```

ARP Logging

You can enable your device to log static and dynamic ARP entries, and you can select either default hexadecimal notation (HHHH.HHHH.HHHH) or standard IEEE format hexadecimal notation (HH-HH-HH-HH-HH-HH) for the MAC addresses displayed in the ARP log output.

If this feature is enabled, ARP log messages are stored on the device in RAM. If the device is rebooted the ARP log messages are lost. ARP logging is disabled by default.

To enable ARP logging, use the command:

```
awplus(config)# arp log [mac-address-format ieee]
```

You can specify whether the MAC address is displayed in the default hexadecimal notation HHHH.HHHH.HHHH or in the standard IEEE format HH-HH-HH-HH-HH-HH.

To disable ARP logging, use the command:

```
awplus(config)# no arp log [mac-address-format ieee]
```

To display the ARP log messages, use the command:

```
awplus(config)# show log | include ARP_LOG
```

See the sample ARP log output and descriptions of the fields displayed in the sample ARP log output in the arp log command on page 25.5.

Domain Name System (DNS)

The Domain Name System allows you to access remote systems by entering human-readable device host names rather than IP addresses. DNS works by creating a mapping between a device name, such as “www.alliedtelesis.com”, and its IP address. These mappings are held on DNS servers. DNS translates meaningful domain names into IP addresses for networking equipment to locate and address these devices. The benefits of DNS are that domain names:

- can map to a new IP address if the host’s IP address changes
- are easier to remember than an IP address
- allow organizations to use a domain name hierarchy that is independent of any IP address assignment

Your AlliedWare Plus™ device has a the ability to resolve domain names for internally generated commands (DNS Client) as well as providing the DNS information to connected hosts (via DNS Relay, DHCP Server or DHCP Relay).

The DNS Client is enabled automatically when at least one DNS server is present on the interface. This client allows you to use domain names instead of IP addresses when using commands on your device from this interface.

The DNS Relay provides the presence of a local virtual DNS server which can service DNS lookup requests sent to it from local hosts. The DHCP Server can be configured to provide domain names information to DHCP clients during the lease process.

Domain name parts

Domain names are made up of a hierarchy of two or more name segments. Each segment is separated by a period. The format of domain names is the same as the host portion of a URL (Uniform Resource Locator). The first segment from the left is unique to the host, with each following segment mapping the host in the domain name hierarchy. The segment on the far right is a top-level domain name shared by many hosts.

Server hierarchy

A network of domain name servers maintains the mappings between domain names and their IP addresses. This network operates in a hierarchy that is similar to the structure of the domain names. When a local DNS server cannot resolve your request it sends the request to a higher level DNS server.

For example, to access the site “alliedtelesis.com”, your PC sends a DNS enquiry to its local DNS server asking for the IP address matching alliedtelesis.com. If this address is already locally cached (following its recent use), the DNS server returns the IP address that matches alliedtelesis.com. If the DNS server does not have this address cached, it forwards the request upwards through the hierarchy of DNS servers until a DNS server can resolve the mapping. This means an often-used domain name is resolved quickly, while an uncommon or nonexistent domain may take longer to resolve or fail.

As well as the hierarchy of domain name servers accessible through the Internet, you can operate your own DNS server to map to private IP addresses within your network.

The DHCP server IP address can be either statically defined, or can be dynamically assigned via DHCPv4 option 6 using “ip name-server” on page 25.42 and DHCP option 15 using “ip domain-name” on page 25.24 if DHCP client is configured. See Chapter 85, Dynamic Host Configuration Protocol (DHCP) Introduction for more information about DHCP and DHCP options.

DNS Client

Your AlliedWare Plus™ device has a DNS Client that is enabled automatically when you add a DNS server to your device. This client allows you to use domain names instead of IP addresses when using commands on your device.

To add a DNS server to the list of servers that the device sends DNS queries to, use the command:

```
awplus(config)# ip name-server <ip-addr>
```

To check the list of servers that the device sends DNS queries to, use the command:

```
awplus# show ip name-server
```

To add a default domain name used to append to DNS requests, use the command:

```
awplus(config)# ip domain-name <domain-name>
```

For example, to use DNS to match hostnames to your internal network “example.net”, use the command:

```
awplus(config)# ip domain-name example.net
```

If you then use the command ping host2, your device sends a DNS request for host2.example.net. To check the domain name configured with this command, use the command:

```
awplus# show ip domain-name
```

Alternatively you can create a list of domain names that your device will try in turn by using the command:

```
awplus(config)# ip domain-list <domain-name>
```

For example, to use DNS to match incomplete hostnames to the top level domains “.com”, and “.net”, use the commands:

```
awplus(config)# ip domain-list .com
awplus(config)# ip domain-list .net
```

If you then use the command ping alliedtelesis, your device sends a DNS request for alliedtelesis.com and if no match was found your device would then try alliedtelesis.net. To check the entries in the domain list, use the command:

```
awplus# show ip domain-list
```

To disable the DNS client on your device, use the command:

```
awplus(config)# no ip domain-lookup
```

To check the status of the DNS Client on your device, and the configured servers and domain names, use the command:

```
awplus# show hosts
```

DNS Relay

DNS Relay provides the presence of a local virtual DNS server on your AlliedWare Plus™ device which can service DNS lookup requests sent to it from local hosts. The DNS Relay will usually relay the requests to an external, or upstream, DNS server. By default, DNS Relay is disabled.

Optionally, DNS name resolver caching may be enabled on the DNS Relay, which can provide some lookup speed advantage and avoid unnecessary repeated requests to external DNS servers. By default, DNS caching is disabled.

When the DNS Relay name resolver cache is enabled on your switch, the switch will maintain a cache of recently used mappings between domain names and IP addresses so that other identical requests can be responded to without further reference to an external, or upstream DNS server. When the switch receives a DNS query from a client the switch will attempt to match the request with entries in this cache. If the switch does not have this address cached, it forwards the request upwards through the hierarchy of DNS servers for resolution. The DNS cache has a limited size, and times out entries after a specified period of up to 60 minutes.

The relaying of DNS queries is required for use in networks where the DNS server and the clients connected to the switch are on different subnets and do not know how to reach each other.

DNS Relay uses the DNS server list configured by the ip name-server command to forward DNS query packets. To enable DNS Relay you need to configure the list of servers that the device sends DNS queries to and then enable DNS forwarding, as shown in the following example for a DNS server with an IPv4 address:

```
awplus# configure terminal
awplus(config)# ip name-server 192.168.1.1
awplus(config)# ip name-server 192.168.1.2
awplus(config)# ip dns forwarding
```

Note both IPv4 and IPv6 support DNS record types. IPv4 and IPv6 are supported in DNS name-to-address and DNS address-to-name lookup processes. Specifying a name server and enabling DNS forwarding maps both IPv4 and IPv6 addresses. You can configure DNS Relay to use IPv6 addresses using the same commands used to configure DNS Relay to use IPv4 addresses, as shown in the following example:

```
awplus# configure terminal
awplus(config)# ip name-server 2001:0db8:010d::1
awplus(config)# ip name-server 2001:0db8:010d::2
awplus(config)# ip dns forwarding
```

You can then configure DNS Relay behavior with the following commands:

To set the number of times the switch will retry to forward DNS queries, use the command:

```
awplus(config)# ip dns forwarding retry <0-100>
```

To set the number of seconds to wait for a response, use the command:

```
awplus(config)# ip dns forwarding timeout <0-3600>
```

To set the interface to use for forwarding and receiving DNS queries, use the command:

```
awplus(config)# ip dns forwarding source-interface
                <interface-name>
```

To specify the DNS Relay name resolver cache size and lifetime, use the command:

```
awplus(config)# ip dns forwarding cache [size <0-1000>]
                [timeout <60-3600>]
```

To remove entries from the DNS Relay name resolver cache, use the command:

```
awplus(config)# clear ip dns forwarding cache
```

Information which may be useful for troubleshooting DNS Relay is available using the DNS Relay debugging function. To enable DNS Relay debugging, use the command:

```
awplus# debug ip dns forwarding
```

To check the status of DNS Relay, use the command:

```
awplus# show ip dns forwarding
```

To display the DNS Relay name resolver cache, use the command:

```
awplus# show ip dns forwarding cache
```

DHCP options

When your device is using its DHCP client for an interface, it can receive the following DHCP options from the DHCP server:

- Option 6 - a list of DNS servers. This list appends to the DNS servers set on your device with the ip name-server command.
- Option 15 - a domain name used to resolve host names. This option replaces the domain name set with the ip domain-name command.

See Chapter 85, Dynamic Host Configuration Protocol (DHCP) Introduction for more information about DHCP and DHCP options.

Internet Control Message Protocol (ICMP)

The Internet Control Message Protocol (ICMP) allows networking devices to send information and control messages to other devices or hosts. Your device implements all non-obsolete ICMP functions.

The following table lists the ICMP messages implemented by your device.

ICMP Message Type	Device Response
Echo reply (0)	This is used to implement the ping command. Your device sends out an echo reply in response to an echo request.
Destination unreachable (3)	This message is sent when your device drops a packet because it did not have a route to the destination.
Redirect (5)	Your device issues this message to inform a local host that its target is located on the same LAN (no routing is required) or when it detects a host using a non-optimal route (usually because a link has failed or changed its status). For example, if your device receives a packet destined to its own MAC address, but with a destination IP address of another host in the local subnet, it returns an ICMP redirect to the originating host. ICMP redirects are disabled on interfaces on which local proxy ARP is enabled.
Echo request (8)	This is related to echo replies. If your device receives an echo request, it sends an echo reply. If you enter the ping command, your device generates echo requests.
Router Advertisements (10)	These are Router Discovery Protocol messages. If Router Discovery is enabled, your device sends these to announce the IP addresses of the sending interface.
Time to Live Exceeded (11)	If the TTL field in a packet falls to zero, your device sends this message.This occurs when there are too many hops in the path that a packet is traversing.

ICMP messages are enabled on all interfaces by default. You can control the flow of ICMP messages across different interfaces using the access-list commands. See Chapter 56, IPv4 Hardware Access Control List (ACL) Commands and Chapter 57, IPv4 Software Access Control List (ACL) Commands.

ICMP Router Discovery Protocol (IRDP)

Router discovery

Your device supports the router specification sections of RFC 1256, *ICMP Router Discovery Messages*. If this feature is configured, your device sends router advertisements periodically and in response to router solicitations. It does not support the Host Specification section of this RFC.

Benefits

Before an IP host can send an IP packet, the host has to know the IP address of a neighboring router that can forward the packet to its destination. ICMP Router Discovery messages let routers automatically advertise themselves to hosts. Other methods either require someone to manually keep these addresses current, or require DHCP to send router addresses.

Router discovery process

The following table summarizes what happens when Router Discovery advertisements are enabled on an interface.

When...	Then...
Router Discovery advertising starts on an interface because: ■ your device starts up, or ■ you enable advertisements on your device or on an interface	your device multicasts a router advertisement and continues to multicast them periodically until router advertising is disabled.
a host starts up	the host may send a router solicitation message.
your device receives a router solicitation	your device multicasts an early router advertisement from the interface on which it received the router solicitation.
a host receives a router advertisement	the host stores the IP address and preference level for the advertisement lifetime.
the lifetimes of all existing router advertisements on a host expire	the host sends a router solicitation.
a host does not receive a router advertisement after sending a small number of router solicitations	the host waits for the next unsolicited router advertisement.
a host needs a default router address	the host uses the IP address of the router or L3 switch with the highest preference level.
Router Discovery advertising is deleted from the interface	your device multicasts a router advertisement with the IP address(es) that stopped advertising, and a lifetime of zero. It continues to periodically multicast router advertisements for other interfaces, if configured to.
the router receives a router advertisement from another router	the router does nothing but silently discards the message

Advertisement messages

A router advertisement is an ICMP (type 10) message that contains the following:

- in the destination address field of the IP header, the interface's configured advertisement address, either 224.0.0.1 or 255.255.255.255.
- in the lifetime field, the interface's configured advertisement lifetime.
- in the Router Address and Preference Level fields, the addresses and preference levels of all the logical interfaces that are set to advertise.

Your device does not send router advertisements by default.

Solicitation message

A router solicitation is an ICMP (type 10) message containing:

- source Address: an IP address belonging to the interface from which the message is sent
- destination Address: the configured Solicitation Address, and
- Time-to-Live: 1 if the Destination Address is an IP multicast address; at least 1 otherwise.

Advertisement interval

The router advertisement interval is the time between router advertisements. For the first few advertisements sent from an interface (up to 3), your device sends the router advertisements at intervals of at most 16 seconds. After these initial transmissions, it sends router advertisements at random intervals between the minimum and maximum intervals that the user configures, to reduce the probability of synchronization with the advertisements from other routers on the same link. By default, the minimum is 450 seconds (7.5 minutes), and the maximum is 600 seconds (10 minutes).

Preference level

The preference level is the preference of the advertised address as a default router address relative to other router addresses on the same subnet. By default, all routers and Layer 3 switches have the same preference level, zero. While it is entered as a decimal from 0 to 2147483647, it is encoded in router advertisements as a twos-complement hex integer from 0x8000000 to 0x7fffffff. A higher preference level is preferred over a lower value.

Lifetime

The lifetime of a router advertisement is how long the information in the advertisement is valid. By default, the lifetime of all advertisements is 1800 seconds (30 minutes).

Address type

Your device can send its router advertisements using either a broadcast or multicast destination address. By default, your device sends router advertisements using the all-systems multicast address (224.0.0.1). However, on networks where the hosts do not support IP multicast you must use the broadcast address (255.255.255.255). To change the address type to broadcast on an interface, use the command:

```
awplus(config-if)# ip irdp broadcast
```

To change the address type back to multicast, use the no variant of the above command, or use the command:

```
awplus(config-if)# ip irdp multicast
```

Configuration procedure

Do the following to configure your device to send router advertisements.

Step 1: Enter the interface to advertise.

Enter the configuration mode for the interface, using the command:

```
awplus(config)# interface <interface>
```

Step 2: Change the address type.

By default, your device sends router advertisements using a multicast destination address. If hosts on your network do not support this, change the address type to broadcast, using the command:

```
awplus(config-if)# ip irdp broadcast
```

Step 3: Configure the advertisement interval and lifetime.

By default, your device sends router advertisements every 7.5 to 10 minutes, with a lifetime of 30 minutes. These settings are likely to work well in most situations, and will not cause a large amount of extra traffic, even if there are several routers on the LAN. If you change these settings, keep the following proportions:

```
lifetime=3 x maxadvertisementinterval
minadvertisementinverval=0.75 x maxadvertisementinterval
```

You cannot set the maximum advertisement interval below the minimum interval. If you are lowering the maximum interval to a value below the current minimum interval, you must change the minimum value first. This also applies to changing the minimum interval above the current maximum interval.

To change the maximum advertisement interval, use the command:

```
awplus(config-if)# ip irdp maxadvertinterval <4-1800>
```

To change the minimum advertisement interval, use the command:

```
awplus(config-if)# ip irdp minadvertinterval <3-1800>
```

To change the lifetime for your device's router advertisements, use the command:

```
awplus(config-if)# ip irdp lifetime <0-9000>
```

Step 4: Set preference levels.

By default, every interface has the same preference for becoming a default router. To give the interface a higher preference, increase the preference level. To give it a lower preference, decrease this value.

To set the preference level for all addresses on this interface, use the command:

```
awplus(config-if)# ip irdp preference <0-2147483647>
```

To set the preference for a specific address on the interface, use the command:

```
awplus(config-if)# ip irdp address <ip-address> preference
                  <0-2147483647>
```

Step 5: Enable advertising on the interface.

To enable router advertisements on an interface, enter the interface mode and use the command:

```
awplus(config-if)# ip irdp
```

Step 6: Enable advertising on your device.

To globally enable router advertisements on your device, enter the configure mode and use the command:

```
awplus(config)# router ip irdp
```

Step 7: Check advertise settings.

To view the IRDP configuration on the interface, use the command:

```
awplus# show ip irdp interface [<interface-name>]
```

To view the global IRDP configuration for your device, use the command:

```
awplus# show ip irdp
```

Debugging IRDP

Information which may be useful for troubleshooting IRDP is available using the IRDP debugging function. To enable IRDP debugging, use the command:

```
awplus# debug ip irdp {event|nsm|receive|send|both|
       detail|all}
```

Checking IP Connections

To verify connections between networks and network devices, use the ping (Packet Internet Groper) and trace route functions on your device.

Ping

Ping tests the connectivity between two network devices to determine whether each network device can “see” the other device. Echo request packets are sent to the destination addresses and responses are displayed on the console.

If you can ping the end destination, then the physical, Layer 2 and Layer 3 links are functioning, and any difficulties are in the network or higher layers.

If pinging the end destination fails, use traceroute to discover the point of failure in the route to the destination.

To ping a device, use the command:

```
awplus# ping {<hostname>|<ipaddr>}
```

Traceroute

You can use traceroute to discover the route that packets pass between two systems running the IP protocol. Traceroute sends an initial UDP packets with the Time To Live (TTL) field in the IP header set starting at 1. The TTL field is increased by one for every subsequent packet sent until the destination is reached. Each hop along the path between two systems responds with a TTL exceeded packet (ICMP type 11) and from this the path is determined.

To use traceroute, use the command:

```
awplus# traceroute [vrf <vrf-name>] {<ip-addr>|<hostname>}
```

Enter either the hostname or the IP address of the device you are trying to reach.

IP Helper

The IP Helper feature allows the switch to receive UDP broadcasts on one subnet, and forward them as broadcasts or unicasts into another subnet, so a client can use an application which uses UDP broadcast (such as Net-BIOS) when the client and server are located in different subnets. The IP Helper feature forwards UDP broadcast network traffic to specific hosts on another subnet and/or to the broadcast address of another subnet.

When the IP Helper feature is enabled on a VLAN interface, the UDP broadcast packets received on the interface are processed for forwarding out through another interface into another subnet. Depending on the nature of the ip-helper addresses configured, the UDP broadcasts will be unicast forwarded to a single host in the destination subnet, or unicast forwarded to multiple hosts in the destination subnet, or broadcast to the broadcast address of the destination subnet. Not all UDP broadcasts will be forwarded when IP Helper is configured. The set of broadcasts to be forwarded can be defined by specifying the destination UDP port(s) of the packets you wish to forward.

The command to enable the forwarding of UDP broadcasts received on a given interface is ip helper-address (entered in interface configuration mode). The ip forward-protocol udp command specifies types of broadcast packets to forward.

Multiple different destination addresses can be specified by using multiple instances of the ip helper-address command under the same interface. If a destination address is specified that is actually the broadcast address of one of the subnets directly connected to the switch, then the UDP packets will be forwarded as broadcasts onto that subnet.

Likewise, multiple different types of UDP packet can be specified for forwarding by specifying multiple different destination ports using the ip forward-protocol udp command.

Note

The types of UDP broadcast packets that the switch will forward are only those specified by the ip forward-protocol command(s). There are not other UDP packet types that the IP helper process forwards by default.

IP Directed Broadcast

IP directed-broadcast is enabled and disabled per VLAN interface. When enabled a directed broadcast packet is forwarded to an enabled VLAN interface if received on another subnet.

An IP directed broadcast is an IP packet whose destination address is a broadcast address for some IP subnet, but originates from a node that is not itself part of that destination subnet. When a directed broadcast packet reaches a switch that is directly connected to its destination subnet, the packet is flooded as a broadcast on the destination subnet.

The ip directed-broadcast command controls the flooding of directed broadcasts when they reach target subnets. The command affects the final transmission of the directed broadcast on its destination subnet. It does not affect the transit unicast routing of IP directed broadcasts. If directed broadcast is enabled for an interface, incoming directed broadcast IP packets intended for the subnet assigned to interface will be flooded as broadcasts on that subnet.

If the no ip directed-broadcast command is configured for an interface, directed broadcasts destined for the subnet where the interface is attached will be dropped instead of broadcast.

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Introduction

This chapter provides an alphabetical reference of commands used to configure the following protocols:

- Address Resolution Protocol (ARP)
- Domain Name Service (DNS)
- ICMP Router Discovery Advertisements (IRDP)

For more information see Chapter 24, Internet Protocol (IP) Addressing and Protocols.

Command List

arp-aging-timeout

This command sets a timeout period on dynamic ARP entries associated with a specific interface. If your device stops receiving traffic for the host specified in a dynamic ARP entry, it deletes the ARP entry from the ARP cache after this timeout is reached.

Your device times out dynamic ARP entries to ensure that the cache does not fill with entries for hosts that are no longer active. Static ARP entries are not aged or automatically deleted.

By default the time limit for dynamic ARP entries is 300 seconds on all interfaces.

The no variant of this command sets the time limit to the default of 300 seconds.

Syntax

```
arp-aging-timeout <0-432000>
no arp-aging timeout
```

Parameter	Description
<0-432000>	The timeout period in seconds.

Default 300 seconds (5 minutes)

Mode Interface Configuration for a VLAN interface.

Example To set the ARP entries on interface `vlan30` to time out after two minutes, use the commands:

```
awplus(config)# interface vlan30
awplus(config-if)# arp-aging-timeout 120
```

Related Commands

clear arp-cache
show arp

arp (IP address MAC address)

This command adds a static ARP entry to the ARP cache. This is typically used to add entries for hosts that do not support ARP or to speed up the address resolution function for a host. The ARP entry must not already exist. Use the alias parameter to allow your device to respond to ARP requests for this IP address. If VRF-Lite is configured, you can add ARP entries to either the global cache or for a specific VRF-instance.

The no variant of this command removes the static ARP entry. Use the clear arp-cache command on page 25.10 to remove the dynamic ARP entries in the ARP cache.

Syntax

```
arp [vrf <vrf-name>] <ip-addr> <mac-address> [<port-number>] [alias]
no arp [vrf <vrf-name>] <ip-addr>
```

Parameter	Description
<ip-addr>	IPv4 address of the device you are adding as a static ARP entry.
<mac-address>	MAC address of the device you are adding as a static ARP entry, in hexadecimal notation with the format HHHH.HHHH.HHHH.
<port-number>	The port number associated with the IP address. Specify this when the IP address is part of a VLAN.
`alias`	Allows your device to respond to ARP requests for the IP address. Proxy ARP must be enabled on the interface before using this parameter.
`vrf`	Apply this command to a VRF instance.
<vrf-name>	The name of the VRF instance.

Mode Global Configuration

Example To add the IP address 10.10.10.9 with the MAC address 0010.2533.4655 into the ARP cache, and have your device respond to ARP requests for this address, use the commands:

```
awplus# configure terminal
awplus(config)# arp 10.10.10.9 0010.2355.4566 alias
```

To apply the above example within VRF `red` use the following commands:

```
awplus# configure terminal
awplus(config)# arp vrf red 10.10.10.9 0010.2355.4566 alias
```

Related Commands

clear arp-cache
ip proxy-arp
show arp

arp log

This command enables the logging of dynamic and static ARP entries in the ARP cache. The ARP cache contains mappings of switch ports, VLAN IDs, and IP addresses to physical MAC addresses for hosts.

This command can display the MAC addresses in the ARP log either using the default hexadecimal notation (HHHH.HHHH.HHHH), or using the IEEE standard hexadecimal notation (HH-HH-HH-HH-HH-HH).

Use the no variant of this command to disable the logging of dynamic and static ARP entries in the ARP cache.

Syntax

```
arp log [mac-address-format ieee]

no arp log [mac-address-format ieee]
```

Parameter	Description
`mac-address-format ieee`	Display the MAC address in hexadecimal notation with the standard IEEE format (HH-HH-HH-HH-HH-HH), instead of displaying the MAC address with the default hexadecimal format (HHHH.HHHH.HHHH).

Default The ARP logging feature is disabled by default.

Mode Global Configuration

Usage You have the option to change how the MAC address is displayed in the ARP log message, to use the default hexadecimal notation (HHHH.HHHH.HHHH), or the IEEE format hexadecimal notation (HH-HH-HH-HH-HH-HH) when you apply the mac-address-format ieee parameter.

Enter the arp log command without the optional mac-address-format ieee parameter specified for MAC addresses in the ARP log output to use the default hexadecimal notation (HHHH.HHHH.HHHH).

Enter the arp log mac-address-format ieee command for MAC addresses in the ARP log output to use the IEEE standard format hexadecimal notation (HH-HH-HH-HH-HH-HH).

Use the no variant of this command (no arp log) without the optional mac-address-format ieee parameter specified to disable ARP logging on the switch

Use the no variant of this command with the optional mac-address-format ieee parameter specified (no arp log mac-address-format ieee) to disable IEEE standard format hexadecimal notation (HH-HH-HH-HH-HH-HH) and revert to the default hexadecimal notation (HHHH.HHHH.HHHH) for MAC addresses in the ARP log output.

To display ARP log messages use the show log | include ARP_LOG command.

Examples To enable ARP logging and use the default hexadecimal notation (HHHH.HHHH.HHHH), use the following commands:

```
awplus# configure terminal
awplus(config)# arp log
```

To disable ARP logging on the switch of MAC addresses displayed using the default hexadecimal notation (HHHH.HHHH.HHHH), use the following commands:

```
awplus# configure terminal
awplus(config)# no arp log
```

To enable ARP logging and to specify that the MAC address in the log message is displayed in the standard IEEE format hexadecimal notation (HH-HH-HH-HH-HH-HH), use the following commands:

```
awplus# configure terminal
awplus(config)# arp log mac-address-format ieee
```

To disable ARP logging on the switch of MAC addresses displayed using the standard IEEE format hexadecimal notation (HH-HH-HH-HH-HH-HH), and revert to the use of the default hexadecimal notation (HHHH.HHHH.HHHH) instead, use the following commands:

```
awplus# configure terminal
awplus(config)# no arp log mac-address-format ieee
```

To display ARP log messages, use following command:

```
awplus# show log | include ARP_LOG
```

Output Below is example output from the show log | include ARP_LOG command after enabling ARP logging displaying default hexadecimal notation MAC addresses (HHHH.HHHH.HHHH) using the arp log command.

Figure 25-1: Example output from the **show log | include ARP_LOG** command

```
awplus#configure terminal
awplus(config)#arp log
awplus(config)#exit
awplus#show log | include ARP_LOG
2010 Apr  6 06:21:01 user.notice awplus HSL[1007]: ARP_LOG port1.0.7 vlan1 add
0013.4078.3b98 (192.168.2.4)
2010 Apr  6 06:22:30 user.notice awplus HSL[1007]: ARP_LOG port1.0.7 vlan1 del
0013.4078.3b98 (192.168.2.4)
2010 Apr  6 06:23:26 user.notice awplus HSL[1007]: ARP_LOG port1.0.7 vlan1 add
0030.940e.136b (192.168.2.20)
2010 Apr  6 06:23:30 user.notice awplus IMISH[1830]: show log | include ARP_LOG
```

Below is example output from the show log | include ARP_LOG command after enabling ARP logging displaying IEEE standard format hexadecimal notation MAC addresses (HH-HH-HH-HH-HH-HH) using the arp log mac-address format ieee command.

Figure 25-2: Example output from the **show log | include ARP_LOG** command

```
awplus#configure terminal
awplus(config)#arp log mac-address-format ieee
awplus(config)#exit
awplus#show log | include ARP_LOG
2010 Apr  6 06:25:28 user.notice awplus HSL[1007]: ARP_LOG port1.0.7 vlan1 add 00-
17-9a-b6-03-69 (192.168.2.12)
2010 Apr  6 06:25:30 user.notice awplus HSL[1007]: ARP_LOG port1.0.7 vlan1 add 00-
03-37-6b-a6-a5 (192.168.2.10)
2010 Apr  6 06:26:53 user.notice awplus HSL[1007]: ARP_LOG port1.0.7 vlan1 del 00-
30-94-0e-13-6b (192.168.2.20)
2010 Apr  6 06:27:31 user.notice awplus HSL[1007]: ARP_LOG port1.0.7 vlan1 del 00-
17-9a-b6-03-69 (192.168.2.12)
2010 Apr  6 06:28:09 user.notice awplus HSL[1007]: ARP_LOG port1.0.7 vlan1 del 00-
03-37-6b-a6-a5 (192.168.2.10)
2010 Apr  6 06:28:14 user.notice awplus IMISH[1830]: show log | include ARP_LOG
```

Below are the parameters in output of the show log | include ARP_LOG command with an ARP log message format of <*ARP_LOG*> <*port number*> <*VLAN ID*> <*Operation*> <*MAC*> <*IP*> after <*date*> <*time*> <*severity*> <*hostname*> <*program name*> information.

Table 25-1: Parameters in output of the **show log | include ARP_LOG** command

Parameter	Description
<*ARP_LOG*>	Indicates ARP log entry information follows <*date*> <*time*> <*severity*> <*hostname*> <*program name*> log information.
<*port number*>	Indicates switch port number for the ARP log entry.
<*VLAN ID*>	Indicates the VLAN ID for the ARP log entry.
<*Operation*>	Indicates 'add' if the ARP log entry displays an ARP addition. Indicates 'del' if the ARP log entry displays an ARP deletion.
<*MAC*>	Indicates the MAC address for the ARP log entry, either in the default hexadecimal notation (HHHH.HHHH.HHHH) or in the IEEE standard format hexadecimal notation (HH-HH-HH-HH-HH-HH) as specified with the arp log or the arp log mac-address-format ieee command.
<*IP*>	Indicates the IP address for the ARP log entry.

Validation Commands show running-config

Related Commands show log

arp opportunistic-nd

Use this command to enable opportunistic neighbor discovery for the global ARP cache, or to enable opportunistic neighbor discovery for a named VRF instance. Opportunistic neighbor discovery changes the behavior for unsolicited ARP packet forwarding on the switch.

Use the no variant of this command to disable opportunistic neighbor discovery for the global ARP cache, or to disable opportunistic neighbor discovery for a named VRF instance.

Syntax

```
arp opportunistic-nd [vrf <vrf-name>]
no arp opportunistic-nd [vrf <vrf-name>]
```

Parameter	Description
`vrf`	Apply this command to a VRF instance.
`<vrf-name>`	The name of the VRF instance.

Default Opportunistic neighbor discovery is disabled by default.

Mode Global Configuration

Usage When opportunistic neighbor discovery is enabled, the switch will reply to any received unsolicited ARP packets (but not gratuitous ARP packets). The source MAC address for the unsolicited ARP packet is added to the ARP cache, so the switch forwards the ARP packet. When opportunistic neighbor discovery is disabled, the source MAC address for the ARP packet is not added to the ARP cache, so the ARP packet is not forwarded by the switch.

Note this command enables or disables opportunistic neighbor discovery for a VRF instance if the vrf parameter and an instance name are applied. If a VRF instance is not specified, then opportunistic neighbor discovery is enabled or disabled for switch ports configured for IPv4.

Use the ipv6 opportunistic-nd command to enable optimistic neighbor discovery in Global Configuration mode for all interfaces on the switch configured for IPv6. Use a show arp command to confirm opportunistic neighbor discovery is configured on the switch.

Example To enable opportunistic neighbor discovery for the global ARP cache, enter:

```
awplus# configure terminal
awplus(config)# arp opportunistic-nd
```

To disable opportunistic neighbor discovery for the global ARP cache, enter:

```
awplus# configure terminal
awplus(config)# no arp opportunistic-nd
```

To enable opportunistic neighbor discovery for the VRF instance `vrf_blue`, enter:

```
awplus# configure terminal
awplus(config)# arp opportunistic-nd vrf vrf_blue
```

To disable opportunistic neighbor discovery for the VRF instance `vrf_blue`, enter:

```
awplus# configure terminal
awplus(config)# no arp opportunistic-nd vrf vrf_blue
```

Related Commands ipv6 opportunistic-nd

Validation Commands show arp

clear arp-cache

This command deletes dynamic ARP entries from the ARP cache.

When running VRF-Lite, this command deletes dynamic ARP entries either from the ARP cache of a specific VRF instance, or from the ARP cache of the Global VRF. To delete all ARP entries from both the Global VRF and all VRF instances, use the command with no parameters.

Syntax

```
clear arp-cache [vrf <vrf-name>|global]
```

Parameter	Description
`global`	When VRF-Lite is configured, apply this command to the global routing and forwarding table
`vrf`	Apply this command to the specified VRF instance.
<vrf-name>	The VRF instance name

Mode Privileged Exec

Usage To display the entries in the ARP cache, use the show arp command. To remove static ARP entries, use the no variant of the arp (IP address MAC address) command on page 25.4.

Examples To clear all dynamic ARP entries, use the command:

```
awplus# clear arp-cache
```

To clear the dynamic ARP entries from the VRF instance named blue, use the commands:

```
awplus# clear arp-cache vrf blue
```

When running VRF-Lite, to clear the dynamic ARP entries from the global VRF and all VRF instances, use the command:

```
awplus# clear arp-cache
```

Related Commands
arp-aging-timeout
arp (IP address MAC address)
show arp

clear ip dns forwarding cache

Use this command to clear the DNS Relay name resolver cache.

Syntax `clear ip dns forwarding cache`

Mode Privileged Exec

Examples To clear the DNS Relay name resolver cache, use the command:

```
awplus# clear ip dns forwarding cache
```

Related Commands ip dns forwarding cache

debug ip dns forwarding

Use this command to enable DNS Relay debugging.

Use the no variant of this command to disable DNS Relay debugging.

Syntax `debug ip dns forwarding`

`no debug ip dns forwarding`

Default DNS Relay debugging is disabled by default.

Mode Privileged Exec

Examples To enable DNS forwarding debugging, use the commands:

```
awplus# debug ip dns forwarding
```

To disable DNS forwarding debugging, use the commands:

```
awplus# no debug ip dns forwarding
```

Related Commands ip dns forwarding
show debugging ip dns forwarding

debug ip packet interface

The debug ip packet interface command enables IP packet debug and is controlled by the terminal monitor command.

If the optional icmp keyword is specified then ICMP packets are shown in the output.

The no variant of this command disables the debug ip interface command.

Syntax

```
debug ip packet interface {<interface-name>|all}
   [address <ip-address>|verbose|hex|arp|udp|tcp|icmp]

no debug ip packet interface [<interface-name>]
```

Parameter	Description
<interface>	Specify a single Layer 3 interface name (not a range of interfaces) This keyword can be specified as either all or as a single Layer 3 interface to show debugging for either all interfaces or a single interface.
all	Specify all Layer 3 interfaces on the switch.
<ip-address>	Specify an IPv4 address. If this keyword is specified, then only packets with the specified IP address as specified in the ip-address placeholder are shown in the output.
verbose	Specify verbose to output more of the IP packet. If this keyword is specified then more of the packet is shown in the output.
hex	Specify hex to output the IP packet in hexadecimal. If this keyword is specified, then the output for the packet is shown in hex.
arp	Specify arp to output ARP protocol packets. If this keyword is specified, then ARP packets are shown in the output.
udp	Specify udp to output UDP protocol packets. If this keyword is specified then UDP packets are shown in the output.
tcp	Specify tcp to output TCP protocol packets. If this keyword is specified, then TCP packets are shown in the output.
icmp	Specify icmp to output ICMP protocol packets. If this keyword is specified, then ICMP packets are shown in the output.

Mode Privileged Exec and Global Configuration

Examples To turn on ARP packet debugging on vlan1, use the command:

```
awplus# debug ip packet interface vlan1 arp
```

To turn on all packet debugging on all interfaces on the switch, use the command:

```
awplus# debug ip packet interface all
```

To turn on TCP packet debugging on `vlan1` and IP address `192.168.2.4` , use the command:

```
awplus# debug ip packet interface vlan1 address 192.168.2.4
        tcp
```

To turn off IP packet interface debugging on all interfaces, use the command:

```
awplus# no debug ip packet interface
```

To turn off IP packet interface debugging on interface `vlan2`, use the command:

```
awplus# no debug ip packet interface vlan2
```

Related Commands

no debug all
show debugging ip dns forwarding
tcpdump
terminal monitor
undebug ip packet interface

debug ip irdp

This command enables debugging of ICMP Router Discovery Protocol (IRDP) events and messages on your device. IRDP debugging is disabled by default.

The no variant of this command disables IRDP debugging. Negating any packet debug mode will switch detail off.

Syntax

```
debug ip irdp {event|nsm|receive|send|both|detail|all}
no debug ip irdp {event|nsm|receive|send|both|detail|all}
```

Parameter	Description
event	Enables debugging of IRDP events.
nsm	Enables debugging of IRDP processing of NSM messages.
receive	Enables debugging of IRDP input packet processing.
send	Enables debugging of IRDP output packet processing.
both	Enables debugging of both IRDP input and output packet processing.
detail	Enables detailed debugging of both IRDP input and output packet processing. Note that setting detail also sets both, so if you set detail, the output will show "packet debugging mode is all". Negating any packet debug mode will switch detail off.
all	Enables all IRDP debugging types.

Default IRDP protocol debugging is disabled by default.

Mode Privileged Exec and Global Configuration

Examples To enable IRDP input packet process debugging, use the following command:

```
awplus# debug ip irdp receive
```

To disable all IRDP debugging, use the following command:

```
awplus# no debug ip irdp all
```

Related Commands

ip irdp
router ip irdp
show ip irdp
undebug ip irdp

ip address

This command sets a static IP address on an interface. To set the primary IP address on the interface, specify only ip address <*ip-address/m*>. This overwrites any configured primary IP address. To add additional IP addresses on this interface, use the secondary parameter. You must configure a primary address on the interface before configuring a secondary address.

Note Use show running-config interface not show ip interface brief when you need to view a secondary address configured on an interface. show ip interface brief will only show the primary address not a secondary address for an interface.

The no variant of this command removes the IP address from the interface. You cannot remove the primary address when a secondary address is present.

Syntax

```
ip address <ip-addr/prefix-length> [secondary [label <label>]]
no ip address <ip-addr/prefix-length> [secondary]
no ip address
```

Parameter	Description
<ip-addr/prefix-length>	The IPv4 address and prefix length you are assigning to the interface.
`label`	Adds a user-defined description of the secondary IP address.
<label>	A user-defined description of the secondary IP address. Valid characters are any printable character and spaces.

Mode Interface Configuration for a VLAN interface or a local loopback interface.

Examples To add the primary IP address `10.10.10.50/24` to the interface `vlan3`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# ip address 10.10.10.50/24
```

To add the secondary IP address `10.10.11.50/24` to the same interface, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# ip address 10.10.11.50/24 secondary
```

To add the IP address `10.10.11.50/24` to the local loopback interface `lo`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface lo
awplus(config-if)# ip address 10.10.11.50/24
```

Related Commands

interface (to configure)
show ip interface
show running-config interface

ip dns forwarding

Use this command to enable DNS Relay, the forwarding of incoming DNS queries for IP hostname-to-address translation.

Use the no variant of this command to disable the forwarding of incoming DNS queries for IP hostname-to-address translation.

Syntax

```
ip dns forwarding
no ip dns forwarding
```

Default The forwarding of incoming DNS query packets is disabled by default.

Mode Global Configuration

Usage See "DNS Relay" on page 24.10 for more information about DNS Relay to map IPv4 and IPv6 addresses to name servers to maintain a a database of hostname-to-address mappings.

Examples To enable the forwarding of incoming DNS query packets, use the commands:

```
awplus# configure terminal
awplus(config)# ip dns forwarding
```

To disable the forwarding of incoming DNS query packets, use the commands:

```
awplus# configure terminal
awplus(config)# no ip dns forwarding
```

Related Commands

debug ip dns forwarding
ip dns forwarding cache
ip dns forwarding retry
ip dns forwarding source-interface
ip dns forwarding timeout
ip name-server
show ip dns forwarding

ip dns forwarding cache

Use this command to set the DNS Relay name resolver cache size and cache entry lifetime period. The DNS Relay name resolver cache stores the mappings between domain names and IP addresses.

Use the no variant of this command to set the default DNS Relay name resolver cache size and cache entry lifetime period.

Syntax

```
ip dns forwarding cache [size <0-1000>] [timeout <60-3600>]
no ip dns forwarding cache [size|timeout]
```

Parameter	Description
<0-1000>	Number of entries in the DNS Relay name resolver cache.
<60-3600>	Timeout value in seconds.

Default The default cache size is 0 (no entries) and the default lifetime is 1800 seconds.

Mode Global Configuration

Usage See "DNS Relay" on page 24.10 for more information about DNS Relay to map IPv4 and IPv6 addresses to name servers to maintain a a database of hostname-to-address mappings.

Examples To set the cache size to `10` entries and the lifetime to `500` seconds, use the commands:

```
awplus# configure terminal
awplus(config)# ip dns forwarding cache size 10 time 500
```

To set the cache size to the default, use the commands:

```
awplus# configure terminal
awplus(config)# no ip dns forwarding cache size
```

Related Commands

clear ip dns forwarding cache
ip dns forwarding
ip dns forwarding retry
ip dns forwarding source-interface
ip dns forwarding timeout
show ip dns forwarding cache

ip dns forwarding retry

Use this command to set the number of times DNS Relay will retry to forward DNS queries.

Use the no variant of this command to set the number of retries to the default of 2.

Syntax

```
ip dns forwarding retry <0-100>
no ip dns forwarding retry
```

Parameter	Description
<0-100>	Number of times DNS Relay will retry to forward a DNS query.

Default The default number of retries is 2.

Mode Global Configuration

Usage See "DNS Relay" on page 24.10 for more information about DNS Relay to map IPv4 and IPv6 addresses to name servers to maintain a a database of hostname-to-address mappings.

Examples To set the retry count to 9, use the commands:

```
awplus# configure terminal
awplus(config)# ip dns forwarding retry 9
```

To set the retry count to the default of 2, use the commands:

```
awplus# configure terminal
awplus(config)# no ip dns forwarding retry
```

Related Commands

ip dns forwarding
ip dns forwarding cache
ip dns forwarding source-interface
ip dns forwarding timeout

ip dns forwarding source-interface

Use this command to set the interface to use for forwarding and receiving DNS queries.

Use the no variant of this command to unset the interface used for forwarding and receiving DNS queries.

Syntax

```
ip dns forwarding source-interface <interface-name>
no ip dns forwarding source-interface
```

Parameter	Description
<interface-name>	An alphanumeric string that is the interface name.

Default The default is that no interface is set and the switch selects the appropriate source IP address automatically.

Mode Global Configuration

Usage See "DNS Relay" on page 24.10 for more information about DNS Relay to map IPv4 and IPv6 addresses to name servers to maintain a a database of hostname-to-address mappings.

Examples To set `vlan1` as the source interface for relayed DNS queries, use the commands:

```
awplus# configure terminal
awplus(config)# ip dns forwarding source-interface vlan1
```

To clear the source interface for relayed DNS queries, use the commands:

```
awplus# configure terminal
awplus(config)# no ip dns forwarding source-interface
```

Related Commands

ip dns forwarding
ip dns forwarding cache
ip dns forwarding retry
ip dns forwarding timeout

ip dns forwarding timeout

Use this command to set the time period for the DNS Relay to wait for a DNS response.

Use the no variant of this command to set the time period to wait for a DNS response to the default of 3 seconds.

Syntax

```
ip dns forwarding timeout <0-3600>
no ip dns forwarding timeout
```

Parameter	Description
<0-3600>	Timeout value in seconds.

Default The default timeout value is 3 seconds.

Mode Global Configuration

Usage See "DNS Relay" on page 24.10 for more information about DNS Relay to map IPv4 and IPv6 addresses to name servers to maintain a a database of hostname-to-address mappings.

Examples To set the timeout value to `12` seconds, use the commands:

```
awplus# configure terminal
awplus(config)# ip dns forwarding timeout 12
```

To set the timeout value to the default of `3` seconds, use the commands:

```
awplus# configure terminal
awplus(config)# no ip dns forwarding timeout
```

Related Commands

ip dns forwarding
ip dns forwarding cache
ip dns forwarding retry
ip dns forwarding source-interface

ip domain-list

This command adds a domain to the DNS list. Domain are appended to incomplete host names in DNS requests. Each domain in this list is tried in turn in DNS lookups. This list is ordered so that the first entry you create is checked first.

The no variant of this command deletes a domain from the list.

Syntax

```
ip domain-list <domain-name>
no ip domain-list <domain-name>
```

Parameter	Description
<domain-name>	Domain string, for example “company.com”.

Mode Global Configuration

Usage If there are no domains in the DNS list, then your device uses the domain specified with the ip domain-name command. If any domain exists in the DNS list, then the device does not use the domain set using the ip domain-name command.

See “Domain Name System (DNS)” on page 24.8 for introductory information about DNS. See “DNS Client” on page 24.9 for information about DNS Client configuration commands.

Example To add the domain `example.net` to the DNS list, use the following commands:

```
awplus# configure terminal
awplus(config)# ip domain-list example.net
```

Related Commands

ip domain-lookup
ip domain-name
show ip domain-list

ip domain-lookup

This command enables the DNS client on your device. This allows you to use domain names instead of IP addresses in commands. The DNS client resolves the domain name into an IP address by sending a DNS enquiry to a DNS server, specified with the ip name-server command.

The no variant of this command disables the DNS client. The client will not attempt to resolve domain names. You must use IP addresses to specify hosts in commands.

Syntax

```
ip domain-lookup
no ip domain-lookup
```

Mode Global Configuration

Usage The client is enabled by default. However, it does not attempt DNS enquiries unless there is a DNS server configured.

See "DNS Client" on page 24.9 for information about DNS Client configuration commands.

Examples To enable the DNS client on your device, use the following commands:

```
awplus# configure terminal
awplus(config)# ip domain-lookup
```

To disable the DNS client on your device, use the following commands:

```
awplus# configure terminal
awplus(config)# no ip domain-lookup
```

Related Commands

ip domain-list
ip domain-name
ip name-server
show hosts
show ip name-server

ip domain-name

This command sets a default domain for the DNS. The DNS client appends this domain to incomplete host-names in DNS requests.

The no variant of this command removes the domain-name previously set by this command.

Syntax

```
ip domain-name <domain-name>
no ip domain-name <domain-name>
```

Parameter	Description
<domain-name>	Domain string, for example “company.com”.

Mode Global Configuration

Usage If there are no domains in the DNS list (created using the ip domain-list command) then your device uses the domain specified with this command. If any domain exists in the DNS list, then the device does not use the domain configured with this command.

See “DNS Client” on page 24.9 for information about DNS Client configuration commands.

When your device is using its DHCP client for an interface, it can receive Option 15 from the DHCP server. This option replaces the domain name set with this command. See Chapter 85, Dynamic Host Configuration Protocol (DHCP) Introduction for more information about DHCP and DHCP options.

Example To configure the domain name, enter the following commands:

```
awplus# configure terminal
awplus(config)# ip domain-name company.com
```

Related Commands

ip domain-list
show ip domain-list
show ip domain-name

ip directed-broadcast

Use this command to enable flooding of directed broadcast packets into a directly connected subnet. If this command is configured on a VLAN interface, then directed broadcasts received on other VLAN interfaces, destined for the subnet on this VLAN, will be flooded to the subnet broadcast address of this VLAN.

Use the no variant of this command to disable ip directed-broadcast. When this feature is disabled using the no variant of this command, directed broadcasts are not forwarded.

Syntax

```
ip directed-broadcast
no ip directed-broadcast
```

Default The ip directed-broadcast command is disabled by default.

Mode Interface Configuration for a VLAN interface.

Usage IP directed-broadcast is enabled and disabled per VLAN interface. When enabled a directed broadcast packet is forwarded to an enabled VLAN interface if received on another subnet.

An IP directed broadcast is an IP packet whose destination address is a broadcast address for some IP subnet, but originates from a node that is not itself part of that destination subnet. When a directed broadcast packet reaches a switch that is directly connected to its destination subnet, that packet is flooded as a broadcast on the destination subnet.

The ip directed-broadcast command controls the flooding of directed broadcasts when they reach target subnets. The command affects the final transmission of the directed broadcast on its destination subnet. It does not affect the transit unicast routing of IP directed broadcasts. If directed broadcast is enabled for an interface, incoming directed broadcast IP packets intended for the subnet assigned to interface will be flooded as broadcasts on that subnet.

If the no ip directed-broadcast command is configured for an interface, directed broadcasts destined for the subnet where the interface is attached will be dropped instead of broadcast.

Examples To enable ip directed-broadcast, to flood broadcast packets out via the `vlan2` interface, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip directed-broadcast
```

To disable ip directed-broadcast, disabling the flooding of broadcast packets via `vlan2`, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip directed-broadcast
```

Related Commands
ip forward-protocol udp
ip helper-address
show running-config

ip forwarding

This command enables IP forwarding on your device. When enabled, your device routes IP packets.

The no variant of this command disables IP forwarding on your device. Even when IP forwarding is not enabled, the device can still work as an IP host; in particular, it can be managed by IP-based applications, such as SNMP, Telnet and SSH.

Syntax

```
ip forwarding
no ip forwarding
```

Default IP forwarding is enabled by default.

Mode Global Configuration

Examples To enable your device to route IP packets, use the commands:

```
awplus# configure terminal
awplus(config)# ip forwarding
```

To stop your device from routing IP packets, use the commands

```
awplus# configure terminal
awplus(config)# no ip forwarding
```

Related Commands show ip interface

ip forward-protocol udp

This command enables you to control which UDP broadcasts will be forwarded to the helper address(es). A UDP broadcast will only be forwarded if the destination UDP port number in the packet matches one of the port numbers specified using this command.

Refer to the IANA site (www.iana.org) for a list of assigned UDP port numbers for protocols to forward using ip forward-protocol udp.

Use the no variant of this command to remove a port number from the list of destination port numbers that are used as the criterion for deciding if a given UDP broadcast should be forwarded to the IP helper address(es).

Syntax

```
ip forward-protocol udp <port>
no ip forward-protocol udp <port>
```

Parameter	Description
<port>	UDP Port Number.

Default The ip forward-protocol udp command is not enabled by default.

Mode Global Configuration

Usage Combined with the ip helper-address command on page 25.30 in interface mode, the ip forward-protocol udp command in Global Configuration mode allows control of which protocols (destination port numbers) are forwarded. The ip forward-protocol udp command configures protocols for forwarding, and the ip helper-address command configures the destination address(es).

Note The types of UDP broadcast packets that the switch will forward are ONLY those specified by the ip forward-protocol command(s). There are not other UDP packet types that the IP helper process forwards by default.

Note The ip forward-protocol udp command does not support BOOTP / DHCP Relay. The ip dhcp-relay command must be used instead. For this reason, you may not configure UDP ports 67 and 68 with the ip forward-protocol udp command.

See "DHCP Relay Agent Introduction" on page 85.8 for information about DHCP Relay.

Examples To configure forwarding of packets on a UDP port, use the following commands:

```
awplus# configure terminal
awplus(config)# ip forward-protocol udp <port>
```

To delete a UDP port from the UDP ports that the switch forwards, use the following commands:

```
awplus# configure terminal
awplus(config)# no ip forward-protocol udp <port>
```

Validation Commands show running-config

Related Commands ip helper-address
ip directed-broadcast

ip gratuitous-arp-link

This command sets the Gratuitous ARP time limit for all switchports. The time limit restricts the sending of Gratuitous ARP packets to one Gratuitous ARP packet within the time in seconds.

Note

This command specifies time between sequences of Gratuitous ARP packets, and time between individual Gratuitous ARP packets occurring in a sequence, to allow legacy support for older devices and interoperation between other devices that are not ready to receive and forward data until several seconds after linkup.

Additionally, jitter has been applied to the delay following linkup, so Gratuitous ARP packets applicable to a given port are spread over a period of 1 second so are not all sent at once. Remaining Gratuitous ARP packets in the sequence occur after a fixed delay from the first one.

Syntax

```
ip gratuitous-arp-link <0-300>

no ip gratuitous-arp-link
```

Parameter	Description
<0-300>	Specify the minimum time between sequences of Gratuitous ARPs and the fixed time between Gratuitous ARPs occurring in a sequence, in seconds. 0 disables the sending of Gratuitous ARP packets. The default is 5 seconds.

Default The default Gratuitous ARP time limit for all switchports is 5 seconds.

Mode Global Configuration

Usage Every switchport will send a sequence of 3 Gratuitous ARP packets to each VLAN that the switchport is a member of, whenever the switchport moves to the forwarding state. The first Gratuitous ARP packet is sent 1 second after the switchport becomes a forwarding switchport. The second and third Gratuitous ARP packets are each sent after the time period specified by the Gratuitous ARP time limit.

Additionally, the Gratuitous ARP time limit specifies the minimum time between the end of one Gratuitous ARP sequence and the start of another Gratuitous ARP sequence. When a link is flapping, the switchport's state is set to forwarding several times. The Gratuitous ARP time limit is imposed to prevent Gratuitous ARP packets from being sent undesirably often.

Examples To disable the sending of Gratuitous ARP packets, use the commands:

```
awplus# configure terminal
awplus(config)# ip gratuitous-arp-link 0
```

To restrict the sending of Gratuitous ARP packets to one every 20 seconds, use the commands:

```
awplus# configure terminal
awplus(config)# ip gratuitous-arp-link 20
```

Validation Commands show running-config

ip helper-address

This command adds a forwarding destination address for IP Helper to enable forwarding of User Datagram Protocol (UDP) broadcasts on an interface.

Use the no variant of this command to disable the forwarding od broadcast packets to specific addresses.

Syntax

```
ip helper-address <ip-addr>
no ip helper-address <ip-addr>
```

Parameter	Description
<ip-addr>	Forwarding destination IP address for IP Helper.

Default The destination address for the ip helper-address command is not configured by default.

Mode Interface Configuration for a VLAN interface.

Usage Combined with the ip forward-protocol udp command in global configuration mode, the ip helper-address command in interface mode allows control of which protocols (destination port numbers) are forwarded. The ip forward-protocol udp command configures protocols for forwarding, and the ip helper-address command configures the destination address(es).

The destination address can be a unicast address or a subnet broadcast address. The UDP destination port is configured separately with the ip forward-protocol udp command. If multiple destination addresses are registered then UDP packets are forwarded to each IP address added to an IP Helper. Up to 32 destination addresses may be added using IP Helper.

Note

The types of UDP broadcast packets that the switch will forward are ONLY those specified by the ip forward-protocol command(s). There are no other UDP packet types that the IP helper process forwards by default.

Note

The ip helper-address command does not support BOOTP / DHCP Relay. The ip dhcp-relay command must be used instead. For this reason, you may not configure UDP ports 67 and 68 with the ip forward-protocol command.

For information about DHCP Relay, see "DHCP Relay Agent Introduction" on page 85.8.

Examples The following example defines IPv4 address `192.168.1.100` as an IP Helper destination address to which to forward UDP broadcasts received on `vlan2`:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip helper-address 192.168.1.100
```

The following example removes IPv4 address `192.168.1.100` as an IP Helper destination address to which to forward UDP broadcasts received on `vlan2`:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip helper-address 192.168.1.100
```

Validation Commands show running-config

Related Commands ip forward-protocol udp
ip directed-broadcast

ip irdp

This command enables ICMP Router Discovery advertising on an interface. However, the interface does not send or process Router Discovery messages until at least one IP address is configured on the interface with the ip address command.

The no variant of this command disables ICMP Router Discovery advertisements on an IP interface. All transmitting and processing of Router Discovery messages ceases immediately on the interface.

Syntax

```
ip irdp
no ip irdp
```

Mode Interface Configuration for a VLAN interface.

Examples To enable Router Discovery advertisements on `vlan4`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ip irdp
```

To disable Router Discovery advertisements on `vlan4`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# no ip irdp
```

Related Commands

ip address
show ip irdp
show ip irdp interface

ip irdp address preference

When multiple routers connected to a LAN are all sending Router Discovery advertisements, hosts need to be able to choose the best router to use. Therefore the IRDP defines a preference value to place in the Router Discovery advertisements. Hosts choose the router with the highest preference value.

This command sets the preference value to include in Router Discovery advertisements sent for the specified IP address.

The no variant of this command sets the preference for a specific address to the default of 0.

Syntax

```
ip irdp address <ip-address> preference <0-2147483647>
no ip irdp address <ip-address> preference
```

Parameter	Description
<ip-address>	The IP address to be advertised with the specified preference value.
<0-2147483647>	The preference value advertised. A higher number increases the preference level for this address.

Default The default preference value is 0.

Mode Interface Configuration for a VLAN interface.

Examples To set the preference value to `3000` for the address `192.168.1.1` advertised on `vlan5`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan5
awplus(config-if)# ip irdp address 192.168.1.1 preference 3000
```

To set the preference value to the default of `0` for the address `192.168.1.1` advertised on `vlan5`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan5
awplus(config-if)# no ip irdp address 192.168.1.1 preference
```

Related Commands

ip irdp
ip irdp preference
show ip irdp interface

ip irdp broadcast

This command configures broadcast Router Discovery advertisements on an interface. The interface sends IRDP advertisements with the broadcast address (255.255.255.255) as the IP destination address.

The no variant of this command configures multicast Router Discovery advertisements on an interface. The interface sends IRDP advertisements with the all-system multicast address (224.0.0.1) as the IP destination address.

Syntax

```
ip irdp broadcast
no ip irdp broadcast
```

Mode Interface Configuration for a VLAN interface.

Examples To enable broadcast Router Discovery advertisements on `vlan13`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan13
awplus(config-if)# ip irdp broadcast
```

To enable multicast Router Discovery advertisements on `vlan13`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan13
awplus(config-if)# no ip irdp broadcast
```

Related Commands

ip irdp
ip irdp multicast
show ip irdp interface

ip irdp holdtime

This command sets the maximum length of time that the advertised addresses are to be considered as valid router addresses by hosts.

The no variant of this command resets the holdtime back to the default of 1800 seconds.

Syntax

```
ip irdp holdtime <0-9000>
no ip irdp holdtime
```

Parameter	Description
<0-9000>	The holdtime value in seconds of addresses advertised.

Default The IRDP holdtime is set to 1800 seconds (30 minutes) by default.

Mode Interface Configuration for a VLAN interface.

Examples To set the holdtime value of addresses advertised on `vlan2` to 4000 seconds, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip irdp holdtime 4000
```

To set the holdtime value of addresses advertised on `vlan2` back to the default, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip irdp holdtime
```

Related Commands show ip irdp interface

ip irdp lifetime

This command sets the maximum length of time that hosts should consider the Router Discovery advertised addresses as valid router addresses. If you change the lifetime value, also change the maxadvertisementinterval and the minadvertisementinterval to maintain the following ratios:

```
lifetime=3 x maxadvertisementinterval
minadvertisementinterval=0.75 x maxadvertisementinterval
```

This command is synonymous with the ip irdp hostname *<0-9000>* command.

The no variant of this command sets the lifetime back to the default of 1800 seconds.

Syntax

```
ip irdp lifetime <0-9000>
no ip irdp lifetime
```

Parameter	Description
<0-9000>	Lifetime value in seconds of the advertised addresses.

Default The lifetime value is 1800 seconds.

Mode Interface Configuration for a VLAN interface.

Examples To set the lifetime value to 4000 seconds for addresses advertised on `vlan6`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan6
awplus(config-if)# ip irdp lifetime 4000
```

To set the lifetime value to the default of 1800 seconds for addresses advertised on `vlan6`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan6
awplus(config-if)# no ip irdp lifetime
```

Related Commands

ip irdp
ip irdp maxadvertinterval
ip irdp minadvertinterval
show ip irdp interface

ip irdp maxadvertinterval

This command sets the maximum time allowed between sending router advertisements from the interface. If you change the maxadvertisementinterval value, also change the lifetime and the minadvertisementinterval to maintain the following ratios:

```
lifetime=3 x maxadvertisementinterval
minadvertisementinterval=0.75 x maxadvertisementinterval
```

You cannot set the maximum advertisement interval below the minimum interval. If you are lowering the maximum interval to a value below the current minimum interval, you must change the minimum value first.

The no variant of this command sets the maxadvertinterval back to the default of 600 seconds.

Syntax

```
ip irdp maxadvertinterval <4-1800>
no ip irdp maxadvertinterval
```

Parameter	Description
<4-1800>	The maximum time, in seconds, between Router Discovery advertisements.

Default The IRDP maximum advertisement interval is set to 600 seconds (10 minutes) by default.

Mode Interface Configuration for a VLAN interface.

Examples To set the maximum interval between Router Discovery advertisements on `vlan7` to 950 seconds, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan7
awplus(config-if)# ip irdp maxadvertinterval 950
```

To set the maximum interval between advertisements on `vlan7` back to the default, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan7
awplus(config-if)# no ip irdp maxadvertinterval
```

Related Commands

ip irdp
ip irdp lifetime
ip irdp minadvertinterval
show ip irdp interface

ip irdp minadvertinterval

This command sets the minimum time allowed between sending router advertisements from the interface. If you change the minadvertisementinterval value, also change the lifetime and the maxadvertisementinterval to maintain the following ratios:

```
lifetime=3 x maxadvertisementinterval
minadvertisementinterval=0.75 x maxadvertisementinterval
```

You cannot set the minimum advertisement interval above the maximum interval. If you are raising the minimum interval to a value above the current maximum interval, you must change the maximum value first.

The no variant of this command sets the minadvertinterval back to the default of 450 seconds.

Syntax

```
ip irdp minadvertinterval <3-1800>
no ip irdp minadvertinterval
```

Parameter	Description
<3-1800>	The minimum time between advertisements in seconds.

Default The IRDP minimum advertisement interval is set to 450 seconds (7.5 minutes) by default.

Mode Interface Configuration for a VLAN interface

Examples To set the minimum interval between advertisements on `vlan4` to 900 seconds, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ip irdp minadvertinterval 900
```

To set the minimum interval between advertisements on `vlan4` back to the default of 450 seconds, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# no ip irdp minadvertinterval
```

Related Commands

ip irdp
ip irdp lifetime
ip irdp maxadvertinterval
show ip irdp interface

ip irdp multicast

This command configures multicast Router Discovery advertisements on an interface. The interface sends IRDP advertisements with the all-system multicast address (224.0.0.1) as the IP destination address.

The no variant of this command configures broadcast Router Discovery advertisements on an interface. The interface sends IRDP advertisements with the broadcast address (255.255.255.255) as the IP destination address.

The multicast address is the default IP destination address for Router Discovery advertisements.

Syntax

```
ip irdp multicast
no ip irdp multicast
```

Mode Interface Configuration for a VLAN interface.

Examples To enable multicast Router Discovery advertisements on vlan5, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan5
awplus(config-if)# ip irdp multicast
```

To enable broadcast Router Discovery advertisements on vlan5, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan5
awplus(config-if)# no ip irdp multicast
```

Related Commands

ip irdp
ip irdp broadcast
show ip irdp interface

ip irdp preference

When multiple routers connected to a LAN are all sending Router Discovery advertisements, hosts need to be able to choose the best router to use. Therefore the IRDP defines a preference value to place in the Router Discovery advertisements. Hosts choose the router with the highest preference value.

This command sets the preference value to include in Router Discovery advertisements sent for the specified interface.

When this command is used, all IP addresses on the interface are assigned the same preference value, except the addresses that have specific preference value assignment using the command ip irdp address preference.

The no variant of this command sets the preference value to the default of 0.

Syntax

```
ip irdp preference <0-2147483647>
no ip irdp preference
```

Parameter	Description
<0-2147483647>	The preference value for the interface. A higher number increases the preference level for addresses on the specific interface.

Default The default preference value is 0.

Mode Interface Configuration for a VLAN interface.

Examples To set the preference of addresses advertised on `vlan6` to `500`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan6
awplus(config-if)# ip irdp preference 500
```

To set the preference value for addresses on `vlan6` back to the default of `0`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan6
awplus(config-if)# no ip irdp preference
```

Related Commands

ip irdp
ip irdp address preference
show ip irdp interface

ip local-proxy-arp

This command allows you to stop MAC address resolution between hosts within a private VLAN edge interface. Local Proxy ARP works by intercepting ARP requests between hosts within a subnet and responding with your device's own MAC address details instead of the destination host's details. This stops hosts from learning the MAC address of other hosts within its subnet through ARP requests.

Local Proxy ARP ensures that devices within a subnet cannot send traffic that bypasses Layer 3 routing on your device. This lets you monitor and filter traffic between hosts in the same subnet, and enables you to have control over which hosts may communicate with one another.

When Local Proxy ARP is operating on an interface, your device does not generate or forward any ICMP-Redirect messages on that interface. This command does not enable proxy ARP on the interface; see the ip proxy-arp command for more information on enabling proxy ARP.

The no variant of this command disables Local Proxy ARP to stop your device from intercepting and responding to ARP requests between hosts within a subnet. This allows the hosts to use MAC address resolution to communicate directly with one another. Local Proxy ARP is disabled by default.

Syntax

```
ip local-proxy-arp
no ip local-proxy-arp
```

Default Local proxy ARP is disabled by default

Mode Interface Configuration for a VLAN interface.

Examples To enable your device to apply Local Proxy ARP on the interface `vlan7`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan7
awplus(config-if)# ip local-proxy-arp
```

To disable your device to apply Local Proxy ARP on the interface `vlan7`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan7
awplus(config-if)# no ip local-proxy-arp
```

Related Commands

ip proxy-arp
show arp
show running-config

ip name-server

This command adds the IPv4 or the IPv6 address of a DNS server to the device's list of servers. The DNS client on your device sends DNS queries to devices on this list when trying to resolve a DNS hostname. Your device cannot resolve a hostname until you have added at least one server to this list. There is no limit on the number of servers you can add to the list.

The no variant of this command removes the DNS server from the list of servers.

Syntax

```
ip name-server <ip-addr>
no ip name-server <ip-addr>
```

Parameter	Description
<ip-addr>	The IP address to be advertised with the specified preference value, entered in the form `A.B.C.D` for an IPv4 address, or in the form `X:X::X.X` for an IPv6 address.

Mode Global Configuration

Usage When your device is using its DHCP client for an interface, it can receive Option 6 from the DHCP server. This option appends the name server list with more DNS servers. See Chapter 85, Dynamic Host Configuration Protocol (DHCP) Introduction for more information about DHCP and DHCP options.

See "DNS Relay" on page 24.10 for more information about DNS Relay to map IPv4 and IPv6 addresses to name servers to maintain a a database of hostname-to-address mappings. Also see "DNS Client" on page 24.9 for information about DNS Client configuration commands.

Example To allow your device to send DNS queries to a DNS server with the IPv4 address `10.10.10.5`, use the commands:

```
awplus# configure terminal
awplus(config)# ip name-server 10.10.10.5
```

To allow your device to send DNS queries to a DNS server with the IPv6 address `2001:0db8:010d::1`, use the commands:

```
awplus# configure terminal
awplus(config)# ip name-server 2001:0db8:010d::1
```

Related Commands

ip domain-list
ip domain-lookup
ip domain-name
show ip name-server

ip proxy-arp

This command enables Proxy ARP responses to ARP requests on an interface. When enabled, your device intercepts ARP broadcast packets and substitutes its own physical address for that of the remote host. By responding to the ARP request, your device ensures that subsequent packets from the local host are directed to its physical address, and it can then forward these to the remote host.

Your device responds only when it has a specific route to the address being requested, excluding the interface route that the ARP request arrived from. It ignores all other ARP requests. See the ip local-proxy-arp command about enabling your device to respond to other ARP messages.

The no variant of this command disables Proxy ARP responses on an interface. Proxy ARP is disabled by default.

Syntax

```
ip proxy-arp
no ip proxy-arp
```

Default Proxy ARP is disabled by default.

Mode Interface mode for a VLAN interface.

Examples To enable your device to Proxy ARP on the interface `vlan13`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan13
awplus(config-if)# ip proxy-arp
```

To disable your device to Proxy ARP on the interface `vlan13`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan13
awplus(config-if)# no ip proxy-arp
```

Related Commands

arp (IP address MAC address)
ip local-proxy-arp
show arp
show running-config

ip redirects

This command enables ICMP redirects for an interface.

Use the no variant of this command to disable the sending of ICMP redirects for an interface.

Syntax

```
ip redirects
no ip redirects
```

Default ICMP redirects are disabled by default.

Mode Interface Configuration for a VLAN interface.

Usage ICMP redirect messages are used to notify hosts that a better route is available to a destination. ICMP redirects are used when a packet is routed into the switch on the same interface that the packet is routed out of the switch. ICMP redirects are also used when the subnet or network of the source address is on the same subnet or network as the next-hop address for a packet.

Use the ip redirects command to allow the sending of ICMP redirects whenever the switch receives a packet that is routed on the same interface that the packet was sent on.

Use the no variant of this command to disallow the sending of ICMP redirects whenever the switch receives a packet that is routed on the same interface that the packet was sent on.

Examples To enable ICMP redirects on interface vlan2, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip redirects
```

To disable ICMP redirects on interface vlan2, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip redirects
```

optimistic-nd

Use this command to enable the optimistic neighbor discovery feature for both IPv4 and IPv6.

Use the no variant of this command to disable the optimistic neighbor discovery feature.

Syntax

```
optimistic-nd

no optimistic-nd
```

Default The optimistic neighbor discovery feature is enabled by default.

Mode Interface Configuration for a VLAN interface.

Usage The optimistic neighbor discovery feature allows the switch, after learning an IPv4 or IPv6 neighbor, to refresh the neighbor before the neighbor is deleted from the hardware L3 switching table. The neighbor is put into the 'stale' state in the software switching table if is it not refreshed, then the 'stale' neighbors are deleted from the hardware L3 switching table.

The optimistic neighbor discovery feature enables the switch to sustain L3 traffic switching to a neighbor without interruption. Without the optimistic neighbor discovery feature enabled L3 traffic is interrupted when a neighbor is 'stale' and is then deleted from the L3 switching table.

If a neighbor receiving optimistic neighbor solicitations does not answer optimistic neighbor solicitations with neighbor advertisements, then the neighbor will be put into the 'stale' state, and subsequently deleted from both the software and the hardware L3 switching tables.

Examples To enable the optimistic neighbor discovery feature on `vlan100`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan100
awplus(config-if)# optimistic-nd
```

To disable the optimistic neighbor discovery feature on `vlan100`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan100
awplus(config-if)# no optimistic-nd
```

Validation Commands show running-config

ping

This command sends a query to another IPv4 host (send Echo Request messages).

Syntax

```
ping [vrf <vrf-name>] [ip] <host> [broadcast] [df-bit {yes|no}]
   [interval <0-128>] [pattern <hex-data-pattern>] [repeat {<1-
   2147483647>|continuous}] [size <36-18024>] [source <ip-addr>]
   [timeout <1-65535>] [tos <0-255>]
```

Parameter	Description
<host>	The destination IP address or hostname.
broadcast	Allow pinging of a broadcast address.
df-bit	Enable or disable the do-not-fragment bit in the IP header.
interval *<0-128>*	Specify the time interval in seconds between sending ping packets. The default is 1.
pattern *<hex-data-pattern>*	Specify the hex data pattern.
repeat	Specify the number of ping packets to send.
<1-2147483647>	Specify repeat count. The default is 5.
continuous	Continuous ping
size *<36-18024>*	The number of data bytes to send, excluding the 8 byte ICMP header. The default is 56 (64 ICMP data bytes).
source *<ip-addr>*	The IP address of a configured IP interface to use as the source in the IP header of the ping packet.
timeout *<1-65535>*	The time in seconds to wait for echo replies if the ARP entry is present, before reporting that no reply was received. If no ARP entry is present, it does not wait.
tos *<0-255>*	The value of the type of service in the IP header.
vrf	Apply the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.

Mode User Exec and Privileged Exec

Example To ping the IP address `10.10.0.5` use the following command:

```
awplus# ping 10.10.0.5
```

To ping the IP address `10.10.0.5` from VRF `red`, use the following command:

```
awplus# ping vrf red 10.10.0.5
```

Note that unless a cross-domain static or leaked route to the destination IP address, you must run this command from within the same routing domain as the address being pinged.

router ip irdp

This command globally enables ICMP Router Discovery (IRDP) advertisements on your device. However, your device does not send or process IRDP messages until at least one interface is configured to use IP and has had IRDP enabled on the interface with the ip irdp command.

The no variant of this command globally disables IRDP advertisements on the device. All interfaces immediately stop transmitting and processing Router Discovery messages.

Syntax

```
router ip irdp
no router ip irdp
```

Mode Global Configuration

Examples To enable Router Discovery advertisements on your device, use the following commands:

```
awplus# configure terminal
awplus(config)# router ip irdp
```

To disable Router Discovery advertisements on your device, use the following commands:

```
awplus# configure terminal
awplus(config)# no router ip irdp
```

Related Commands

ip irdp
show ip irdp

show arp

Use this command to display entries in the ARP routing and forwarding table—the ARP cache contains mappings of IP addresses to physical addresses for hosts. To have a dynamic entry in the ARP cache, a host must have used the ARP protocol to access another host.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show arp [global|vrf <vrf-name>]
```

Parameter	Description
`security`	Specify the DHCP Snooping ARP security output option.
`interface`	Specify an interface list for DHCP Snooping ARP security output.
`<interface-list>`	Specify a single Layer 3 interface name, or a a range of interfaces.
`statistics`	Specify brief DHCP Snooping ARP security statistics.
`detail`	Specify detailed DHCP Snooping ARP security statistics.
`global`	When VRF-Lite is configured, apply this command to the global routing and forwarding table
`vrf`	Apply this command to the specified VRF instance.
`<vrf-name>`	The VRF instance name

Mode

User Exec and Privileged Exec

Usage

Running this command with no additional parameters, will display all entries in the ARP routing and forwarding table.

With VRF-Lite configured, and no additional parameters entered, the command output displays all entries, listed by their VRF instance. By adding either a specific VRF instance or global parameter entry, you can selectively list ARP entries by their membership of a specific VRF instance.

Example

To display all ARP entries in the ARP cache, use the following command:

```
awplus# show arp
```

Output

Figure 25-3: Example output from the **show arp** command

```
awplus# show arp

  IP Address      MAC Address    Interface    Port        Type
192.168.10.2    0015.77ad.fad8  vlan1       port1.0.1   dynamic
192.168.20.2    0015.77ad.fa48  vlan2       port1.0.2   dynamic
192.168.1.100   00d0.6b04.2a42  vlan2       port1.0.8   static

[VRF: red]
  IP Address      MAC Address    Interface    Port        Type
10.1.1.1        0015.77ad.1234  vlan11      port1.0.11  dynamic
```

Example To display the dynamic ARP entries in the global routing instance, use the command:

```
awplus# show arp global
```

Output Figure 25-4: Example output from the **show arp global** command

```
  IP Address      MAC Address    Interface    Port        Type
192.168.10.2    0015.77ad.fad8  vlan1       port1.0.1   dynamic
192.168.20.2    0015.77ad.fa48  vlan2       port1.0.2   dynamic
192.168.1.100   00d0.6b04.2a42  vlan2       port1.0.8   static
```

Example To display the dynamic ARP entries for a VRF instance `red`, use the command:

```
awplus# show arp vrf red
```

Output Figure 25-5: Example output from the **show arp vrf red** command

```
awplus# show arp vrf red

[VRF: red]
  IP Address      MAC Address    Interface    Port        Type
192.168.10.2    0015.77ad.fad8  vlan1       port1.0.1   dynamic
```

Table 25-2: Parameters in the output of the **show arp** command

Parameter	Meaning
`IP Address`	IP address of the network device this entry maps to.
`MAC Address`	Hardware address of the network device.
`Interface`	Interface over which the network device is accessed.
`Port`	Physical port that the network device is attached to.
`Type`	Whether the entry is a static or dynamic entry. Static entries are added using the arp (IP address MAC address) command. Dynamic entries are learned from ARP request/reply message exchanges.
`VRF`	The name of the VRF instance. The VRF components only display when VRF is configured on the switch.

Related Commands arp (IP address MAC address)
clear arp-cache

show debugging ip dns forwarding

Use this command to display the DNS Relay debugging status. DNS Relay debugging is set using the debug ip dns forwarding command.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show debugging ip dns forwarding`

Mode User Exec and Privileged Exec

Example To display the DNS Relay debugging status, use the command:

```
awplus# show debugging ip dns forwarding
```

Output Figure 25-6: Example output from the **show debugging ip dns forwarding** command

```
DNS Relay debugging status:
  debugging is on
```

Related Commands debug ip dns forwarding

show debugging ip packet

Use this command to show the IP interface debugging status. IP interface debugging is set using the debug ip packet interface command.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show debugging ip packet`

Mode User Exec and Privileged Exec

Example To display the IP interface debugging status when the terminal monitor off, use the command:

```
awplus# terminal no monitor
awplus# show debug ip packet
```

Output Figure 25-7: Example output from the **show debugging ip packet** command with **terminal monitor** off

```
IP debugging status:
interface all tcp (stopped)
interface vlan1 arp verbose (stopped)
```

Example To display the IP interface debugging status when the terminal monitor is on, use the command:

```
awplus# terminal monitor
awplus# show debug ip packet
```

Output Figure 25-8: Example output from the **show debugging ip packet** command with **terminal monitor** on

```
IP debugging status:
interface all tcp (running)
interface vlan1 arp verbose (running)
```

Related Commands debug ip packet interface
terminal monitor

show hosts

This command shows the default domain, domain list, and name servers configured on your device.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show hosts
```

Mode

User Exec and Privileged Exec

Example

To display the default domain, use the command:

```
awplus# show hosts
```

Output

Figure 25-9: Example output from the **show hosts** command

```
Default domain is mycompany.com
Domain list: company.com
Name/address lookup uses domain service
Name servers are 10.10.0.2 10.10.0.88
```

Related Commands

ip domain-list
ip domain-lookup
ip domain-name
ip name-server

show ip dns forwarding

Use this command to display the DNS Relay status.

Syntax `show ip dns forwarding`

Mode User Exec and Privileged Exec

Examples To display the DNS Relay status, use the command:

```
awplus# show ip dns forwarding
```

Output Figure 25-10: Example output from the **show ip dns forwarding** command

```
Servers           Forwards      Fails
192.168.1.1             12          0
192.168.1.2              6          3
```

Related Commands ip dns forwarding

show ip dns forwarding cache

Use this command to display the DNS Relay name resolver cache.

Syntax `show ip dns forwarding cache`

Mode User Exec and Privileged Exec

Examples To display the DNS Relay name resolver cache, use the command:

```
awplus# show ip dns forwarding cache
```

Output Figure 25-11: Example output from the **show ip dns forwarding cache** command

```
Host                                    Address                 Expires Flags
www.example.com                         192.168.1.1                 180
mail.example.com                        www.example.com             180 CNAME
www.example.com                         192.168.1.1                 180 REVERSE
mail.example.com                        192.168.1.5                 180
```

Related Commands ip dns forwarding cache

show ip domain-list

This command shows the domains configured in the domain list. The DNS client uses the domains in this list to append incomplete hostnames when sending a DNS enquiry to a DNS server.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip domain-list`

Mode User Exec and Privileged Exec

Example To display the list of domains in the domain list, use the command:

```
awplus# show ip domain-list
```

Output Figure 25-12: Example output from the **show ip domain-list** command

```
alliedtelesis.com
mycompany.com
```

Related Commands ip domain-list
ip domain-lookup

show ip domain-name

This command shows the default domain configured on your device. When there are no entries in the DNS list, the DNS client appends this domain to incomplete hostnames when sending a DNS enquiry to a DNS server.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip domain-name
```

Mode User Exec and Privileged Exec

Example To display the default domain configured on your device, use the command:

```
awplus# show ip domain-name
```

Output Figure 25-13: Example output from the **show ip domain-name** command

```
alliedtelesis.com
```

Related Commands

ip domain-name
ip domain-lookup

show ip forwarding

Use this command to display the IP forwarding status.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip forwarding
```

Mode User Exec and Privileged Exec

Example

```
awplus# show ip forwarding
```

Output Figure 25-14: Example output from the **show ip forwarding** command

```
awplus#show ip forwarding
IP forwarding is on
```

show ip interface

Use this command to display information about interfaces and the IP addresses assigned to them. To display information about a specific interface, specify the interface name with the command.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip interface [<interface-list>] [brief]
```

Parameter	Description
<interface-list>	The interfaces to display information about. An interface-list can be: ■ an interface, e.g. `vlan2` ■ a continuous range of interfaces separated by a hyphen, e.g. `vlan2-8` or `vlan2-vlan5` ■ a comma-separated list of interfaces or interface ranges, e.g. `vlan2,vlan5,vlan8-10` The specified interfaces must exist.

Mode User Exec and Privileged Exec

Examples To show brief information for the assigned IP address for interface `port1.0.2` use the command:

```
awplus# show ip interface port1.0.2 brief
```

To show the IP addresses assigned to `vlan2` and `vlan3`, use the command:

```
awplus# show ip interface vlan2-3 brief
```

Output Figure 25-15: Example output from the **show ip interface brief** command

```
Interface              IP-Address      Status          Protocol
port1.0.2              unassigned      admin up        down
vlan1                  192.168.1.1     admin up        running
vlan2                  192.168.2.1     admin up        running
vlan3                  192.168.3.1     admin up        running
vlan8                  unassigned      admin up        down
```

show ip interface vrf

Use this command to display protocol and status information about configured interfaces and their assigned IP addresses in VRF instances.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip interface [vrf <vrf-name>|global]`

Parameter	Description
`vrf`	A VRF instance.
`<vrf-name>`	The name of a specific VRF instance.
`global`	The global routing and forwarding table

Mode User Exec and Privileged Exec

Examples To display all interfaces and IP addresses associated with a VRF instance `red`, use the command:

```
awplus# show ip interface vrf red
```

Output Figure 25-16: Example output from the **show ip interface vrf red** command

```
[VRF: red]
Interface            IP-Address          Status       Protocol
lo1                  unassigned          admin up     running
vlan1                192.168.10.1/24     admin up     running
```

Example To display all interfaces and IP addresses associated with all VRF instances, use the command:

```
awplus# show ip interface
```

Output Figure 25-17: Example output from the **show ip interface** with VRF-Lite configured

```
Interface            IP-Address          Status         Protocol
eth0                 unassigned          admin up       down
lo                   unassigned          admin up       running
vlan1                192.168.1.1/24      admin up       running
vlan4                172.30.4.43/24      admin up       down

[VRF: red]
Interface            IP-Address          Status
Protocol
lo1                  unassigned          admin up       running

[VRF: blue]
Interface            IP-Address          Status
Protocol
lo2                  unassigned          admin up       running
```

show ip irdp

This command displays whether IRDP is globally enabled on your device, and the status of the debugging modes.

If the debug ip irdp command has been set with the detail parameter then the both parameter is also set and the output will show "packet debugging mode is all".

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip irdp`

Mode User Exec and Privileged Exec

Example To display global IRDP configuration, use the command:

```
awplus# show ip irdp
```

Output Figure 25-18: Example output from the **show ip irdp** command

```
IRDP is enabled
  event debugging is disabled
  nsm debugging is disabled
  packet debugging mode is disabled
```

Figure 25-19: Example output from the **show ip irdp** command with **debug ip irdp detail** set

```
IRDP is enabled
  event debugging is disabled
  nsm debugging is disabled
  packet debugging mode is all
```

Figure 25-20: Example output from the **show ip irdp** command with **debug ip irdp both** set

```
IRDP is enabled
  event debugging is disabled
  nsm debugging is disabled
  packet debugging mode is both
```

Related Commands debug ip irdp
router ip irdp

show ip irdp interface

This command displays the configuration of IRDP on all interfaces, or for a specified interface.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip irdp interface [<interface-name>]`

Parameter	Description
<interface-name>	Displays the interface status and configuration details of the specified interface.

Mode User Exec and Privileged Exec

Example To display the IRDP configuration for `vlan4`, use the command:

```
awplus# show ip irdp interface vlan4
```

Output Figure 25-21: Example output from the **show ip irdp interface** command

```
vlan13 is up, line protocol is up
ICMP Router Discovery Protocol
  Sending mode           multicast
  Router Lifetime        1350 seconds
  Default Preference     0
  Min Adv Interval       450 seconds
  Max Adv Interval       600 seconds
  Next advertisement in 551 seconds
  Non default prefix preferences
     192.168.1.1         preference     25000

  In packets                    0                Out packets                   3
  In bad packets                0                Out bad packets               0
  In good packets               0                Out good packets              3
  In ignored packets            0
```

Table 25-3: Parameters in the output of the **show ip irdp interface** command

Parameter	Description
`Sending mode`	Whether this interface is sending broadcast or multicast router advertisements. This means the destination IP address of router advertisements will be either the multicast address 224.0.0.1, or the broadcast address 255.255.255.255.
`Router Lifetime`	The lifetime value set for router advertisements sent from this interface. This is the maximum time that other devices should treat the advertised address as valid.
`Default Preference`	The preference value for IP addresses as default router addresses, relative to other router addresses on the same subnet. This preference value is used for all IP addresses on this interface, except for those listed under the heading "non default prefix preferences".
`Min Adv Interval`	Minimum time allowed between sending router advertisements from this interface.

Table 25-3: Parameters in the output of the **show ip irdp interface** command

Parameter	Description
`Max Adv Interval`	Maximum time allowed between sending router advertisements from this interface.
`Non default prefix preferences`	List of the IP addresses on this interface that have been set with a specific router preference value. These addresses use the preference value listed beside them, rather than the interface's default preference value.
`In packets`	The total number of packets received by IRDP on this interface. IRDP processes all ICMP packets received on this interface.
`Out packets`	The number of packets sent by IRDP on this interface.
`In bad packets`	The number of packets received by IRDP that it has discarded because they do not conform or corrupted.
`Out bad packets`	The number of packets that IRDP generated but failed to send to the network layer.
`In good packets`	The number of packets received and processed by IRDP.
`Out good packets`	The number of packets generated and successfully sent by IRDP.
`In ignored packets`	The number of incoming packets ignored, like ICMP packets other than IRDP.

Related Commands

ip irdp
show ip irdp

show ip name-server

This command displays the list of DNS servers your device sends DNS requests to with assigned IPv4 and IPv6 addresses. This is a static list configured using the ip name-server command.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip name-server
```

Mode

User Exec and Privileged Exec

Example

To display the list of DNS servers that your device sends DNS requests to, use the command:

```
awplus# show ip name-server
```

Output

Figure 25-22: Example output from the **show ip name-server** command

```
Nameservers:
 10.10.0.123
 10.10.0.124
 2001:0db8:010d::1
 2001:0db8:010d::2
```

Related Commands

ip domain-lookup
ip name-server

tcpdump

Use this command to start a tcpdump, which gives the same output as the Unix-like tcpdump command to display TCP/IP traffic. Press `<ctrl> + c` to stop a running tcpdump.

Syntax `tcpdump [vrf <vrf-name>] <line>`

Parameter	Description
<line>	Specify the dump options. For more information on the options for this placeholder see URL http://www.tcpdump.org/tcpdump_man.html
`vrf`	Apply the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.

Mode Privileged Exec

Example To start a tcpdump running to capture IP packets, enter the command:

```
awplus# tcpdump ip
```

To start a tcpdump on interface `vlan2` associated with a VRF instance `red`, enter the command:

```
awplus# tcpdump vrf red vlan2
```

Output Figure 25-23: Example output from the **tcpdump** command

```
03:40:33.221337 IP 192.168.1.1 > 224.0.0.13: PIMv2, Hello,
length: 34
1 packets captured
2 packets received by filter
0 packets dropped by kernel
```

Related Commands debug ip packet interface

traceroute

Use this command to trace the route to the specified IPv4 host.

Syntax `traceroute [vrf <vrf-name>] {<ip-addr>|<hostname>}`

Parameter	Description
`vrf`	Apply the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.
<ip-addr>	The destination IPv4 address. The IPv4 address uses the format A.B.C.D.
<hostname>	The destination hostname.

Mode User Exec and Privileged Exec

Example

```
awplus# traceroute 10.10.0.5
awplus# traceroute vrf red 192.168.0.1
```

undebug ip packet interface

This command applies the functionality of the no debug ip packet interface command on page 25.12.

undebug ip irdp

This command applies the functionality of the no debug ip irdp command on page 25.14.

Chapter 26: IPv6 Introduction

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Introduction

This chapter describes the main features of IPv6, the switch's implementation of IPv6 and how to configure and operate IPv6 on the switch.

This chapter describes the following IPv6 features:

- linking together networks that run IPv6.
- allowing address autoconfiguration of hosts connected to the switch.

Overview

IPv6 is the next generation of the Internet Protocol (IP). It has primarily been developed to solve the problem of the eventual exhaustion of the IPv4 address space, but also offers other enhancements. IPv6 addresses are 16 bytes long, in contrast to IPv4's 4 byte addresses. Other features of IPv6 include:

- Address structure improvements:
  - « globally unique addresses with more levels of addressing hierarchy to reduce the size of routing tables
  - « autoconfiguration of addresses by hosts
  - « improved scalability of multicast routing by adding a "scope" field to multicast addresses
  - « a new type of address, the "anycast address", which sends packets to any one of a group of devices
- Removes the need for packet fragmentation en-route, by dynamic determination of the largest packet size that is supported by every link in the path. A link's MTU (Maximum Transmission Unit) must be at least 1280 bytes, compared with 576 bytes for IPv4.
- Includes a Traffic Class that allow packets to be labelled with an appropriate priority. If the network becomes congested, the lowest priority packets are dropped.
- Includes Flow labels that indicate to intermediate switches and routers that packets are part of a flow, and that a particular flow requires a particular type of service. This feature enables, for example, real-time processing of data streams. It also increases routing speed because the forwarding router need only check the flow label, not the rest of the header. The handling indicated by the flow label can be done by the IPv6 Hop-by-Hop header, or by a separate protocol such as RSVP.
- Mandatory authentication and data integrity protocols through IPsec. IPsec is optional in IPv4.

IPv6 Addresses and Prefixes

IPv6 addresses are hexadecimal, and are made up of eight pairs of octets separated by colons. An example of a valid address is 2001:0db8:0000:0000:0260:0000:97ff:64aa. In the interests of brevity, addresses can be abbreviated in two ways:

- Leading zeros can be omitted, so this address can be written as 2001:db8:0:0:260:0:97ff:64aa.
- Consecutive zeros can be replaced with a double colon, so this address can be written as 2001:db8::260:0:97ff:64a. Note that a double colon can replace any number of consecutive zeros, but an address can contain only one double colon.

Like IPv4 addresses, a proportion of the leftmost bits of the IPv6 address can be used to indicate the subnet, rather than a single node. This part of the address is called the *prefix*. Prefixes provide the equivalent functionality to a subnet mask in IPv4, allowing a subnet to be addressed, rather than a single node. If a prefix is specified, the IPv6 address is followed by a slash and the number of bits that represent the prefix. For example, 2001::/16 indicates that the first 16 bits (2001) of the address 2001:0:0:0:0:0:0:0 represent the prefix.

Like IPv4 addresses, IPv6 addresses are attached to interfaces.

Note RFC 3849 allocates the prefix 2001:0db8::/32 for documentation purposes.

Address types

IPv6 supports the following address types:

- Unicast
- Multicast
- Anycast

Unicast addresses

A unicast address is attached to a single interface and delivers packets only to that interface. The following special addresses have been defined:

- IPv4-compatible and IPv4-mapped addresses. IPv4-compatible addresses are used to tunnel IPv6 packets across an IPv4 network. IPv4-mapped addresses are used by an IPv6 host to communicate with an IPv4 host. The IPv6 host addresses the packet to the mapped address.
- Link-local addresses can be used on the local network on which the interface is attached. The link-local prefix is fe80::/10. Different interfaces on a device may have the same link-local address. The switch will automatically generate a link-local address for all interfaces that are using IPv6. Commands entered to configure link-local addresses that match any automatically generated link-local addresses by the switch will not be executed.
  Enter the show ipv6 interface command to display automatically generated link-local addresses not shown in the running-config. Automatically generated link-local addresses contain the last six hexadecimal numbers of the MAC address for a given interface.

- The Loopback address, consisting of ::1, which is the equivalent of the IPv4 loopback address, and allows a host to send packets to itself.
- The Unspecified address, consisting of ::, which is the equivalent of the IPv4 unspecified address, and is used as a source address by hosts during the autoconfiguration process.

Multicast addresses

IPv6 multicast addresses provide the equivalent functionality to broadcast addresses in IPv4. Broadcast addresses are not supported in IPv6. A multicast address identifies a group of interfaces, and packets are sent to all interfaces in that group.

Among the special addresses that have been defined are addresses that allow multicasting to:

- All interfaces on a particular host (ff01::1)
- All nodes on a local network (ff01::2)
- All routers on the local link (ff02::2)
- All routers on the local site (ff05::2).

Anycast addresses

An *anycast* address is a unicast address that is attached to more than one interface. If a packet is sent to an anycast address it is delivered to the nearest interface with that address, with the definition of “nearest” depending on the protocol used for routing. If the protocol is RIPv6, the nearest interface is the one that is the shortest number of hops away.

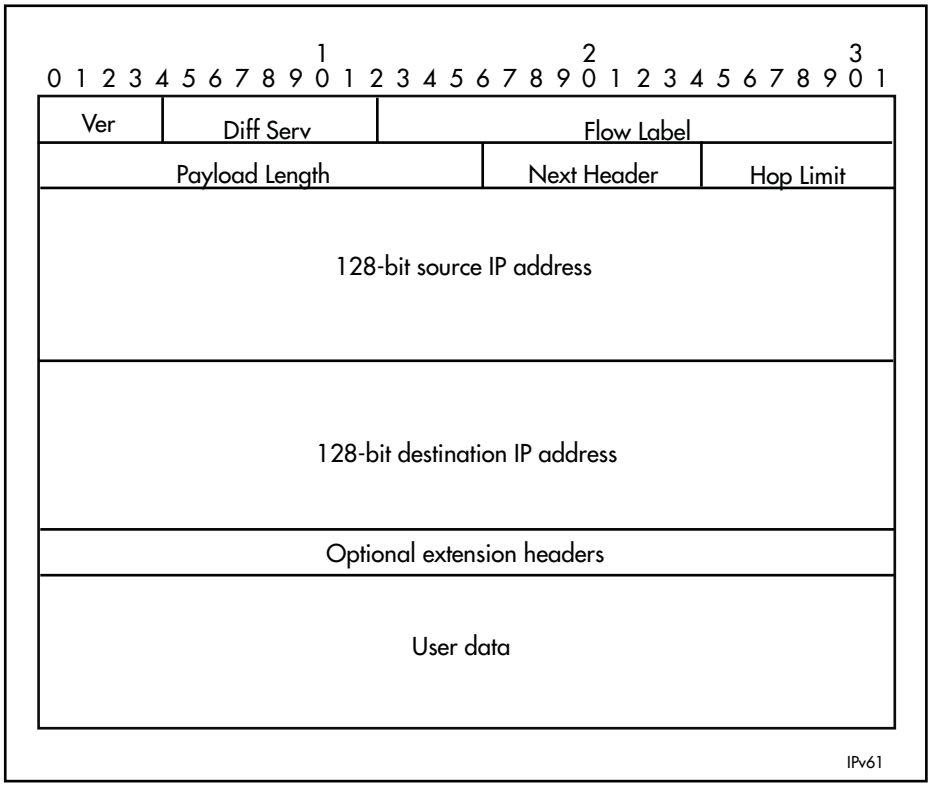
Anycast addresses can be assigned to routers only, and packets cannot originate from an anycast address. A router must be configured to know that it is using an anycast address because the address format cannot be distinguished from that of a unicast address.

Only one anycast address has been predefined: the subnet-router address. The subnet-router address sends messages to the nearest router on a subnet and consists of the subnet’s prefix followed by zeros.

IPv6 Headers

The basic unit of data sent through an internet is called a *packet* in IPv6. A packet consists of a *header* followed by the *data*. The following figure shows the IPv6 packet.

Figure 26-1: IPv6 packet



.

Table 26-1: IPv6 packet - Field Description

Field	Function
Ver	Version of the IP protocol that created the packet. For IPv6, this field has a value of 6.
Differentiated Services	8-bit value that contains the 6-bit DSCP and is used to prioritize traffic as part of a Quality of Service system. For more information, see "Differentiated Services Architecture" on page 60.4. Additional information can be found in RFC 2474, *Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers*.
Flow Label	20-bit value that indicates the data flow to which this packet belongs.This flow may be handled in a particular way.
Payload Length	Length of the user data portion of the packet. If the data payload is larger than 64 kB, the length is given in the optional "Jumbo Payload" header and the Payload Length header is given a value of zero.

Table 26-1: IPv6 packet - Field Description(cont.)

Field	Function
Next Header	Number that indicates the type of header that immediately follows the basic IP header. This header type may be an optional IPv6 extension header, a relevant IPv4 option header, or another protocol, such as TCP or ICMPv6. The IPv6 extension header values are: 0 (Hop-by-Hop Options Header) 43 (IPv6 Routing Header) 44 (IPv6 Fragment Header) 50 (Encapsulating Security Payload) 51 (IPv6 Authentication Header) 59 (No Next Header) 60 (Destination Options Header)
Hop Limit	Field that is the equivalent of the IPv4 Time To Live field, measured in hops.
Source IP address	128-bit IPv6 address of the sender.
Destination IP address	128-bit IPv6 address of the recipient.
Optional extension headers	Headers for less-frequently used information.
User data	Payload.

Basic IPv6 header structure

The headers contain information necessary to move the packet across the internet. They must be able to cope with missing and duplicated packets as well as possible fragmentation (and reassembly) of the original packet.

IPv6 headers are twice as long as IPv4 headers (40 bytes instead of 20 bytes) and contain four times the address space size (128 bits instead of 32 bits).

They no longer contains the header length, identification, flags, fragment offset, and header checksum fields. Some of these options are placed in extension headers. The Time To Live field is replaced with a hop limit, and the IPv4 Type of Service field is replaced with a Differentiated Services field. The Differentiated Services field contains the DSCP bits, used in a Quality of Service (QoS) regime. The following table explains IPv4 header fields that changed in IPv6.

Changed Field	Description
Type of Service	The type of service that a connection should receive is indicated in IPv6 by the Flow Label field in the IPv6 header.
Fragmentation information (the Identification field, the Flags field and the Fragment Offset field)	In most cases fragmentation does not occur in IPv6. If it does, packets are fragmented at their source and not en route. Therefore, the fragmentation information is contained in an extension header to reduce the size of the basic IPv6 header.
Header Checksum	This option has not been provided in IPv6. This is because transport protocols implement checksums and because of the availability of the IPsec authentication header (AH) in IPv6.
Options	Extension headers handle all the optional values associated with IPv6 packets. The biggest advantage of this scheme is that the size of the basic IP header is a constant.

Extension headers

IPv6 implements many of the less commonly used fields in the IPv4 header (or their equivalents) as extension headers, which are placed after the basic IPv6 header. The length of each header must be a multiple of 8 bytes.

The first extension header is identified by the Next Header field in the basic IPv6 header. Any subsequent extension headers are identified by an 8-bit "Next Header" value at the beginning of the preceding extension header.

IPv6 nodes that originate packets are required to place extension headers in a specific order:

1. The basic IPv6 header. This must come immediately before the extension headers.
2. The Hop-by-Hop header. This specifies options that must be examined by every node in the routing path.
3. A Destination Options header. This is used to specify options to be processed by the first destination or final destination. The destination options header is the only extension header that may be present more than once in the IPv6 packet.
4. The Routing header. This enables a static path to be specified for the packet, if the dynamically-determined path is undesirable.
5. The Fragment header. This indicates that the source node has fragmented the packet, and contains information about the fragmentation.
6. The Authentication header (AH). This verifies the integrity of the packet and its headers.
7. The Encapsulating Security Payload (ESP) header. This encrypts a packet and verifies the integrity of its contents.
8. The Upper Layer Protocol header. This indicates which protocol a higher layer (such as the transport layer) is to process the packet with (for example, TCP).

The Internet Control Message Protocol (ICMPv6)

The Internet Control Message Protocol, ICMPv6, provides a mechanism for error reporting and route discovery and diagnostics. It also conveys information about multicast group membership, a function that is carried out by the Internet Group Management Protocol (IGMP) in IPv4, and performs address resolution, which the Address Resolution Protocol (ARP) performs in IPv4.

Significant aspects of ICMPv6 include neighbor discovery, which enables one device in a network to find out about other nearby devices; and stateless address autoconfiguration, which allows a device to dynamically determine its own IPv6 address.

ICMPv6 is also used to support the Ping v6 (*Packet Internet Groper*) and Trace route v6 functions that are used to verify the connections between networks and network devices. Ping is used to test the connectivity between two network devices to determine whether each network device can "see" the other device. Trace route is used to discover the route used to pass packets between two systems running the IP protocol.

Both of these functions operate almost identically in IPv4 and IPv6. For more information, see "Ping" on page 24.17.

Neighbor Discovery

Neighbor discovery is an ICMPv6 function that enables a router or a host to identify other devices on its links. This information is then used in address autoconfiguration, to redirect a node to use a more appropriate router if necessary, and to maintain reachability information with its neighbors.

The IPv6 Neighbor Discovery protocol is similar to a combination of the IPv4 protocols ARP, ICMP Router Discovery and ICMP Redirect.

The following table describes packet types involved with neighbor discovery.

Packet Type	Description
router solicitation	Packet in which a host sends out a request for routers to generate advertisements.
router advertisement	Allows routers to advertise their presence and other network parameters. A router sends an advertisement packet in response to a solicitation packet from a host.
neighbor solicitation	Packet in which a node sends a packet to determine the link layer address of a neighbor or to verify that a neighbor is still active.
neighbor advertisement	A response to a neighbor solicitation packet. These packets are also used to notify neighbors of link layer address changes.
redirect	Informs hosts of a better first hop.

To comply with Section 6.2.1 of RFC 2461, *IPv6 Neighbor Discovery*, the router does not generate router advertisements by default. See "Neighbor Discovery" on page 26.8 for instructions about enabling advertisements.

The following table explains packet types and services.

Packet Type	Description
address resolution	A method for carrying out address autoconfiguration, and is achieved using the Neighbor Solicitation Message and the Neighbor Advertisement Message.
router and prefix discovery	On connection to a link, a node needs to know the address of a router that the node can use to reach the rest of the world. The node also needs to know the prefix (or prefixes) that define the range of IP addresses on its link that it can reach without going through a router. Routers use ICMP to convey this information to hosts, by means of router advertisements. The message may have an option attached (the *source link address* option), which enables the receiving node to respond directly to the router, without performing a neighbor solicitation.
immediate information	The configuration of a router includes a defined frequency at which unsolicited advertisements are sent. If a node wants to obtain information about the nearest router immediately, rather than waiting for the next unsolicited advertisement, the node can send a router solicitation message. Each router that receives the solicitation message sends a router advertisement specifically to the node that sent the solicitation.

Packet Type	Description
redirection	If a node is aware of more than one router that it can use to connect to wider networks, the router to which it sends packets by default does not always represent the most desirable route. ICMPv6 uses the redirect packet to communicate a more effective path to the node.
Neighbor Unreachability Detection (NUD)	A node may issue solicitation requests to determine whether a path is still viable, or may listen in on acknowledgement packets of higher layer protocols, such as TCP. If the node determines that a path is no longer viable, it attempts to establish a new link to the neighbor, or to re-establish the previous link. NUD can be used between any two devices in the network, independent of whether the devices are acting as hosts or routers.

Stateless address autoconfiguration

Stateless address autoconfiguration allows an IPv6-aware device to be plugged into a network without manual configuration with an IP address. This plug and play functionality results in networks that are easier to set up and modify, and simplifies the process of shifting to use a new Internet Service Provider (ISP).

Stateless address autoconfiguration is achieved in a series of steps. Routers and hosts perform the first three steps, which autoconfigure a link-local address. A global address is autoconfigured in the last three steps, which only hosts perform.

On the router or host

1. During system start-up, the node begins autoconfiguration by generating a link-local address for the interface. A link-local address is formed by adding the interface ID to the link-local prefix fe80::/10 (reference RFC 3513).

Note

Different interfaces on a device may have the same link-local address. The switch will automatically generate a link-local address for all interfaces that are using IPv6. Commands entered to configure link-local addresses that match any automatically generated link-local addresses by the switch will not be executed. Enter the show ipv6 interface command to display automatically generated link-local addresses not shown in the running-config. Automatically generated link-local addresses contain the last six hexadecimal numbers of the MAC address for a given interface.

2. The node then transmits a neighbor solicitation message to this address. If the address is already in use, the node that the address belongs to replies with a neighbor advertisement message. The autoconfiguration process stops and manual configuration of the node is then required.

3. If no neighbor advertisement is received, the node concludes that the address is available and assigns it to the chosen interface.

On the host

1. The node then sends one or more router solicitations to detect if any routers are present. Any routers present responds with a router advertisement.

   If no router advertisement is received, the node tries to use DHCP to obtain an address and other configuration information. If no DHCP server responds, the node continues using the link-level address

   If a router advertisement is received, this message informs the node how to proceed with the auto configuration process. The prefix from the router advertisement, if received, is added to the link-level address to form the global unicast IP address.

2. This address is then assigned to the network interface.

   If routers are present, the node continues to receive router advertisements. The node updates its configuration when there are changes in the router advertisements.

IPv6 Routing

Routing in IPv6 is almost identical to IPv4 routing under CIDR, except that the addresses are 128-bit IPv6 addresses instead of 32-bit IPv4 addresses.

Routing Information Protocol (RIPv6)

RIP is a simple distance vector protocol that defines networks based on how many hops they are from the router. When a network is more than 15 hops away (one hop is one link), it is not included in the routing table.

RIPv6, also referred to as RIPng (for “next generation”) is similar to RIPv2. Extensions to RIPv2 to support IPv6 are:

- the address field of a routing entry is expanded to 128 bits to allow IPv6 prefixes
- the 32-bit RIPv2 subnet mask field is replaced by an 8-bit prefix length field
- authentication is removed in RIPv6
- the size of a routing packet is no longer arbitrarily limited
- RIPv6 specifies the next hop instead of simply allowing the recipient of the update to set the next hop to the sender of the update.

In RIPv6, each router uses a routing table to keep track of every destination that is reachable throughout the system. Each entry in the routing table contains:

- the IPv6 prefix of the destination
- a metric, which represents the total cost of getting a packet from the router to that destination
- the IPv6 address of the next router along the path to the destination
- a flag to indicate that information about the route has changed recently
- various timers associated with the route.

Integration of IPv4 and IPv6

IPv6 has been designed in such a way that a smooth transition from IPv4 is possible. The most effective way to ensure this is to use a *dual IP stack*. A node configured as a dual stack system has both a 128-bit IPv6 address and a 32-bit IPv4 address, and so can communicate with nodes running IPv4 and those running IPv6.

Another aspect of the transition is to *tunnel* IPv6 packets through an IPv4 network. IPv6 packets are tunnelled simply by encapsulating the IPv6 packet within an IPv4 datagram, and identifying that this datagram is an encapsulated IPv6 packet by giving the datagram a protocol value of 41.

IPv6 on your Switch

This section describes the switch's support for IPv6, and how to configure IPv6 on the switch.

Enabling IPv6

The switch's implementation of IPv6 is disabled by default. To enable IPv6 forwarding, use the ipv6 forwarding command on page 27.8.

To display information about IPv6 settings, use the show ipv6 interface brief command on page 27.26.

Because the switch implements IPv6 as a dual stack, implementing IPv6 does not affect IPv4 functionality.

IPv6 Stateless Address Autoconfiguration (SLAAC)

The switch's implementation of IPv6 supports SLAAC on an interface. To enable IPv6 SLAAC on an interface, use the ipv6 address autoconfig command on page 27.5. SLAAC automatically applies the MAC address of the interface to an IPv6 address for the interface specified. ipv6 address autoconfig enables automatic configuration of IPv6 addresses on an interface using stateless autoconfiguration, and enables IPv6 processing on an interface.

IPv6 EUI-64 Addressing

The switch's implementation of IPv6 supports EUI-64. To enable IPv6 EUI-64, use the ipv6 address command on page 27.3 specifying the optional eui64 parameter for an interface. EUI-64 applies the MAC address of the interface to an IPv6 address for the interface. The EUI-64 identifiers from the MAC address are used as the least significant 64 bits of a unicast address.

IPv6 Link-local Addresses

The switch's implementation of IPv6 supports IPv6 link-local addresses without global addresses for communications within the local subnetwork. Routers do not forward packets to link-local addresses. To enable IPv6 link-local addresses, use the ipv6 enable command on page 27.7. ipv6 enable automatically configures an IPv6 link-local address on the interface and enables IPv6 processing on the interface.

Note that link-local addresses are retained in the system until they are negated by using the no variant of the command that established them. See the Link Local Addresses glossary entry, and the ipv6 enable command for more information. Also note that the link-local address is retained in the system if the global address is removed using another command, which was not used to establish the link-local address. For example, if a link local address is established with the ipv6 enable command then it will not be removed using a no ipv6 address command.

IPv6 RA Guard

This section describes the switch's support for IPv6 RA Guard, and how to configure IPv6 RA Guard on the switch.

RA Guard Introduction

Router Advertisements (RAs) and Router Redirects are used to manage IPv6 networks. RA messages advertise a router's presence and specify network parameters that are used by hosts as part of address auto-configuration and setting next-hop routes for particular destinations.

RAs are periodically transmitted by routers allowing networks to be reconfigured by changes to the routers only. Routers can also send redirects to hosts suggesting that they use a different next-hop route for a particular traffic stream. But because the entire network configuration can be modified by what is contained in RAs and redirects, the network is vulnerable to rogue messages that are generated either through misconfiguration or due to a malicious attack.

RA Guard on the switch simply considers each of its ports as either trusted or untrusted. Any host connected to a port is considered trusted or untrusted depending on the port status. A trusted port will accept RAs and redirects and will forward RAs and redirects on trusted ports. An untrusted port will block and discard all RAs and redirects received from the untrusted host.

Enabling IPv6 RA Guard

The switch's implementation of IPv6 RA Guard is disabled by default. To enable IPv6 RA Guard on a port to block RAs from an untrusted host, use the ipv6 nd raguard command on page 27.17. Disable IPv6 RA Guard to allow RAs on a port using the no ipv6 nd raguard command.

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Command List

This chapter provides an alphabetical reference of commands used to configure IPv6. For more information, see Chapter 26, IPv6 Introduction.

clear ipv6 neighbors

Use this command to clear all dynamic IPv6 neighbor entries.

Syntax `clear ipv6 neigbors`

Mode Privileged Exec

Example

```
awplus# clear ipv6 neighbors
```

ipv6 address

Use this command to set the IPv6 address of a VLAN interface and enable IPv6. Use the optional eui64 parameter to derive the interface identifier of the IPv6 address from the MAC address of the interface. Note that the MAC address of the default VLAN is applied if the interface does not have a MAC address of its own when specifying the eui64 parameter.

Use the no variant of this command to remove the IPv6 address assigned and disable IPv6. Note that if no global addresses are left after removing the IPv6 address then IPv6 is disabled.

Syntax

```
ipv6 address <ipv6-addr/prefix-length> [eui64]
no ipv6 address <ipv6-addr/prefix-length> [eui64]
```

Parameter	Description
<ipv6-addr/prefix-length>	Specifies the IPv6 address to be set, for example, 2001:db8::1/128. The IPv6 address uses the format X:X::X:X/Prefix-Length. The prefix-length is usually set between 0 and 64, or has the value 128.
`[eui64]`	Specifies the lower 64 bits of the IPv6 address from the eui64 interface identifier (EUI - Extended Unique Identifier). EUI-64 identifiers are used as the least significant 64 bits of a unicast network address or a link-local address using stateless autoconfiguration.

Mode Interface Configuration for a VLAN interface.

Usage If the eui64 parameter is specified then the lower 64 bits of the IPv6 address are replaced with the same address that would be acquired through stateless address autoconfiguration (SLAAC) if the device received an RA (Router Advertisement) specifying this prefix. See ipv6 address autoconfig for a detailed command description and examples to enable and disable SLAAC.

Note that link-local addresses are retained in the system until they are negated by using the no variant of the command that established them. See the Link Local Addresses glossary entry, and the ipv6 enable command for more information.

Also note that the link-local address is retained in the system if the global address is removed using another command, which was not used to establish the link-local address. For example, if a link local address is established with the ipv6 enable command then it will not be removed using a no ipv6 address command.

Example To assign the IPv6 address `2001:0db8::a2/64` to the interface `vlan2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 address 2001:0db8::a2/64
```

To remove the IPv6 address `2001:0db8::a2/64` from the interface `vlan2`, use the

following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ipv6 address 2001:0db8::a2/64
```

To assign the eui64 derived address in the prefix `2001:db8::/48` to interface `vlan2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-fr-subif)# ipv6 address 2001:0db8::/48 eui64
```

To remove the eui64 derived address in the prefix `2001:db8::/48` from interface `vlan2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-fr-subif)# no ipv6 address 2001:0db8::/48 eui64
```

Validation Commands

show running-config
show ipv6 interface brief
show ipv6 route

Related Commands

ipv6 address autoconfig

ipv6 address autoconfig

Use this command to enable IPv6 stateless address autoconfiguration (SLAAC) for an interface. This configures an IPv6 address on an interface derived from the MAC address on the interface.

Use the no variant of this command to disable IPv6 SLAAC on an interface. Note that if no global addresses are left after removing all IPv6 autoconfigured addresses then IPv6 is disabled.

Syntax

```
ipv6 address autoconfig

no ipv6 address autoconfig
```

Mode Interface Configuration for a VLAN interface.

Usage The ipv6 address autoconfig command enables automatic configuration of IPv6 addresses using stateless autoconfiguration on an interface and enables IPv6, but does not enable IPv6 forwarding. See ipv6 forwarding command on page 27.8 for further description and examples.

IPv6 hosts can configure themselves when connected to an IPv6 network using ICMPv6 (Internet Control Message Protocol version 6) router discovery messages. Configured routers respond with a Router Advertisement (RA) containing configuration parameters for IPv6 hosts.

The SLAAC process derives the interface identifier of the IPv6 address from the MAC address of the interface. When applying SLAAC to an interface, note that the MAC address of the default VLAN is applied to the interface if the interface does not have its own MAC address.

If SLAAC is not suitable then a network can use stateful configuration with DHCPv6 (Dynamic Host Configuration Protocol version 6) Relay, or hosts can be configured statically. See ip dhcp-relay server-address for the DHCPv6 Relay server command description and examples. For introduction and configuration information about DHCPv6 Relay agent see “DHCP Relay Agent Introduction” on page 85.8 and “Configuring the DHCP Relay Agent” on page 85.8.

Note that link-local addresses are retained in the system until they are negated by using the no variant of the command that established them. See the Link Local Addresses glossary entry, and the ipv6 enable command for more information.

Also note that the link-local address is retained in the system if the global address is removed using another command, which was not used to establish the link-local address. For example, if a link local address is established with the ipv6 enable command then it will not be removed using a no ipv6 address command.

Example To enable SLAAC on the interface `vlan2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 address autoconfig
```

To disable SLAAC on the interface `vlan2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ipv6 address autoconfig
```

Validation Commands
show running-config
show ipv6 interface brief
show ipv6 route

Related Commands
ipv6 address
ipv6 enable

ipv6 enable

Use this command to enable IPv6 on an interface without an IPv6 global address for the interface. This enables IPv6 with a IPv6 link-local address, not an IPv6 global address.

Use the no variant of this command to disable IPv6 on an interface without a global address. Note the no variant of this command does not operate on an interface with an IPv6 global address or an interface configured for IPv6 stateless address autoconfiguration (SLAAC),

Syntax

```
ipv6 enable
no ipv6 enable
```

Mode Interface Configuration

Usage The ipv6 enable command automatically configures an IPv6 link-local address on the interface and enables the interface for IPv6 processing. Note that link-local addresses are retained in the system until they are negated by using the no variant of the command that established them. See the Link Local Addresses glossary entry for more information.

Also note that the link-local address is retained in the system if the global address is removed using another command, which was not used to establish the link-local address. For example, if a link local address is established with the ipv6 enable command then it will not be removed using a no ipv6 address command.

Example To enable IPv6 with only a link-local IPv6 address on the interface `vlan2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 enable
```

To disable IPv6 with only a link-local IPv6 address on the interface `vlan2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ipv6 enable
```

Validation Commands
show running-config
show ipv6 interface brief
show ipv6 route

Related Commands
ipv6 address
ipv6 address autoconfig

ipv6 forwarding

Use this command to turn on IPv6 forwarding.

Use the no variant of this command to turn off IPv6 forwarding.

Note

The switch will not apply any IPv6 functionality unless you have allocated it memory resource by using the platform routingratio command on page 15.32.

Syntax

```
ipv6 forwarding
no ipv6 forwarding
```

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# ipv6 forwarding
```

ipv6 nd current-hoplimit

Use this command to specify the advertised current hop limit used between IPv6 Routers.

Use the no variant of this command to reset the current advertised hop limit to its default (0).

Note This command is only supported in the stand-alone mode. IPv6 is not supported on x600 or x610 series switches in VCStack configurations.

Syntax

```
ipv6 nd current-hoplimit <hoplimit>
no ipv6 nd current-hoplimit [<hoplimit>]
```

Parameter	Description
<hoplimit>	Specifies the advertised current hop limit value. Valid values are from 0 to 255 hops.

Default 0 (No advertised current hop limit specified)

Mode Interface Configuration for a VLAN interface.

Example To set the advertised current hop limit to 2 between IPv6 Routers, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 nd current-hoplimit 2
```

To reset the advertised current hop limit to the default (0), use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ipv6 nd current-hoplimit
```

Related Commands

ipv6 nd managed-config-flag
ipv6 nd prefix
ipv6 nd suppress-ra

ipv6 nd managed-config-flag

Use this command to set the managed address configuration flag, contained within the router advertisement field.

Setting this flag indicates the operation of a stateful autoconfiguration protocol such as DHCPv6 for address autoconfiguration, and that address information (i.e. the network prefix) and other (non-address) information can be requested from the switch.

An unset flag enables hosts receiving the advertisements to use a sateless autoconfiguration mechanism to establish their IPv6 addresses. The default is flag unset.

Use the no variant of this command to reset this command to its default of, *flag unset*.

Syntax

```
ipv6 nd managed-config-flag
no ipv6 nd managed-config-flag
```

Default Unset

Mode Interface Configuration for a VLAN interface.

Usage Advertisement flags will not be transmitted unless you have applied the no ipv6 nd suppress-ra command on page 27.20. This step is included in the example below.

Example To set the managed address configuration flag on `vlan2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 nd managed-config-flag
awplus(config-if)# no ipv6 nd suppress-ra
```

Related Commands

ipv6 nd suppress-ra
ipv6 nd prefix
ipv6 nd other-config-flag

ipv6 nd minimum-ra-interval

Use this command in Interface Configuration mode to set a minimum Router Advertisement (RA) interval for a VLAN interface.

Use the no variant of this command in Interface Configuration mode to remove the minimum RA interval for a VLAN interface.

Syntax

```
ipv6 nd minimum-ra-interval <seconds>

no ipv6 nd minimum-ra-interval [<seconds>]
```

Parameter	Description
<seconds>	Specifies the number of seconds between IPv6 Router Advertisements (RAs). Valid values are from 3 to 1350 seconds.

Default The RA interval for a VLAN interface is unset by default.

Mode Interface Configuration for a VLAN interface.

Examples To set the minimum RA interval for VLAN interface `vlan2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 nd minimum-ra-interval 60
```

To remove the minimum RA interval for VLAN interface `vlan2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ipv6 nd minimum-ra-interval 60
```

Related Commands

ipv6 nd ra-interval
ipv6 nd suppress-ra
ipv6 nd prefix
ipv6 nd other-config-flag

ipv6 nd other-config-flag

Use this command to set the other stateful configuration flag (contained within the router advertisement field) to be used for IPv6 address auto-configuration. This flag is used to request the router to provide information in addition to providing addresses.

Note

Setting the ipv6 nd managed-config-flag command on page 27.10 implies that the ipv6 nd other-config-flag will also be set.

Use no variant of this command to reset the value to the default.

Syntax

```
ipv6 nd other-config-flag
no ipv6 nd other-config-flag
```

Default Unset

Mode Interface Configuration for a VLAN interface.

Usage Advertisement flags will not be transmitted unless you have applied the no ipv6 nd suppress-ra command on page 27.20. This step is included in the example below.

Example To set the ipv6 other-config-flag on `vlan4`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ipv6 nd other-config-flag
awplus(config-if)# no ipv6 nd suppress-ra
```

Related Commands

ipv6 nd suppress-ra
ipv6 nd prefix
ipv6 nd managed-config-flag

ipv6 nd prefix

Use this command in Interface Configuration mode for a VLAN interface to specify the IPv6 prefix information that is advertised by the router advertisement for IPv6 address auto-configuration.

Use the no parameter with this command to reset the IPv6 prefix for a VLAN interface in Interface Configuration mode.

Syntax

```
ipv6 nd prefix <ipv6-prefix/length>

ipv6 nd prefix <ipv6-prefix/length> [<valid-lifetime>]

ipv6 nd prefix <ipv6-prefix/length> <valid-lifetime>
   <preferred-lifetime> [no-autoconfig]

ipv6 nd prefix <ipv6-prefix/length> <valid-lifetime>
   <preferred-lifetime> off-link [no-autoconfig]

no ipv6 nd prefix [<ipv6-addr/prefix-length>|all]
```

Parameter	Description
<ipv6-prefix/length>	The prefix to be advertised by the router. The IPv6 address prefix uses the format X:X::/prefix-length. The prefix-length is usually set between 0 and 64, or has the value 128.The default is X:X::/64.
<valid-lifetime>	The the period during which the specified IPv6 address prefix is valid. This can be set to a value between 0 and 4294967295 seconds. The default is 2592000 (30 days). Note that this period should be set to a value greater than that set for the prefix preferred-lifetime.
<preferred-lifetime>	Specifies theIPv6 prefix preferred lifetime. This is the period during which the IPv6 address prefix is considered a current (undeprecated) value. After this period, the command is still valid but should not be used in new communications. Set to a value between 0 and 4294967295 seconds. The default is 604800 seconds (7 days). Note that this period should be set to a value less than that set for the prefix valid-lifetime.
`off-link`	Specify the IPv6 prefix off-link flag. The default is *flag set*.
`no-autoconfig`	Specify the IPv6 prefix no autoconfiguration flag. Setting this flag indicates that the prefix is not to be used for autoconfiguration. The default is *flag set*.
`all`	Specify all IPv6 prefixes associated with the VLAN interface.

Default Valid-lifetime default is 2592000 seconds (30 days). Preferred-lifetime default is 604800 seconds (7 days).

Mode Interface Configuration for a VLAN interface.

Usage This command specifies the IPv6 prefix flags that are advertised by the router advertisement message.

Examples The following example configures the switch to issue router advertisements on VLAN interface `vlan4`, and advertises the address prefix of `2001:0db8::/64`.

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ipv6 nd prefix 2001:0db8::/64
```

The following example configures the switch to issue router advertisements on VLAN interface `vlan4`, and advertises the address prefix of `2001:0db8::/64` with a valid lifetime of 10 days and a preferred lifetime of 5 days.

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ipv6 nd prefix 2001:0db8::/64 864000 432000
```

The following example configures the switch to issue router advertisements on VLAN interface `vlan4`, and advertises the address prefix of `2001:0db8::/64` with a valid lifetime of 10 days, a preferred lifetime of 5 days and no prefix used for autoconfiguration.

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ipv6 nd prefix 2001:0db8::/64 864000 43200
no-autoconfig
```

The following example resets router advertisements on VLAN interface `vlan4`, so the address prefix of `2001:0db8::/64` is not advertised from the switch.

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# no ipv6 nd prefix 2001:0db8::/64
```

The following example resets all router advertisements on VLAN interface `vlan4`:

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# no ipv6 nd prefix all
```

Related Commands ipv6 nd suppress-ra

ipv6 nd ra-interval

Use this command to specify the interval between IPv6 Router Advertisements (RA) transmissions.

Use no parameter with this command to reset the value to the default value (600 seconds).

Syntax

```
ipv6 nd ra-interval <seconds>

no ipv6 nd ra-interval
```

Parameter	Description
<seconds>	Specifies the number of seconds between IPv6 Router Advertisements (RAs). Valid values are from 4 to 1800 seconds.

Default 600 seconds.

Mode Interface Configuration for a VLAN interface.

Usage Advertisement flags will not be transmitted unless you have applied the no ipv6 nd suppress-ra command on page 27.20 as shown in the example below.

Example To set the advertisements interval on `vlan4` to be 60 seconds, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ipv6 nd ra-interval 60
awplus(config-if)# no ipv6 nd suppress-ra
```

Related Commands

ipv6 nd minimum-ra-interval
ipv6 nd suppress-ra
ipv6 nd prefix

ipv6 nd ra-lifetime

Use this command to specify the time period that this router can usefully act as a default gateway for the network. Each router advertisement resets this time period.

Use no parameter with this command to reset the value to default.

Syntax

```
ipv6 nd ra-lifetime <seconds>
no ipv6 nd ra-lifetime
```

Parameter	Description
<seconds>	Time period in seconds. Valid values are from 0 to 9000. Note that you should set this time period to a value greater than the value you have set using the ipv6 nd ra-interval command.

Default 1800 seconds

Mode Interface Configuration for a VLAN interface.

Usage This command specifies the lifetime of the current router to be announced in IPv6 Router Advertisements.

Advertisement flags will not be transmitted unless you have applied the no ipv6 nd suppress-ra command. This instruction is included in the example shown below.

Example To set the advertisement lifetime of 8000 seconds on `vlan4`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ipv6 nd ra-lifetime 8000
awplus(config-if)# no ipv6 nd suppress-ra
```

Related Commands

ipv6 nd suppress-ra
ipv6 nd prefix

ipv6 nd raguard

Use this command to apply the Router Advertisements (RA) Guard feature from the Interface Configuration mode for a switch port. This blocks all RA messages received on a switch port. For introductory information about RA Guard see "RA Guard Introduction" on page 26.12. Use the no parameter with this command to disable RA Guard for a specified switch port.

Syntax

```
ipv6 nd raguard
no ipv6 nd raguard
```

Default RA Guard is not enabled by default.

Mode Interface Configuration for a switch port interface.

Usage Router Advertisements (RAs) are used by Routers to announce themselves on the link. Applying RA Guard to a switch port disallows Router Advertisements and redirect messages. RA Guard blocks RAs from untrusted hosts. Blocking RAs stops untrusted hosts from flooding malicious RAs and stops any misconfigured hosts from disrupting traffic on the local network.

Enabling RA Guard on a port blocks RAs from a connected host and indicates the port and host are untrusted. Disabling RA Guard on a port allows RAs from a connected host and indicates the port and host are trusted. Ports and hosts are trusted by default to allow RAs.

Example To enable RA Guard on switch ports `port1.0.2-1.0.12`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2-1.0.12
awplus(config-if)# ipv6 nd raguard
```

To verify RA Guard is enabled on switch port interface `port1.0.2`, use the command:

```
awplus# show running-config interface port1.0.2
```

Output Example output from a **show running-config interface port1.0.2** to verify RA Guard:

```
!
interface port1.0.2
 switchport mode access
 ipv6 nd raguard
!
```

To disable RA Guard on switch ports `port1.0.2-1.0.12`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2-port1.0.12
awplus(config-if)# no ipv6 nd raguard
```

When RA Guard is disabled on a switch port it is not displayed in show running-config output.

Related Commands show running-config interface

ipv6 nd reachable-time

Use this command to specify the reachable time in the router advertisement to be used for detecting reachability of the IPv6 neighbor.

Use the no variant of this command to reset the value to default.

Syntax

```
ipv6 nd reachable-time <milliseconds>
no ipv6 nd reachable-time
```

Parameter	Description
<milliseconds>	Time period in milliseconds. Valid values are from 1000 to 3600000. Setting this value to 0 indicates an unspecified reachable-time.

Default 0 milliseconds

Mode Interface Configuration for a VLAN interface.

Usage This command specifies the reachable time of the current router to be announced in IPv6 Router Advertisements.

Advertisement flags will not be transmitted unless you have applied the no ipv6 nd suppress-ra command. This instruction is included in the example shown below.

Example To set the reachable-time in router advertisements on `vlan4` to be 1800000 milliseconds, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ipv6 nd reachable-time 1800000
awplus(config-if)# no ipv6 nd suppress-ra
```

To reset the reachable-time in router advertisements on `vlan4` to an unspecified reachable-time (0 milliseconds), enter the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# no ipv6 nd reachable-time
```

Related Commands ipv6 nd suppress-ra
ipv6 nd prefix

ipv6 nd retransmission-time

Use this command to specify the advertised retransmission interval for Neighbor Solicitation in milliseconds between IPv6 Routers.

Use the no variant of this command to reset the retransmission time to the default (1 second).

Syntax

```
ipv6 nd retransmission-time <milliseconds>
no ipv6 nd retransmission-time [<milliseconds>]
```

Parameter	Description
<milliseconds>	Time period in milliseconds. Valid values are from 1000 to 3600000.

Default 1000 milliseconds (1 second)

Mode Interface Configuration for a VLAN interface.

Example To set the retransmission-time of Neighbor Solicitation on `vlan2` to be 800000 milliseconds, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 nd retransmission-time 800000
```

To reset the retransmission-time of Neighbor Solicitation on `vlan2` to the default 1000 milliseconds (1 second), enter the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ipv6 nd retransmission-time
```

Related Commands ipv6 nd suppress-ra
ipv6 nd prefix

ipv6 nd suppress-ra

Use this command to inhibit IPv6 Router Advertisement (RA) transmission for the current interface. Router advertisements are used when applying IPv6 stateless auto-configuration.

Use no parameter with this command to enable Router Advertisement transmission.

Syntax

```
ipv6 nd suppress-ra
no ipv6 nd suppress-ra
```

Default Router Advertisement (RA) transmission is suppressed by default.

Mode Interface Configuration for a VLAN interface.

Example To enable the transmission of router advertisements from interface `vlan4` on the switch, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# no ipv6 nd suppress-ra
```

Related Commands

ipv6 nd ra-interval
ipv6 nd prefix

ipv6 neighbor

Use this command to add a static IPv6 neighbor entry.

Use the no variant of this command to remove a specific IPv6 neighbor entry.

Syntax

```
ipv6 neighbor <ipv6-address> <vlan-name> <mac-address> <port-list>
no ipv6 neighbor <ipv6-address> <vlan-name> <port-list>
```

Parameter	Description
<ipv6-address>	Specify the neighbor's IPv6 address in format `X:X::X:X`.
<vlan-name>	Specify the neighbor's VLAN name.
<mac-address>	Specify the MAC hardware address in hexadecimal notation with the format `HHHH.HHHH.HHHH`.
<port-list>	Specify the port number, or port range.

Mode Global Configuration

Usage Use this command to clear a specific IPv6 neighbor entry. To clear all dynamic address entries, use the clear ipv6 neighbors command.

Example To create a static neighbor entry for IPv6 address `2001:0db8::a2`, on `vlan 4`, MAC address `0000.cd28.0880`, on `port1.0.19`, use the command:

```
awplus# configure terminal
awplus(config)# ipv6 neighbor 2001:0db8::a2 vlan4
0000.cd28.0880 port1.0.19
```

Related Commands clear ipv6 neighbors

ipv6 opportunistic-nd

Use this command to enable opportunistic neighbor discovery for the global IPv6 ARP cache. Opportunistic neighbor discovery changes the behavior for unsolicited ARP packet forwarding on the switch.

Use the no variant of this command to disable opportunistic neighbor discovery for the global IPv6 ARP cache.

Syntax

```
ipv6 opportunistic-nd
no ipv6 opportunistic-nd
```

Default Opportunistic neighbor discovery is disabled by default.

Mode Global Configuration

Usage When opportunistic neighbor discovery is enabled, the switch will reply to any received unsolicited ARP packets (but not gratuitous ARP packets). The source MAC address for the unsolicited ARP packet is added to the IPv6 ARP cache, so the switch forwards the ARP packet. When opportunistic neighbor discovery is disabled, the source MAC address for the ARP packet is not added to the IPv6 ARP cache, so the ARP packet is not forwarded by the switch.

Use the arp opportunistic-nd command to enable optimistic neighbor discovery in Global Configuration mode for all interfaces on the switch configured for IPv4. Use a show arp command to confirm opportunistic neighbor discovery is configured on the switch.

Example To enable opportunistic neighbor discovery for the IPv6 ARP cache, enter:

```
awplus# configure terminal
awplus(config)# ipv6 opportunistic-nd
```

To disable opportunistic neighbor discovery for the IPv6 ARP cache, enter:

```
awplus# configure terminal
awplus(config)# no ipv6 opportunistic-nd
```

Related Commands arp opportunistic-nd

Validation Commands show arp

ipv6 route

Use this command to establish the distance for static routes of a network prefix.

Use the no variant of this command to disable the distance for static routes of the network prefix.

Syntax

```
ipv6 route <dest-prefix> <dest-prefix/length>
   {<gateway-ip>|<gateway-name>} [<distvalue>]

no ipv6 route <dest-prefix> <dest-prefix/length>
   {<gateway-ip>|<gateway-name>} [<distvalue>]
```

Parameter	Description
<dest-prefix/length>	Specifies the IP destination prefix. The IPv6 address prefix uses the format X:X::/prefix-length. The prefix-length is usually set between 0 and 64, or has the value 128.
<gateway-ip>	Specifies the IP gateway (or next hop) address. The IPv6 address uses the format X:X::X:X/Prefix-Length. The prefix-length is usually set between 0 and 64, or has the value 128.
<distvalue>	Specifies the administrative distance for the route. Valid values are from 1 to 255.
<gateway-name>	Specifies the name of the gateway (or next hop) interface.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# ipv6 route 2001:0db8::1/128 myintname 32
```

Validation Commands show running-config
show ipv6 route

ping ipv6

This command sends a query to another IPv6 host (send Echo Request messages).

Syntax

```
ping ipv6 [<host>|<ipv6-address>] [repeat {<1-2147483647>|
   continuous}] [size <10-1452>] [interface <interface-list>]
   [timeout <1-65535>]
```

Parameter	Description
<ipv6-addr>	The destination IPv6 address. The IPv6 address uses the format X:X::X:X.
<hostname>	The destination hostname.
repeat	Specify the number of ping packets to send.
<1-2147483647>	Specify repeat count. The default is 5.
size *<10-1452>*	The number of data bytes to send, excluding the 8 byte ICMP header. The default is 56 (64 ICMP data bytes).
interface *<interface-list>*	The interface or range of configured IP interfaces to use as the source in the IP header of the ping packet.
timeout *<1-65535>*	The time in seconds to wait for echo replies if the ARP entry is present, before reporting that no reply was received. If no ARP entry is present, it does not wait.
repeat	Specify the number of ping packets to send.
<1-2147483647>	Specify repeat count. The default is 5.
continuous	Continuous ping.
size *<10-1452>*	The number of data bytes to send, excluding the 8 byte ICMP header. The default is 56 (64 ICMP data bytes).
timeout *<1-65535>*	The time in seconds to wait for echo replies if the ARP entry is present, before reporting that no reply was received. If no ARP entry is present, it does not wait.

Mode User Exec and Privileged Exec

Example

```
awplus# ping ipv6 2001:0db8::a2
```

Related Commands traceroute ipv6

show ipv6 forwarding

Use this command to display IPv6 forwarding status.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 forwarding`

Mode User Exec and Privileged Exec

Example

```
awplus# show ipv6 forwarding
```

Output Figure 27-1: Example output from the **show ipv6 forwarding** command

```
ipv6 forwarding is on
```

show ipv6 interface brief

Use this command to display brief information about interfaces and the IPv6 address assigned to them, and optionally Neighbor Discovery configurations for a configured interface.

To display information about a specific interface, specify the interface name with the command.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 interface [brief|<interface> [nd]]`

Parameter	Description
`brief`	Specify this optional parameter to display brief IPv6 interface information.
`<interface>`	Specify the configured interface to display IPv6 information about. For instance `vlan2`. The specified interface must exist and be configured.
`nd`	Specify this optional parameter for Neighbor Discovery configurations.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ipv6 interface brief
awplus# show ipv6 interface brief vlan1 nd
```

Output Figure 27-2: Example output from the **show ipv6 interface brief** command

```
Interface       IPv6-Address                                Status      Protocol
lo              unassigned                                  admin up    running
vlan1           unassigned                                  admin up    running
vlan10          2001:db8:a:0:0:c0a8:a0b/64                  admin up    running
                2001:db8::200:cdff:fe28:84a/64
vlan20          2001:db8::14:0:0:c0a8:140b/64               admin up    running
                2001:db8::200:cdff:fe28:84a/64
vlan30          2001:db8::1e:0:0:c0a8:1e0b/64               admin up    running
                2001:db8::200:cdff:fe28:84a/64
vlan40          2001:db8::28:0:0:c0a8:280b/64               admin up    running
                2001:db8::200:cdff:fe28:84a/64
vlan201         unassigned                                  admin up    running
vlan250         2001:db8::fa:0:0:c0a8:fa0b/64               admin up    running
                2001:db8::200:cdff:fe28:84a/64
```

Related Commands show interface brief

show ipv6 neighbors

Use this command to display all IPv6 neighbors.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 neighbors`

Mode User Exec and Privileged Exec

show ipv6 route

Use this command to display the IPv6 routing table for a protocol or from a particular table.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ipv6 route
    [connected|database|ospf|rip|static|summary|
    <ipv6-address>|<ipv6-addr/prefix-length>)]
```

Parameter	Description
`connected`	Displays only the routes learned from connected interfaces.
`database`	Displays only the IPv6 routing information extracted from the database.
`ospf`	Displays only the routes learned from IPv6 Open Shortest Path First (OSPFv3).
`rip`	Displays only the routes learned from IPv6 Routing Information Protocol (RIPng).
`static`	Displays only the IPv6 static routes you have configured.
`summary`	Displays summary information from the IPv6 routing table.
`<ipv6-address>`	Displays the routes for the specified address in the IP routing table. The IPv6 address uses the format X:X::X:X/ Prefix-Length. The prefix-length is usually set between 0 and 64, or has the value 128.
`<ipv6-prefix/length>`	Displays only the routes for the specified IP prefix. The IPv6 address prefix uses the format X:X::/prefix-length. The prefix-length is usually set between 0 and 64, or has the value 128.

Mode User Exec and Privileged Exec

Example 1

```
awplus# show ipv6 route
```

Output Figure 27-3: Example output of the **show ipv6 route** command

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, O - OSPF, B - BGP
S   ::/0 [1/0] via 2001::a:0:0:c0a8:a6, vlan10
C   2001:db8::a:0:0:0:0/64 via ::, vlan10
C   2001:db8::14:0:0:0:0/64 via ::, vlan20
C   2001:db8::0:0:0:0/64 via ::, vlan30
C   2001:db8::28:0:0:0:0/64 via ::, vlan40
C   2001:db8::fa:0:0:0:0/64 via ::, vlan250
C   2001:db8::/64 via ::, vlan250
C   2001:db8::/64 via ::, vlan40
C   2001:db8::/64 via ::, vlan20
C   2001:db8::/64 via ::, vlan10
```

Example 2

```
awplus# show ipv6 route database
```

Output Figure 27-4: Example output of the **show ipv6 route database** command

```
IPv6 Routing Table
Codes: C - connected, S - static, R - RIP, O - OSPF, B - BGP
       > - selected route, * - FIB route, p - stale info
Timers: Uptime

S   ::/0 [1/0] via 2001::a:0:0:c0a8:a01 inactive, 6d22h12m
         [1/0] via 2001::fa:0:0:c0a8:fa01 inactive, 6d22h12m
```

show ipv6 route summary

Use this command to display the summary of the current NSM RIB entries.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ipv6 route summary
```

Mode

User Exec and Privileged Exec

Example

```
awplus# show ipv6 route summary
```

Output

Figure 27-5: Example output from the **show ipv6 route summary** command

```
IPv6 routing table name is Default-IPv6-Routing-Table(0)
IPv6 routing table maximum-paths is 4
RouteSource     Networks
connected       4
ospf            5
Total           9
FIB             5
```

Related Commands

show ip route
show ip route database

traceroute ipv6

Use this command to trace the route to the specified IPv6 host.

Syntax `traceroute ipv6 {<ipv6-addr>|<hostname>}`

Parameter	Description
<ipv6-addr>	The destination IPv6 address. The IPv6 address uses the format X:X::X:X.
<hostname>	The destination hostname.

Mode User Exec and Privileged Exec

Example

```
awplus# traceroute ipv6 2001:0db8::a2
```

Related Commands ping ipv6

Chapter 28: IPv6to4 Tunneling Configuration

Introduction 28.2
6to4 Automatic Tunnel Configuration 28.2
Tunneling Operation 28.2
6to4 tunnels operation and configuration summary 28.3
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Introduction

This chapter contains a basic IPv6to4 automatic tunneling configuration example for reference.

To see details on the Tunneling commands used in this sample configuration, or to see the outputs of the Validation commands, refer to Chapter 29, IPv6to4 Tunneling Commands. Links to the Tunneling commands used in the examples are also provided below the examples.

6to4 Automatic Tunnel Configuration

IPv6 transition is required to migrate from IPv4 to IPv6. One method to connect to the global IPv6 network over the existing IPv4 network is called 6to4 automatic tunneling.

Although this method is called '6to4 tunneling', it does not involve discrete point-to-point tunnels. The 'tunneling' in '6to4 tunneling' refers to the fact that the IPv6 packets are encapsulated in IPv4 packets to be 'tunneled' across the IPv4 domain. Hence, '6to4 tunneling' is primarily a scheme for encapsulating IPv6 packets inside IPv4 headers.

Using 6to4 tunneling, you are not required to specify tunnel destination addresses. You only choose the interface that connects the switch to the IPv4 domain, and designate that interface to be the tunnel entry-point. As will be explained below, the IPv4 address that represents the point at which any given IPv6 packet will eventually exit the IPv4 domain is derived from the IPv6 packet itself. Note that the packet's destination IPv6 address itself contains the destination IPv4 address that is used for tunnel encapsulation.

The 6to4 tunneling implementation in AlliedWare Plus™ is used for routing only between IPv6 addresses that are of the form:

`2002: <valid-IPv4-unicast-address> : XX:XX:XX:XX:XX`

6to4 tunneling makes use of the fact that for every valid IPv4 unicast address `A.B.C.D`, there is always a corresponding valid IPv6 subnet `2002:<A.B.C.D>::/48`. So, for every global IP v4 address that has been allocated to an organization, there is immediately a global IPv6 subnet `2002:<ipv4-address>::/48` available to that organization.

Tunneling Operation

When an IPv4 interface on the switch is designated as a tunnel entry point, using the tunnel source command on page 29.5 command, an IPv6 tunnel interface is created. The interface is automatically allocated the IPv6 address: `2002:<ipv4-address>::1/128`.

Note

Other implementations of 6to4 tunneling might have a different scheme for deriving the IPv6 address of the tunnel interface, as there is no standardized scheme. This does not cause any interoperability problems, however, as the IPv6 address of the tunnel interface is not actually involved in the routing process.

This tunnel interface is the gateway used by the IPv6 packets to enter the IPv4 domain. As IPv6 packets enter the IPv4 domain, the switch must encapsulate them by pre-pending IPv6 packets with an IPv4 header. The source address of the encapsulating header is the IPv4 address that has been specified by the tunnel source command. The process for determining the destination IP address is explained in more detail below.

The key to routing across the IPv4 domain is that there is a connection between the IPv4 address of a tunnel endpoint and the IPv6 subnets which can be reached via that endpoint. The connection is that the tunnel interface with IP address `<ipv4-address>` is considered to be the gateway to all IPv6 subnets within the range `2002:<ipv4-address>::/48`.

When a switch is required to deliver packets, via a tunnel interface, to IPv6 addresses in the range `2002:<ipv4-address>::/48`, the switch knows that the IPv4 address to which the switch must deliver that packet is given by the 17th through 48th bits of the IPv6 destination address. So, the encapsulation process extracts those bits from the IPv6 destination address, and uses them as the IPv4 destination address in the encapsulating header.

For example, if `192.0.2.1` is the IPv4 address of a tunnel endpoint, then the IPv6 subnets in the range `2002:c000:201::/48` are automatically known to be reachable via that tunnel endpoint. If another tunnel endpoint has an IPv6 packet to deliver to `2002:c000:201:6::04:8d`, via the tunnel, then that switch will encapsulate the packet in an IPv4 header with a destination address of `192.0.2.1`

The corollary to this is the requirement that, to be reachable from other 6to4 networks, the IPv6 VLAN interfaces on the IPv6 side a tunneling switch will need to be configured with IPv6 addresses that are subnetted from the `2002:<ipv4-address>::/48` address.

For example, `2002:<ipv4-address>:1::/64, 2002:<ipv4-address>:2::/64, 2002:<ipv4-address>:3::/64`, etc.

Note `2002:<ipv4-address>::/64` cannot be used here, because it conflicts with the automatically configured tunnel address.

6to4 tunnels operation and configuration summary

1. When an IPv4 address is designated as the source address of a tunnel, that tunnel interface is automatically given the IPv6 address `2002:<ipv4-address>::1/128`

2. The switch does not automatically create any IPv6 routes via that tunnel interface, so you do need to explicitly create a route to direct traffic over the tunnel interface.
   Typically, you will create a route to `2002::/16` via the tunnel interface. There might be occasions, though, when you want to just create some more restricted routes, within the `2002::/16` range, over the tunnel interface.

3. Once routes have been created that direct traffic over the tunnel interface, it is not necessary to specify nexthop addresses for the individual remote IPv6 subnets that are reachable via the tunnel. The switch will automatically know the IPv4 nexthop via which to reach any IPv6 subnet in the range `2002:<ipv4-address>::/48`.

4. The only IPv6 addresses that can be routed to via the 6to4 tunnels on switches running AlliedWare Plus™ are IPv6 addresses of the form:

   `2002:<valid-IPv4-unicast-address>:xx:xx:xx:xx:xx`

Example 6to4 configuration

The following example shows the minimum configuration required for 6to4 automatic tunnel configuration. Follow the commands and descriptions in the tables below the sample network:

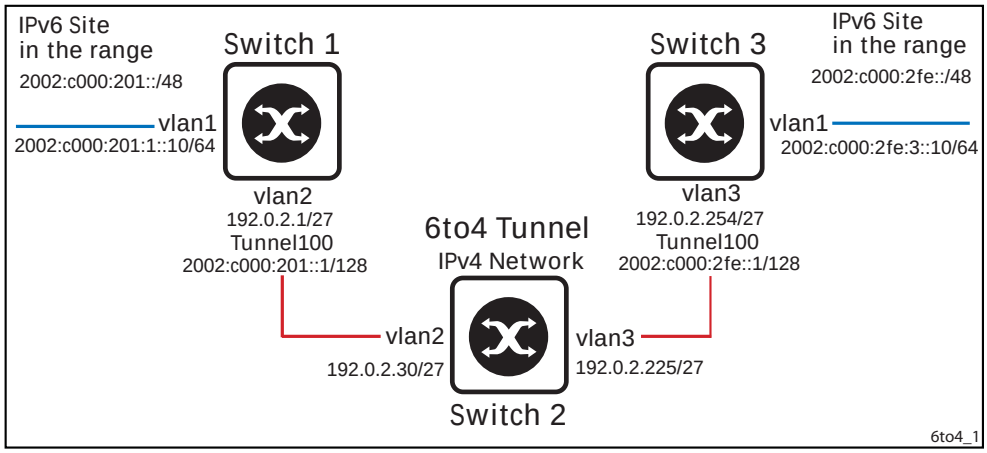

Table 28-1: Example configuration for 6to4 automatic tunneling: Switch 1

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) and enter the Interface Configuration mode.
`awplusa(config-if)#`	
`ip address 192.0.2.1/27`	Set the IPv4 address for the interface (`vlan2`).
`awplus(config-if)#`	
`exit`	Exit Interface Configuration mode and enter Global Configuration mode.
`awplus(config)#`	
`interface vlan1`	Specify the interface (`vlan1`) and enter the Interface Configuration mode.
`awplus(config-if)#`	
`ipv6 address 2002:c000:201:1::10/64`	Set the IPv6 address for the interface (`vlan1`).
`awplus(config-if)#`	
`exit`	Exit Interface Configuration mode and enter Global Configuration mode.
`awplus(config)#`	
`ipv6 forwarding`	Enable IPv6 routing.
`awplus(config)#`	
`interface tunnel 100`	Create a tunnel interface.
`awplus(config-if)#`	
`tunnel mode ipv6ip 6to4`	Set the tunnel mode.

Table 28-1: Example configuration for 6to4 automatic tunneling: Switch 1 (cont.)

`awplus(config-if)#` `tunnel source 192.0.2.1`	Define the IPv4 address to be used as the source address for the tunnel interface.
`awplus(config-if)#` `exit`	Exit Interface Configuration mode and enter Global Configuration mode.
`awplus(config)#` `ipv6 route 2002::/16 tunnel100`	Add a route to send traffic for other 6to4 subnets via the tunnel interface.
`awplus(config)#` `router ospf`	Create an OSPF routing instance.
`awplus(config-router)#` `router-id 10.70.0.57`	Specify a Router ID for the OSPF routing process.
`awplus(config-router)#` `network 192.0.2.0/27 area 0`	Enable OSPF routing with a specified Area ID on interfaces with IP addresses within the specified network address. The Area ID used in this case is `0`, which specifies the backbone area.

Table 28-2: Example configuration for 6to4 automatic tunneling: Switch 2

`awplus#` `configure terminal`	Enter the Global Configuration mode.
`awplus(config)#` `interface vlan2`	Specify the interface (`vlan2`) and enter the Interface Configuration mode.
`awplus(config-if)#` `ip address 192.0.2.30/27`	Set the IPv4 address of the interface (`vlan2`).
`awplus(config-if)#` `exit`	Exit Interface mode and enter the Global Configuration mode.
`awplus(config)#` `interface vlan3`	Specify the interface (`vlan3`) and enter the Interface Configuration mode.
`awplus(config-if)#` `ip address 192.0.2.225/27`	Set the IPv4 address of the interface (`vlan3`).
`awplus(config-if)#` `exit`	Exit the Interface Configuration mode and enter the Global Configuration mode.
`awplus(config)#` `router ospf`	Create an OSPF routing instance.

Table 28-2: Example configuration for 6to4 automatic tunneling: Switch 2 (cont.)

`awplus(config-router)#`	
`router-id 10.70.0.58`	Specify a Router ID for the OSPF routing process.
`awplus(config-router)#`	
`network 192.0.2.0/27 area 0`	Enable OSPF routing with a specified Area ID on interfaces with IP addresses with a specified network address. The Area ID used in this case is `0`, which specifies the backbone area.
`awplus(config-router)#`	
`network 192.0.2.224/27 area 0`	Enable OSPF routing with a specified Area ID on interfaces with IP addresses within the specified network address. The Area ID used in this case is `0`, which specifies the backbone area.

Table 28-3: Example configuration for 6to4 automatic tunneling: Switch 3

`awplus(config)#`	
`interface vlan3`	Specify interface (`vlan3`) and enter the Interface Configuration mode.
`awplus(config-if)#`	
`ip address 192.0.2.254/27`	Set the IPv4 address for the interface (`vlan3`).
`awplus(config-if)#`	
`exit`	Exit the Interface Configuration mode and enter the Global Configuration mode.
`awplus(config)#`	
`interface vlan1`	Specify the interface (`vlan1`) and enter the Interface Configuration mode.
`awplus(config-if)#`	
`ipv6 address 2002:c000:2fe:3::10/64`	Set the IPv6 address for the interface (`vlan1`).
`awplus(config-if)#`	
`exit`	Exit Interface mode and enter Global Configuration mode.
`awplus(config)#`	
`ipv6 forwarding`	Enable IPv6 routing.
`awplus(config)#`	
`interface tunnel 100`	Create a tunnel interface.
`awplus(config-if)#`	
`tunnel mode ipv6ip 6to4`	Set the tunnel mode.
`awplus(config-if)#`	
`tunnel source 192.0.2.254`	Define the IPv4 address to be used as the source address for the tunnel interface.

Table 28-3: Example configuration for 6to4 automatic tunneling: Switch 3 (cont.)

`awplus(config-if)#`	
`exit`	Exit Interface Configuration mode and enter Global Configuration mode.
`awplus(config)#`	
`ipv6 route 2002::/16 tunnel100`	Add a route to send traffic for other 6to4 subnets via the tunnel interface.
`awplus(config)#`	
`router ospf`	Create an OSPF routing instance.
`awplus(config-router)#`	
`router-id 10.70.0.76`	Specify a Router ID for the OSPF routing process.
`awplus(config-router)#`	
`network 192.0.2.224/27 area 0`	Enable OSPF routing with a specified Area ID on interfaces with IP addresses within the specified network address. The Area ID used in this case is 0, which specifies the backbone area.

Note

The IPv6 address which is automatically assigned to the tunnel interface in this example for Switch 1 is 2002:<IPv4 address in hex>::1/128, where <IPv4 address in hex> represents the IPv4 address of the tunnel source, converted to hexadecimal.

So, the tunnel interface is the gateway from the IPv4 network to the IPv6 subnet 2002:<IPv4 address in hex>::/48

Hence, the IPv6 address configured on vlan1 must be in the subnet 2002:<IPv4 address in hex>::/48. However, if the address on vlan1 is given a /64 prefix-length it must differ from the tunnel address somewhere in the 49-64th bits.

For example, in this scenario: vlan2 IP address (which the tunnel will go over): 192.0.2.1 = c0000201 hex (shown as c000:201without leading zeros in the example). Tunnel 100 IPv6 address will automatically use 2002:c000:0201:0000::1/128 as its IPv6 address.

So, configure the following address on vlan1: 2002:c000:0201:<xxxx>::x/6 where <xxxx> is anything other than 0000 e.g. 2002:c000:0201:1::10/64

Names of Commands Used

interface tunnel
ip address
ipv6 address
network area
router-id
tunnel mode ipv6ip
tunnel source

Chapter 29: IPv6to4 Tunneling Commands

Command List 29.2
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tunnel dscp (6to4) 29.3
tunnel mode ipv6ip 29.4
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tunnel ttl 29.6

Command List

This chapter provides an alphabetical reference of commands used to configure automatic IPv6 tunneling over IPv4. For more information, see Chapter 28, IPv6to4 Tunneling Configuration.

interface tunnel

Use this command to create a new tunnel interface, which is identified by an integer (1-145).

This command is also used to enter interface configuration mode for existing tunnel interfaces.

Use the no variant of this command to destroy a previously created tunnel interface.

Syntax

```
interface tunnel <1-145>
no interface tunnel <1-145>
```

Default Disabled

Mode Global Configuration

Usage This command creates a new tunnel interface to configure in Interface mode.

Examples

```
awplus# configure terminal
awplus(config)# interface tunnel 100
awplus(config-if)#

awplus# configure terminal
awplus(config)# no interface tunnel 100
awplus(config)#
```

Related Commands tunnel dscp (6to4)
tunnel source

tunnel dscp (6to4)

Use this command to configure the value (0-63) to use for the IPv4 DSCP (Differentiated Services Code Point) field in the IPv4 header that encapsulates the tunneled IPv6 packets. By default the IPv4 DSCP field value is 0.

Use the no variant of this command to reset the IPv4 DSCP field to the default (0).

Syntax

```
tunnel dscp <0-63>
no tunnel dscp
```

Default The default IPv4 DSCP field value is 0.

Mode Interface Configuration for 6to4 tunnel interfaces.

Usage This command controls the IPv4 DSCP field in the IPv4 headers that are prepended (or prefixed) to the tunneled IPv6 packets.

Examples

```
awplus# configure terminal
awplus(config)# interface tunnel 100
awplus(config-if)# tunnel source 192.0.2.1
awplus(config-if)# tunnel dscp 10

awplus# configure terminal
awplus(config)# interface tunnel 100
awplus(config-if)# tunnel source 192.0.2.1
awplus(config-if)# no tunnel dscp
```

Related Commands

interface tunnel
tunnel mode ipv6ip
tunnel source

tunnel mode ipv6ip

Use this command to specify the IPv6 transition tunnel mode. In AlliedWare Plus™ 6to4 automatic tunneling is the only tunnel mode supported.

Use the no variant of this command to return the mode of the IPv6 transition tunnel to an undefined state.

Syntax

```
tunnel mode ipv6ip 6to4
no tunnel mode
```

Parameter	Description
6to4	6to4 automatic tunnel mode.

Mode Interface Configuration for 6to4 tunnel interfaces.

Usage This command specifies a tunnel encapsulation mode for IPv6 in IPv4. Currently only 6to4 automatic tunneling is supported. Future releases may support alternative tunneling modes.

It is a requirement that the mode is set on a tunnel. The tunnel will not be operational until the tunnel mode has been set using the tunnel mode ipv6ip 6to4 command.

Example

```
awplus# configure terminal
awplus(config)# interface tunnel 100
awplus(config-if)# tunnel source 192.0.2.1
awplus(config-if)# tunnel mode ipv6ip

awplus# configure terminal
awplus(config)# interface tunnel 100
awplus(config-if)# tunnel source 192.0.2.1
awplus(config-if)# no tunnel mode
```

Related Commands

interface tunnel
tunnel dscp (6to4)
tunnel source

tunnel source

Use this command to specify the IPv4 source address for packets being encapsulated in the tunnel. It should be the IPv4 address on the interface that attaches the switch for the IPv4 domain through which the IPv6 packets are to be tunneled.

Use the no variant of this command to remove a tunnel source address for a tunnel interface.

Syntax

```
tunnel source <ipv4-addr>
no tunnel source
```

Parameter	Description
<ipv4-addr>	IPv4 tunnel source address.

Mode Interface Configuration for 6to4 tunnel interfaces.

Usage This command specifies an IPv4 source address for the tunnel.

Note There are constraints on the IPv4 source address specified for the tunnel. The IPv4 source address for the tunnel must be the IPv4 address of an interface on the switch, and it must be the interface for carrying the tunnel traffic.

Example

```
awplus# configure terminal
awplus(config)# interface tunnel 100
awplus(config-if)# tunnel source 192.0.2.1

awplus# configure terminal
awplus(config)# interface tunnel 100
awplus(config-if)# no tunnel source
```

Related Commands interface tunnel
tunnel dscp (6to4)

tunnel ttl

Use this command to configure the value to use for the Time to Live (TTL) field in the IPv4 header that encapsulates the tunneled IPv6 packets.

Use the no variant of this command to inherit the TTL value from the encapsulated packet.

Syntax

```
tunnel ttl <1-255>
no tunnel ttl
```

Default By default the TTL value is inherited from the encapsulated packet.

Mode Interface Configuration for 6to4 tunnel interfaces.

Usage This command specifies a value of Time to Live (TTL) in the tunnel IPv4 encapsulation header.

Example

```
awplus# configure terminal
awplus(config)# interface tunnel 100
awplus(config-if)# tunnel source 192.0.2.1
awplus(config-if)# tunnel ttl 255

awplus# configure terminal
awplus(config)# interface tunnel 100
awplus(config-if)# tunnel source 192.0.2.1
awplus(config-if)# no tunnel ttl
```

Related Commands interface tunnel
tunnel dscp (6to4)

Chapter 30: Routing Protocol Overview

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RIP 30.2
OSPF 30.2
BGP 30.3
PIM-SM 30.4
VRRP 30.4

Introduction

This chapter introduces the basic routing protocols supported within the AlliedWare Plus™ Operating System.

RIP

A distance-vector protocol, Routing Information Protocol (RIP) is an Interior Gateway Protocol (IGP) that uses hop counts as its metrics. The AlliedWare Plus™ RIP module supports RFCs 1058 and 1723; the RIPv2 module supports more fields in the RIP packets, and supports security authentication features.

At regular intervals of the routing update timer (a default value of 30 seconds), and at the time of change in the topology, the RIP router sends update messages to other routers. The listening routers update their route table with the new route, and increase the metric value of the path by one (referred to as a hop count). The router recognizes the IP address advertising router as the next hop, then sends the routing updates to other routers. A maximum allowable hop count is 15. If a router reaches a metric value of 16 or more (referred to as infinity), the destination is identified as unreachable. This avoids the indefinite routing loops. The split-horizon and hold-down features are used to avoid propagation incorrect routing information. The route becomes not valid when the route time-out timer expires; it remains in the table until the route-flush timer expires.

OSPF

A link-state routing protocol, Open Shortest Path First (OSPF) is an interior gateway protocol (IGP) that uses the Shortest Path First (SPF) Dijsktra algorithm.

OSPF sends link-state advertisements (LSAs) to all other routers within the same hierarchical area. Data on attached interfaces, metrics used, and other variables, are included in OSPF LSAs. As OSPF routers accumulate link-state data, they use the SPF algorithm to calculate the shortest path to each node.

An Autonomous System (AS) or Domain is defined as a group of networks with common routing infrastructure. OSPF can work in one AS; or receive or send routes from or to different AS systems. Autonomous systems consist of areas. An area is a group of neighboring networks or attached hosts. A router attached to multiple areas with its interfaces is called an Area Border Router (ABR). It creates a distinct topological database: a group of LSAs received from all routers in the same area, for each area. All the routers in the same area have an identical topological database. OSPF routing traffic is restricted in the area because areas are unknown to each other. The routing information is distributed between areas, area border routers, networks, and connected routers by the OSPF backbone.

All backbone OSPF area routers use the same procedures and algorithms to maintain routing information within the backbone that any area router would. The backbone topology is invisible to all routers within an area. The individual area topologies are invisible to the backbone. Sometimes the backbone is not a contiguous area. Virtual links function as if they were direct links, and are configured between backbone routers that share a link to a non-backbone area.

AS border routers running OSPF learn about exterior routes through exterior gateway protocols (EGPs) such as the Border Gateway Protocol (BGP).

During boot-up, an OSPF router initializes its routing-protocol-specific data structures and tables. When the lower layer protocols with which it interfaces are functional, it sends the OSPF Hello protocol packets to find neighboring routers. A router sends Hello packets as keep-alive packets, informing other routers about its continuing functionality. Two routers are adjacent when their link state databases are synchronized.

Multi-access networks have more than two routers. On multi-access networks, the hello protocol chooses a designated router and a designated backup-router. The designated router generates LSAs for the entire multi-access network, and reduces network traffic and the size of the topological database. The designated router also determines the adjacency of routers and the synchronization of their topological databases. The data on a router's adjacencies or state changes are provided by periodic transmission of an LSA. Failed routers are detected, and topology is changed quickly by comparison of adjacencies to link states. Each router calculates a shortest path tree, with itself as a root, from the topological database generated from these LSAs. This shortest path tree creates a routing table.

BGP

Border Gateway Protocol (BGP) is an exterior gateway protocol (EGP) that determines the best path in networks, performs optimal routing between multiple autonomous systems or domains, and exchanges routing information with other BGP systems. The RFCs 1771 (BGP4), 1654 (first BGP4 specification), and 1105, 1163, 1267 (older version of BGP) describe BGP and BGP4.

Multiple-peer BGP routers in different autonomous systems, or administrative domains on the same physical network, support consistent internetwork topology using inter-autonomous system routing. Multiple-peer BGP routers within the same AS support consistent system topology using inter-autonomous system routing. BGP determines the router to serve as the connection point for specific external autonomous system routing services. Multiple-peer BGP routers transport traffic across an autonomous system that does not run BGP using pass-through autonomous-systems routing. In this case, if the traffic does not originate, or is destined for an autonomous system under consideration, the AS is used only to transport (pass-through) the traffic using another intra-autonomous system routing protocol.

BGP exchanges information about the list of autonomous system paths with other BGP systems. A connectivity mapping between autonomous systems is created, routing loops are pruned, and other autonomous systems-level policy decisions are taken. Each BGP router maintains a routing table of all feasible and optimal paths to other networks and incrementally updates the routing information received from other peer BGP routers.

The BGP routing metric describes the preference of the path, and is assigned to each link by the network administrator. The network administrator assigns this value to a link depending on path criteria such as:

- the number of autonomous systems through which the path passes
- the history of stability
- the line speed
- any delays
- cost per packet

PIM-SM

The AlliedWare Plus™ Protocol Independent Multicast–Sparse Mode (PIM-SM) module is a multicast routing protocol module that uses the underlying unicast Routing Information Base (RIB) to determine the best next-hop neighbor to reach the root of the multicast data distribution tree, the Rendezvous Point (RP), or the source. It builds unidirectional-shared trees per group, and optionally creates shortest-path trees per source.

VRRP

Mission-critical applications running on fault-tolerant networking equipment, such as routers and switches, require redundancy and high availability. This section provides an architectural overview of Virtual Router Redundancy Protocol (VRRP) implementation in the AlliedWare Plus™ OS.

Typically, end hosts are connected to the enterprise network through a single router (first-hop router) that is in the same Local Area Network (LAN) segment. The most popular method of configuration is for the end hosts to statically configure this router as their default gateway. This minimizes configuration and processing overhead. The main problem with this configuration method is that it produces a single point of failure if the enterprise network's first-hop router fails.

VRRP attempts to solve this problem by introducing the concept of a virtual router, composed of two or more VRRP routers on the same subnet. The concept of a virtual IP address is also introduced, which is the address that end hosts configure as their default gateway. Only one of the routers (called the Master) forwards packets on behalf of this IP address. In the event that the Master fails, one of the other routers (Backups) assumes forwarding responsibility for it.

Chapter 31: Route Selection

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Types of Routes 31.2
- Interface Routes 31.2
- Static Routes 31.2
- Dynamic Routes 31.3

RIB and FIB Routing Tables 31.4
- Administrative Distance 31.5
- Equal Cost Multipath Routing 31.7
- How AlliedWare Plus Deletes Routes 31.7
- How AlliedWare Plus Adds Routes 31.8

Introduction

This chapter describes the route selection process used by the AlliedWare Plus™ Operating System. Understanding the route selection process helps in analyzing and troubleshooting route-related problems.

The process of routing packets consists of selectively forwarding data packets from one network to another. Your device must determine which network to send each packet to, and over which interface to send the packet in order to reach the desired network. This information is contained in your device routes. For each packet, your device chooses the best route it has for that packet and uses that route to forward the packet. In addition, you can define filters to restrict the way packets are sent.

Types of Routes

Your device learns routes from static information entered as part of the configuration process and by listening to any configured routing protocols. The following types of routes are available on your device:

Interface Routes

Your device creates an interface route when you create the interface. This route tells your device to send packets over that interface when the packets are addressed to the interface's subnet.

Static Routes

You can manually enter routes, which are then called static routes. You can use static routes to:

- specify the default route (to 0.0.0.0). If your device does not have a route to the packet's destination, it sends it out the default route. The default route normally points to an external network such as the Internet.
- set up multiple networks or subnets. In this case you define multiple routes for a particular interface, usually a LAN port. This is a method of supporting multiple subnets on a single physical media.

To create a static route, use the command:

```
awplus(config)# ip route [vrf <vrf-name>] <subnet&mask>
                [<gateway-ip>] [<interface>] [<distance>]
```

Dynamic Routes

Your device learns dynamic routes from one or more routing protocols such as RIP, BGP, or OSPF. The routing protocol updates these routes as the network topology changes.

In all but the most simple networks, we recommend that you configure at least one dynamic routing protocol. Routing protocols enables your device to learn routes from other routers and switches on the network, and to respond automatically to changes in network topology.

Routing protocols use different metrics to calculate the best path for a destination. However, when two paths have an equal cost/metric and Equal Cost Multipath (ECMP) is enabled on a system, AlliedWare Plus™ may receive two paths from the same protocol.

- Routing Information Protocol (RIP)

  Routing Information Protocol (RIP) is a simple distance vector IPv4 routing protocol. It determines the number of hops between the destination and your device, where one hop is one link. Given a choice of routes, RIP uses the route that takes the lowest number of hops. If multiple routes have the same hop count, RIP chooses the first route it finds.

  See Chapter 33, RIP Configuration for further information about RIP Configuration.

- Routing Information Protocol next generation (RIPng)

  Routing Information Protocol next generation (RIPng) is a simple distance vector IPv6 routing protocol. It determines the number of hops between the destination and your device, where one hop is one link. Given a choice of routes, RIPng uses the route that takes the lowest number of hops. If multiple routes have the same hop count, RIPng chooses the first route it finds.

  RIPng (Routing Information Protocol next generation) is an extension of RIPv2 to support IPv6. RFC 2080 specifies RIPng. The differences between RIPv2 and RIPng are:

  « RIPng does not support RIP updates authentication

  « RIPng does not allow the attachment of arbitrary tags to routes

  « RIPng requires the encoding of the next-hop for a set of routes

  See Chapter 35, RIPng Configuration for further information about RIPng Configuration.

- Open Shortest Path First (OSPF)

  The Open Shortest Path First (OSPF) protocol is documented in RFC 1247. It has a number of significant benefits over RIP, including:

  « OSPF supports the concept of areas to allow networks to be administratively partitioned as they grow in size.

  « Load balancing, in which multiple routes exist to a destination, is also supported. OSPF distributes traffic over these links.

  See Chapter 37, OSPF Introduction and Configuration for further information about OSPF Configuration.

- Border Gateway Protocol (BGP)

  The Border Gateway Protocol (BGP) allows routers in different routing domains to exchange routing information. This facilitates the forwarding of data across the borders of the routing domains. BGP-4 is based on distance vector (DV) protocol algorithms.

  See Chapter 41, BGP Configuration for further information about BGP Configuration.

RIB and FIB Routing Tables

Your device maintains its routing information in routing tables that tell your device how to find a remote network or host. Each route is uniquely identified in a table by its IP address, network mask, next hop, interface, protocol, and policy. There are two routing tables populated by your device: the Routing Information Base (RIB) and the Forwarding Information Base (FIB).

Note Routes in the FIB are used locally but are not advertised to neighbors if they are not also in the RIB.

Routing Information Base

The RIB records all the routes that your device has learnt. Your device uses the RIB to advertise routes to its neighbor devices and to populate the FIB. It adds routes to this table when:

- you add a static route using the ip route command
- one or more routing protocols, such as RIP or OSPF, exchange routing information with other routers or hosts
- your device receives route information from a connected interface
- your device gathers route information from an ICMP redirect message or DHCP message

Forwarding Information Base

The RIB populates the Forwarding Information Base (FIB) with the best route to each destination. When your device receives an IP packet, and no filters are active that would exclude the packet, it uses the FIB to find the most specific route to the destination. If your device does not find a direct route to the destination, and no default route exists, it discards the packet and sends an ICMP message to that effect back to the source.

Adjusting table entries

To view the routes in the RIB, use the command:

```
awplus# show ip route [vrf <vrf-name>|global] database [bgp|
       connected|ospf|rip|static]
```

To view the routes in the FIB, use the command:

```
awplus# show ip route [bgp|connected|ospf|rip|static|<ip-
       addr>|<ip-addr/prefix-length>]
```

Administrative Distance

When multiple routes are available for the same prefix, the AlliedWare Plus™ Operating System adds the routes with the lowest administrative distance to the FIB. The administrative distance is a rank given to a route based on the protocol that the route was received from. The lower the administrative distance, the higher the route preference. For example, if the RIB has these routes

Route	Prefix	Protocol	Distance
1	192.168.0/16	eBGP	20
2	192.168.0/16	OSPF	110
3	192.168.1/24	OSPF	110

then the AlliedWare Plus™ Operating System adds routes 1 and 3 to the FIB. It does not add route 2, as this has a higher administrative distance than a route with the same prefix.

Note Administrative distance indicates a level of trustworthiness of a route where the lower the administrative distance the higher the integrity of a route.

The following table lists the default administrative distances of protocols.

Protocols	Distance	Preference
Connected Routes directly connected to an interface.	-	1 (highest)
Static Routes added using the ip route command or learnt through DHCP options on interfaces using DHCP to obtain an IP address.	1	2
eBGP Routes learnt from BGP that are external to your network.	20	3
OSPF Routes learnt from OSPF.	110	4
RIP Routers learnt from RIP.	120	5
iBGP Routes learnt from BGP that are internal to your network.	200	6 (lowest)
Unknown No traffic will be passed to neighbors via this route.	255	(route is not advertised to neighbors)

You can change the administrative distances for static routes and protocol derived routes. Use the following commands:

For static routes, specify the distance when adding the route, use the command:

```
awplus(config)# ip route [vrf <vrf-name>] <subnet&mask>
                [<gateway-ip>] [<interface>] [<distance>]
```

For eBGP and iBGP routes, enter the Router Configuration mode and use the command to enter a separate administrative distance value for each BGP route type.:

```
awplus(config-router)# distance bgp <ebgp> <ibgp> <local>
```

To set the administrative distance for a specific BGP route, use the command:

```
awplus(config-router)# distance <1-255> <ip-address/m>
                       [<listname>]
```

For OSPF routes, enter the Router Configuration mode and use the command:

```
awplus(config-router)# distance ospf {external <1-255>|
                       inter-area <1-255>|intra-area <1-255>}
```

To enter a separate administrative distance value for each OSPF route type. To set the same value for all OSPF route types, use the command:

```
awplus(config-router)# distance <1-255>
```

For RIP routes, enter the Router Configuration mode, and use the command:

```
awplus(config-router)# distance <1-255> [<ip-addr/prefix-
                       length> [<access-list>]]
```

This sets the administrative distance for all RIP routes.

You cannot set an administrative distance for connected routes.

Note

AlliedWare Plus™ does not populate routes with an administrative distance of 255 in the FIB (Forwarding Information Base). But AlliedWare Plus™ does populate routes with an administrative distance of 255 in the RIB (Routing Information Base).

See the below examples showing the behavior of a static route with an administrative distance of 255, which is only added to the RIB, as seen from the below show output.

Output Figure 31-1: Static route with an administrative distance of 255 that is added to the RIB

```
awplus(config)#ip route 100.0.0.0/24 192.168.1.100 255
awplus(config)#end
awplus#show ip route database

Codes: C - connected, S - static, R - RIP, B - BGP
       O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       > - selected route, * - FIB route, p - stale info

S       100.0.0.0/24 [255/0] via 192.168.1.100, vlan1
C    *> 192.168.1.0/24 is directly connected, vlan1
```

Output Figure 31-2: Static route with an administrative distance of 255 that is not added to the FIB

```
awplus(config)#ip route 100.0.0.0/24 192.168.1.100 255
awplus(config)#end
awplus#show ip route

Codes: C - connected, S - static, R - RIP, B - BGP
       O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       * - candidate default

C       192.168.1.0/24 is directly connected, vlan1
```

Equal Cost Multipath Routing

When multiple routes are available for the same prefix within the FIB, then your device uses Equal Cost Multipath Routing (ECMP) to determine how to forward packets.

ECMP allows the AlliedWare Plus™ Operating System to distribute traffic over multiple equal-cost routes to a destination. The software determines that two or more routes are equal cost if they have the same destination IP address and mask. When the software learns such multiple routes, it puts them in an ECMP route group. When it sends traffic to that destination, it distributes the traffic across all routes in the group.

The AlliedWare Plus™ Operating System distributes traffic over the routes one flow at a time, so all packets in a session take the same route. Each equal-cost route group can contain up to eight individual routes. ECMP is only used to select between routes already in the FIB.

By default, each equal-cost route group can contain four routes. You can change this setting by using the command:

```
awplus(config)# maximum-paths <1-8>
```

The maximum path setting determines how many routes with the same prefix value and the same administrative distance that the FIB can contain. Once an equal-cost route group has the maximum number of routes, then the RIB cannot add any further routes to the route group. The device only adds to the group if a route is deleted from the FIB.

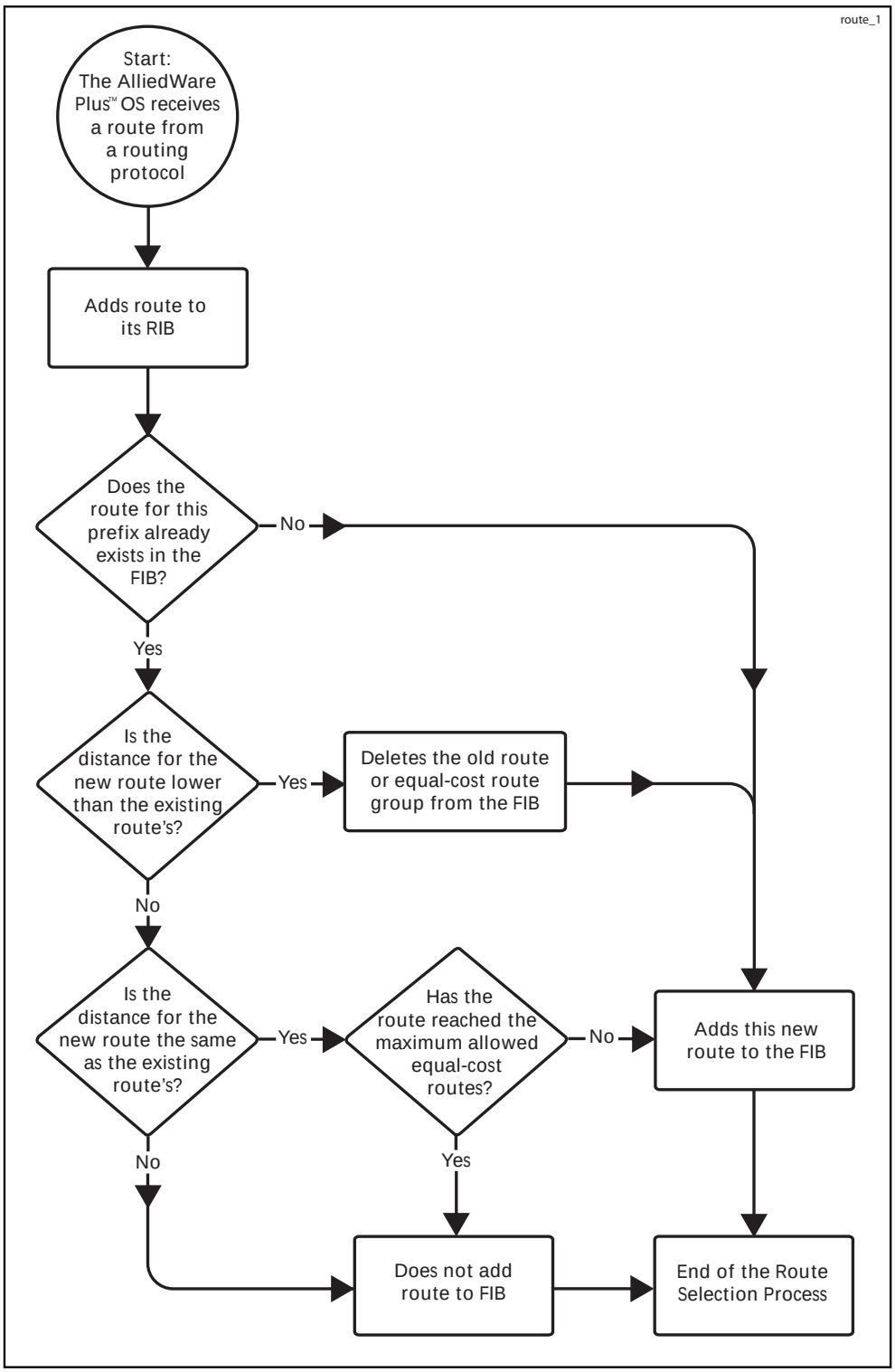
To disable ECMP, set the maximum paths value to one.

How AlliedWare Plus Deletes Routes

When the AlliedWare Plus™ Operating System receives a route delete request from a routing protocol, it first deletes the specified route from its RIB. Then it checks if the specified route is in the FIB. If the route is in the FIB, it deletes it from the FIB and checks if another route is available in its database for the same prefix. If there is another route in the database, the software installs this route in the FIB. When multiple such routes exist, the software uses the route selection mechanism to choose the best route before adding it to the FIB.

How AlliedWare Plus Adds Routes

The following flow chart shows how the software adds a route to the FIB.



Chapter 32: Routing Commands

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Introduction

This chapter provides an alphabetical reference of commands routing commands that are common across the routing IP protocols. For more information see Chapter 30, Routing Protocol Overview and Chapter 31, Route Selection.

Command List

ip route

This command adds a static route to the Routing Information Base (RIB). If this route is the best route for the destination, then your device adds it to the Forwarding Information Base (FIB). Your device uses the FIB to advertise routes to neighbors and forward packets.

When using VRF (Virtual Routing and Forwarding), you can use this command to configure a static inter-VRF route to a destination network that is reachable by a remote gateway located in a different VRF instance. Note that to apply the command in this way, the ip route static inter-vrf command must be in enabled (its default condition). For more information about VRF see, Chapter 45, VRF-Lite Introduction and Configuration and Chapter 46, VRF-Lite Commands.

The no variant of this command removes the static route from the RIB and FIB.

Syntax

```
ip route [vrf <vrf-name>] <subnet&mask> [<gateway-ip>] [<interface>]
    [<distance>]

no ip route [vrf <vrf-name>] <subnet&mask> [<gateway-ip>]
    [<interface>] [<distance>]
```

Parameter	Description
<subnet&mask>	The IPv4 address of the destination subnet defined using either a prefix length or a separate mask specified in one of the following formats:
	The IPv4 subnet address in dotted decimal notation followed by the subnet mask, also in dotted decimal notation.
	The IPv4 subnet address in dotted decimal notation, followed by a forward slash, then the prefix length.
<gateway-ip>	The IPv4 address of the gateway device.
<interface>	The interface that connects your device to the network. Enter the name of the VLAN or its VID. You can also enter 'null' as an interface. Specify a 'null' interface to add a null or blackhole route to the switch. The gateway IP address or the interface is required, if VRF-Lite is not configured. If VRF-Lite is configured: ■ When adding a static intra-VRF route, you must specify either the gateway IP address or the interface. ■ When adding a static inter-VRF route, you must specify both the gateway IP address and the interface.

Parameter(cont.)	Description(cont.)
<distance>	The administrative distance for the static route in the range <1-255>. Static routes by default have an administrative distance of 1.
vrf	Applies the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance to enter IPv4 Address-Family mode for.

Mode Global Configuration

Default The default administrative distance for a static route is 1 for priority over non-static routes.

Usage Administrative distance can be modified so static routes do not take priority over other routes.

Specify a 'Null' interface to add a null or blackhole route to the switch. A null or blackhole route is a routing table entry that does not forward packets, so any packets sent to it are dropped.

Examples To add the destination 192.168.3.0 with the mask 255.255.255.0 as a static route available through the device at "10.10.0.2" with the default administrative distance, use the commands:

```
awplus# configure terminal
awplus(config)# ip route 192.168.3.0 255.255.255.0 10.10.0.2
```

To remove the destination 192.168.3.0 with the mask 255.255.255.0 as a static route available through the device at "10.10.0.2" with the default administrative distance, use the commands:

```
awplus# configure terminal
awplus(config)# no ip route 192.168.3.0 255.255.255.0 10.10.0.2
```

To specify a null or blackhole route 192.168.4.0/24, so packets forwarded to this route are dropped, use the commands:

```
awplus# configure terminal
awplus(config)# ip route 192.168.4.0/24 null
```

To add the destination 192.168.3.0 with the mask 255.255.255.0 as a static route available through the device at "10.10.0.2" with an administrative distance of 128, use the commands:

```
awplus# configure terminal
awplus(config)# ip route 192.168.3.0 255.255.255.0 10.10.0.2 128
```

To create a static route from source VRF instance red, to the subnet 192.168.50.0/24 with a next hop of 192.168.20.6, use the following commands for static intra-VRF routing configuration:

```
awplus# configure terminal
awplus(config)# ip route vrf red 192.168.50.0/24 192.168.20.6
```

To remove a static route from source vrf red, to the subnet 192.168.50.0/24 with a next hop of 192.168.20.6, use the following commands for static intra-VRF routing configuration:

```
awplus# configure terminal
awplus(config)# no ip route vrf red 192.168.50.0/24 192.168.20.6
```

To create a static route from source vrf red, to the subnet 192.168.50.0/24 with a next hop of 192.168.20.6 via vlan-10, use the following commands for static inter-VRF routing configuration:

```
awplus# configure terminal
awplus(config)# ip route vrf red 192.168.50.0/24 192.168.20.6
vlan10
```

To remove a static route from source vrf red, to the subnet 192.168.50.0/24 with a next hop of 192.168.20.6 via vlan-10, use the following commands for static inter-VRF routing configuration:

```
awplus# configure terminal
awplus(config)# no ip route vrf red 192.168.50.0/24
192.168.20.6 vlan10
```

To create a static route from source vrf red, to the subnet 192.168.50.0/24 with a next hop of 192.168.20.6 via vlan-10, with an administrative distance of 225, use the following commands:

```
awplus# configure terminal
awplus(config)# ip route vrf red 192.168.50.0/24 192.168.20.6
vlan10 225
```

This example is shown as part of a larger VRF configuration, in "Static Inter-VRF Routing" on page 45.14.

Related Commands show ip route

maximum-paths

This command enables ECMP on your device, and sets the maximum number of paths that each route has in the Forwarding Information Base (FIB). ECMP is enabled by default.

The no variant of this command sets the maximum paths to the default of 4.

Syntax

```
maximum-paths <1-8>
no maximum-paths
```

Parameter	Description
<1-8>	The maximum number of paths that a route can have in the FIB.

Default By default the maximum number of paths is 4.

Mode Global Configuration

Examples To set the maximum number of paths for each route in the FIB to 5, use the command:

```
awplus# configure terminal
awplus(config)# maximum-paths 5
```

To set the maximum paths for a route to the default of 4, use the command:

```
awplus# configure terminal
awplus(config)# no maximum-paths
```

show ip route

Use this command to display routing entries in the FIB (Forwarding Information Base). The FIB contains the best routes to a destination, and your device uses these routes when forwarding traffic. You can display a subset of the entries in the FIB based on protocol. If VRF-Lite is configured, you can display routing entries in the FIB associated with either the global routing domain or a named VRF.

To modify the lines displayed, use the | (output modifier token); to save the output to a file, use the > output redirection token.

Syntax

```
show ip route [bgp|connected|ospf|rip|static|<ip-addr>|<ip-addr/
   prefix-length>]
```

```
show ip route {vrf <vrf-name>|global} [bgp|connected|ospf|rip|static]
```

Parameter	Description
`global`	If VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.
`bgp`	Displays only the routes learned from BGP.
`connected`	Displays only the routes learned from connected interfaces.
`ospf`	Displays only the routes learned from OSPF.
`rip`	Displays only the routes learned from RIP.
`static`	Displays only the static routes you have configured.
<ip-addr>	Displays the routes for the specified address. Enter an IPv4 address.
<ip-addr/prefix-length>	Displays the routes for the specified network. Enter an IPv4 address and prefix length.

Mode User Exec and Privileged Exec

Example To display the OSPF routes in the FIB, use the command:

```
awplus# show ip route ospf
```

To display all routing entries in the FIB associated with a VRF instance `red`, use the command:

```
awplus# show ip route vrf red
```

Output Each entry in the output from this command has a code preceding it, indicating the source of the routing entry. For example, O indicates OSPF as the origin of the route. The first few lines of the output list the possible codes that may be seen with the route entries.

Typically, route entries are composed of the following elements:

- code
- a second label indicating the sub-type of the route
- network or host ip address
- administrative distance and metric
- nexthop ip address
- outgoing interface name
- time since route entry was added

Figure 32-1: Example output from the **show ip route** command

```
Codes: C - connected, S - static, R - RIP, B - BGP
       O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       * - candidate default

O       10.10.37.0/24 [110/11] via 10.10.31.16, vlan2, 00:20:54
C       3.3.3.0/24 is directly connected, vlan1
C       10.10.31.0/24 is directly connected, vlan2
C       10.70.0.0/24 is directly connected, vlan4
O E2    14.5.1.0/24 [110/20] via 10.10.31.16, vlan2, 00:18:56
C       33.33.33.33/32 is directly connected, lo
```

To avoid repetition, only selected route entries comprised of different elements are described here:

OSPF Route

`O  10.10.37.0/24 [110/11] via 10.10.31.16, vlan2, 00:20:54`

This route entry denotes:

- This route in the network `10.10.37.0/24` was added by OSPF.
- This route has an administrative distance of 110 and metric/cost of 11.
- This route is reachable via nexthop `10.10.31.16`.
- The outgoing local interface for this route is `vlan2`.
- This route was added 20 minutes and 54 seconds ago.

Connected Route

`C  10.10.31.0/24 is directly connected, vlan2`

This route entry denotes:

- Route entries for network `10.10.31.0/24` are derived from the IP address of local interface `vlan2`.
- These routes are marked as Connected routes `(C)` and always preferred over routes for the same network learned from other routing protocols.

OSPF External Route

`O E2  14.5.1.0/24 [110/20] via 10.10.31.16, vlan2, 00:18:56`

This route entry denotes:

- This route is the same as the other OSPF route explained above; the main difference is that it is a Type 2 External OSPF route.

Related Commands maximum-paths
show ip route database

show ip route database

This command displays the routing entries in the RIB (Routing Information Base).

When multiple entries are available for the same prefix, RIB uses the routes' administrative distances to choose the best route. All best routes are entered into the FIB (Forwarding Information Base). To view the routes in the FIB, use the show ip route command.

To modify the lines displayed, use the | (output modifier token); to save the output to a file, use the > output redirection token.

Syntax

```
show ip route [vrf <vrf-name>|global] database [bgp|connected|ospf|
   rip|static]
```

Parameter	Description
`global`	If VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.
`bgp`	Displays only the routes learned from BGP.
`connected`	Displays only the routes learned from connected interfaces.
`ospf`	Displays only the routes learned from OSPF.
`rip`	Displays only the routes learned from RIP.
`static`	Displays only the static routes you have configured.

Mode User Exec and Privileged Exec

Example To display the static routes in the RIB, use the command:

```
awplus# show ip route database static
```

Output Figure 32-2: Example output from the **show ip route database** command

```
Codes: C - connected, S - static, R - RIP, B - BGP
       O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
              > - selected route, * - FIB route, p - stale info

O     *> 9.9.9.9/32 [110/31] via 10.10.31.16, vlan2, 00:19:21
O        10.10.31.0/24 [110/1] is directly connected, vlan2, 00:28:20
C     *> 10.10.31.0/24 is directly connected, vlan2
S     *> 10.10.34.0/24 [1/0] via 10.10.31.16, vlan2
O        10.10.34.0/24 [110/31] via 10.10.31.16, vlan2, 00:21:19
O     *> 10.10.37.0/24 [110/11] via 10.10.31.16, vlan2, 00:21:19
C     *> 10.30.0.0/24 is directly connected, vlan6
S     *> 11.22.11.0/24 [1/0] via 10.10.31.16, vlan2
O E2  *> 14.5.1.0/24 [110/20] via 10.10.31.16, vlan2, 00:19:21
O        16.16.16.16/32 [110/11] via 10.10.31.16, vlan2, 00:21:19
S     *> 16.16.16.16/32 [1/0] via 10.10.31.16, vlan2
O     *> 17.17.17.17/32 [110/31] via 10.10.31.16, vlan2, 00:21:19
C     *> 45.45.45.45/32 is directly connected, lo
O     *> 55.55.55.55/32 [110/21] via 10.10.31.16, vlan2, 00:21:19
C     *> 127.0.0.0/8 is directly connected, lo
```

Example To display all routing entries in the RIB associated with a VRF instance `red`, use the command:

```
awplus# show ip route vrf red database
```

Output Figure 32-3: Example output from the **show ip route vrf red database** command

```
[VRF: red]
Codes: C - connected, S - static, R - RIP, B - BGP
       O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
              > - selected route, * - FIB route, p - stale info

O       192.168.10.0/24 [110/1] is directly connected, vlan1, 06:45:51
C    *> 192.168.10.0/24 is directly connected, vlan1
B     > 192.168.33.0/24 [20/0] via 192.168.30.3, 06:45:52
O E2 *> 192.168.110.0/24 [110/20] via 192.168.10.2, vlan1, 06:45:00
O E2 *> 192.168.111.0/24 [110/20] via 192.168.10.2, vlan1, 06:45:00
```

The routes added to the FIB are marked with a `*`. When multiple routes are available for the same prefix, the best route is indicated with the `>` symbol. All unselected routes have neither the `*` nor the `>` symbol.

```
S     *> 10.10.34.0/24 [1/0] via 10.10.31.16, vlan2
O        10.10.34.0/24 [110/31] via 10.10.31.16, vlan2, 00:21:19
```

These route entries denote:

- The same prefix was learned from OSPF and from static route configuration.
- Since this static route has a lower administrative distance than the OSPF route (110), the static route (1) is selected and installed in the FIB.

If the static route becomes unavailable, then the device automatically selects the OSPF route and installs it in the FIB.

Related Commands maximum-paths
show ip route

show ip route summary

This command displays a summary of the current RIB (Routing Information Base) entries.

To modify the lines displayed, use the | (output modifier token); to save the output to a file, use the > output redirection token.

Syntax `show ip route summary [vrf <vrf-name>|global]`

Parameter	Description
`vrf`	Specific VRF instance.
<vrf-name>	The name of the VRF instance.
`global`	The global routing and forwarding table.

Mode User Exec and Privileged Exec

Example To display a summary of the current RIB entries, use the command:

```
awplus# show ip route summary
```

Output Figure 32-4: Example output from the **show ip route summary** command

```
IP routing table name is Default-IP-Routing-Table(0)
IP routing table maximum-paths is 4
Route Source    Networks
connected       5
ospf            2
Total           8
```

Figure 32-5: Example output from the **show ip route summary vrf red** command

```
IP routing table name is Default-IP-Routing-Table(0)
IP routing table maximum-paths is 4
Route Source    Networks
connected       1
Total           1
FIB             0

[VRF: red]
Route Source    Networks
connected       1
ospf            2
Total           3
```

Related Commands show ip route
show ip route database

Chapter 33: RIP Configuration

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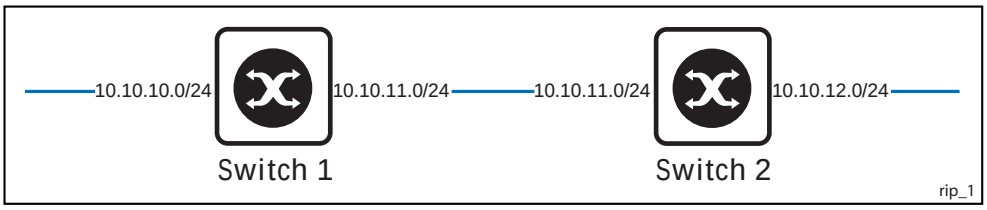
Introduction

This chapter contains basic RIP configuration examples. To see details on the RIP commands used in these examples, or to see the outputs of the Validation commands, refer to the Chapter 34, RIP Commands.

Enabling RIP

This example shows the minimum configuration required for enabling two devices to exchange routing information using RIP. The routing devices in this example are Allied Telesis managed Layer 3 Switches. `Switch 1` and `Switch 2` are two neighbors connecting to network 10.10.11.0/24. Switch 1 and Switch 2 are also connected to networks 10.10.10.0/24 and 10.10.12.0/24 respectively. This example assumes that the devices have already been configured with IP interfaces in those subnets.

To enable RIP, first define the RIP routing process and then associate a network with the routing process.



Switch 1

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router rip`	Define a RIP routing process and enter the Router Configuration mode.
`awplus(config-router)#`	
`network 10.10.10.0/24`	Associate network 10.10.10.0/24 with the RIP process.
`awplus#`	
`network 10.10.11.0/24`	Associate network 10.10.11.0/24 with the RIP process.

Switch 2

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router rip`	Define a RIP routing process and enter the Router Configuration mode.
`awplus(config-router)#`	
`network 10.10.11.0/24`	Associate networks with the RIP process
`awplus(config-router)#`	
`network 10.10.12.0/24`	Associate networks with the RIP process

Names of Commands Used

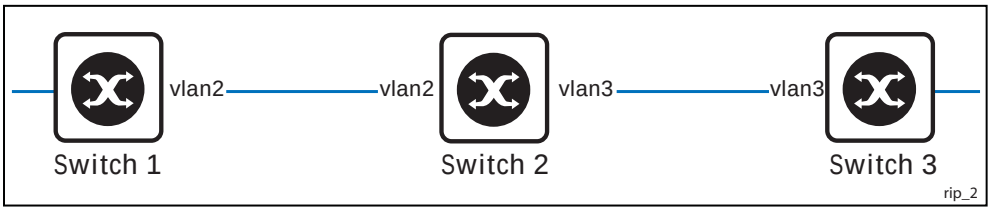
router rip
network (RIP)

Validation Commands

show ip rip
show running-config
show ip protocols rip
show ip rip interface
show ip route

Specifying the RIP Version

Configure a router to receive and send specific versions of RIP packets on a VLAN interface. The routing devices in this example are Allied Telesis managed Layer 3 Switches. In this example, Switch 2 is configured to receive and send RIP version 1 and version 2 information on both `vlan2` and `vlan3` interfaces.



Switch 2

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router rip`	Enable the RIP routing process.
`awplus(config-router)#`	
`exit`	Return to the Global Configuration mode
`awplus(config)#`	
`interface vlan2`	Specify vlan2 as an interface you want to configure.
`awplus(config-if)#`	
`ip rip send version 1 2`	Allow sending RIP version 1 and version 2 packets out of this interface.
`awplus(config-if)#`	
`ip rip receive version 1 2`	Allow receiving of RIP version 1 and version 2 packets from the vlan2 interface.
`awplus(config-if)#`	
`exit`	Exit the Interface mode and return to Global Configuration mode to configure the next interface.
`awplus(config)#`	
`interface vlan3`	Specify interface vlan3 as the interface you want to configure.
`awplus(config-if)#`	
`ip rip send version 1 2`	Allow sending RIP version 1 and version 2 packets out of this interface.
`awplus(config-if)#`	
`ip rip receive version 1 2`	Allow receiving of RIP version 1 and version 2 packets from the vlan3 interface.

Names of Commands Used

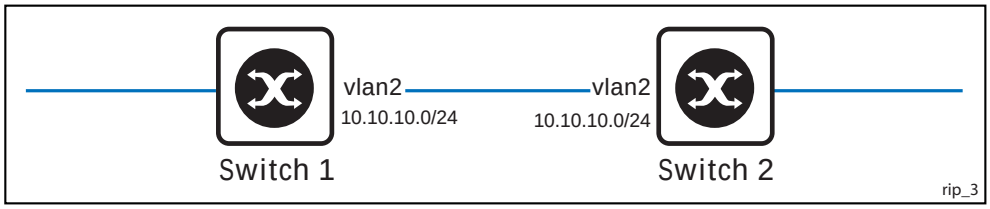
ip rip send version
ip rip receive version

Validation Commands

show ip rip
show running-config
show ip protocols rip
show ip rip interface
show ip route

RIPv2 Authentication (Single Key)

AlliedWare Plus™ RIP implementation provides the choice of configuring authentication for a single key or for multiple keys. This example illustrates authentication of the routing information exchange process for RIP using a single key. The routing devices in this example are Allied Telesis managed Layer 3 Switches. Switch 1 and Switch 2 are running RIP and exchange routing updates. To configure single key authentication on Switch 1, specify an interface and then define a key or password for that interface. Next, specify an authentication mode. Any receiving RIP packet on this specified interface should have the same string as password. For an exchange of updates between Switch 1 and Switch 2, define the same password and authentication mode on Switch 2.



Switch 1

`awplus#`	
`configure terminal`	Enter the Configure mode.
`awplus(config)#`	
`router rip`	Define a RIP routing process and enter the Router Configuration mode.
`awplus(config-router)#`	
`network 10.10.10.0/24`	Associate network 10.10.10.0/24 with the RIP process.
`awplus(config-router)#`	
`redistribute connected`	Enable redistributing from connected routes.
`awplus(config-router)#`	
`exit`	Exit the Router Configuration mode and return to the Configure mode.
`awplus(config)#`	
`interface vlan2`	Specify the VLAN interface (vlan2) for authentication.
`awplus(config-if)#`	
`ip rip authentication string Secret`	Specify the authentication string (Secret) for this interface.
`awplus(config-if)#`	
`ip rip authentication mode md5`	Specify the authentication mode to be MD5.

Switch 2

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router rip`	Define a RIP routing process and enter the Router Configuration mode.
`awplus(config-router)#`	
`network 10.10.10.0/24`	Associate network 10.10.10.0/24 with the RIP process.
`awplus(config-router)#`	
`redistribute connected`	Enable redistributing from connected routes.
`awplus(config-router)#`	
`exit`	Exit the Router Configuration mode and return to the Global Configuration mode.
`awplus(config)#`	
`interface vlan2`	Specify the VLAN interface (vlan2) for authentication.
`awplus(config-if)#`	
`ip rip authentication string Secret`	Specify the authentication string (Secret) on this interface.
`awplus(config-if)#`	
`ip rip authentication mode md5`	Specify the authentication mode to be MD5.

Names of Commands Used

ip rip authentication string
ip rip authentication mode
redistribute (RIP)
network (RIP)

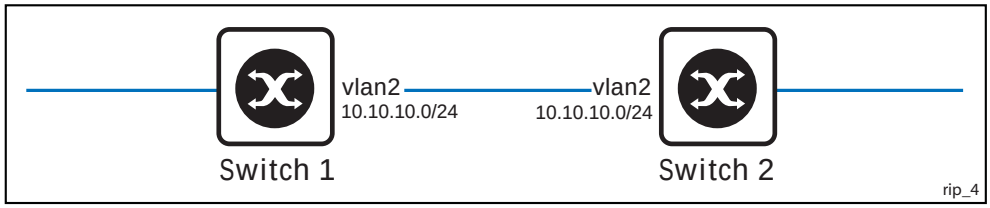
Validation Commands

show ip rip
show running-config
show ip protocols rip
show ip rip interface
show ip route

RIPv2 Text Authentication (Multiple Keys)

This example illustrates text authentication of the routing information exchange process for RIP using multiple keys. The routing devices in this example are Allied Telesis managed Layer 3 Switches. Switch 1 and Switch 2 are running RIP and exchanging routing updates. To configure authentication on Switch 1, define a key chain, specify keys in the key chain and then define the authentication string or passwords to be used by the keys. Set the time period during which it is valid to receive or send the authentication key by specifying the accept and send lifetimes. After defining the key string, specify the key chain (or the set of keys) that will be used for authentication on each interface and also the authentication mode to be used.

Switch 1 accepts all packets that contain any key string that matches one of the key strings included in the specified key chain (within the accept lifetime) on that interface. The key ID is not considered for matching. For additional security, the accept lifetime and send lifetime are configured such that every fifth day the key ID and key string changes. To maintain continuity, the accept lifetimes should be configured to overlap. This will accommodate different time-setup on machines. However, the send lifetime does not need to overlap and we recommend not configuring overlapping send lifetimes.



Switch 1

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router rip`	Define a RIP routing process and enter the Router Configuration mode.
`awplus(config-router)#`	
`network 10.10.10.0/24`	Associate network 10.10.10.0/24 with the RIP process.
`awplus(config-router)#`	
`redistribute connected`	Enable redistributing of connected routes.
`awplus(config-router)#`	
`exit`	Exit the Router Configuration mode and return to the Global Configuration mode.
`awplus(config)#`	
`key chain SUN`	Enter the key chain management mode to add keys to the key chain SUN.
`awplus(config-keychain)#`	
`key 10`	Add authentication key ID (10) to the key chain SUN.
`awplus(config-keychain-key)#`	
`key-string Secret`	Specify a password (Secret) to be used by the specified key.

Switch 1(cont.)

`awplus(config-keychain-key)#`	
`accept-lifetime 12:00:00 Mar 2 2007 14:00:00 Mar 7 2007`	Specify the time period during which authentication key string `Secret` can be received. In this case, key string `Secret` can be received from noon of March 2 to 2 pm March 7, 2007.
`awplus(config-keychain-key)#`	
`send-lifetime 12:00:00 Mar 2 2007 12:00:00 Mar 7 2007`	Specify the time period during which authentication key string `Secret` can be send. In this case, key string `Secret` can be received from noon of March 2 to noon of March 7, 2007.
`awplus(config-keychain-key)#`	
`exit`	Exit the keychain-key mode and return to keychain mode.
`awplus(config-keychain)#`	
`key 20`	Add another authentication key (`20`) to the key chain `SUN`.
`awplus(config-keychain-key)#`	
`key-string Earth`	Specify a password (`Earth`) to be used by the specified key.
`awplus(config-keychain-key)#`	
`accept-lifetime 12:00:00 Mar 7 2007 14:00:00 Mar 12 2007`	Specify the time period during which authentication key string `Earth` can be received. In this case, key string `Earth` can be received from noon of March 7 to 2 pm March 12, 2007.
`awplus(config-keychain-key)#`	
`send-lifetime 12:00:00 Mar 7 2007 12:00:00 Mar 12 2007`	Specify the time period during which authentication key string `Earth` can be sent. In this case, key string `Secret` can be received from noon of March 7 to noon of March 12, 2007.
`awplus(config-keychain-key)#`	
`end`	Enter Privileged Exec mode.
`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`interface vlan2`	Specify VLAN interface (vlan2) as the interface you want to configure on Switch 1.
`awplus(config-if)#`	
`ip rip authentication key-chain SUN`	Enable RIPv2 authentication on the `vlan2` interface and specify the key chain `SUN` to be used for authentication.
`awplus(config-if)#`	
`ip rip authentication mode text`	Specify text authentication mode to be used for RIP packets. This step is optional, as text is the default mode.

Switch 2

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router rip`	Define a RIP routing process and enter the Router Configuration mode.
`awplus(config-router)#`	
`network 10.10.10.0/24`	Associate network 10.10.10.0/24 with the RIP process.
`awplus(config-router)#`	
`redistribute connected`	Enable redistributing from connected routes.
`awplus(config-router)#`	
`exit`	Exit the Router Configuration mode and return to the Global Configuration mode.
`awplus(config)#`	
`key chain MOON`	Enter the key chain management mode to add keys to the key chain `MOON`.
`awplus(config-keychain)#`	
`key 30`	Add authentication key ID (`30`) to the key chain `MOON`.
`awplus(config-keychain-key)#`	
`key-string Secret`	Specify a password (`Secret`) to be used by the specified key.
`awplus(config-keychain-key)#`	
`accept-lifetime 12:00:00 Mar 2 2007 14:00:00 Mar 7 2007`	Specify the time period during which authentication key string `Secret` can be received. In this case, key string `Secret` can be received from noon of March 2 to 2 pm March 7, 2007.
`awplus(config-keychain-key)#`	
`send-lifetime 12:00:00 Mar 2 2007 12:00:00 Mar 7 2007`	Specify the time period during which authentication key string `Secret` can be send. In this case, key string `Secret` can be received from noon of March 2 to noon of March 7, 2007.
`awplus(config-keychain)#`	
`key 40`	Add another authentication key (`40`) to the key chain `MOON`.
`awplus(config-keychain-key)#`	
`key-string Earth`	Specify a password (`Earth`) to be used by the specified key.
`awplus(config-keychain-key)#`	
`accept-lifetime 12:00:00 Mar 7 2007 14:00:00 Mar 12 2007`	Specify the time period during which authentication key string `Earth` can be received. In this case, key string `Earth` can be received from noon of March 7 to 2 pm March 12, 2007.

Switch 2(cont.)

`awplus(config-keychain-key)#`	
`send-lifetime 12:00:00 Mar 7 2007 12:00:00 Mar 12 2007`	Specify the time period during which authentication key string `Earth` can be sent. In this case, key string `Secret` can be received from noon of March 7 to noon of March 12, 2007.
`awplus(config-keychain-key)#`	
`end`	Enter Privileged Exec mode.
`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`interface vlan2`	Specify the VLAN interface that you want to configure on Switch 2.
`awplus(config-if)#`	
`ip rip authentication key-chain MOON`	Enable RIPv2 authentication on the vlan2 interface, and specify the key chain MOON to be used for authentication.
`awplus(config-if)#`	
`ip rip authentication mode text`	Specify authentication mode to be used for RIP packets. This step is optional, as text is the default mode.

Names of Commands Used

key chain, key-string
accept-lifetime
send-lifetime
ip rip authentication key-chain
ip rip authentication mode

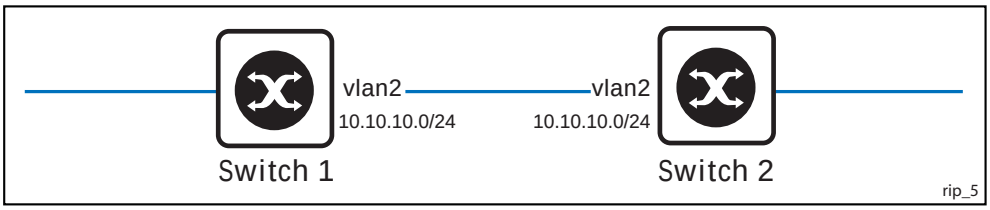
Validation Commands

show ip rip
show running-config
show ip protocols rip
show ip rip interface
show ip route

RIPv2 md5 authentication (Multiple Keys)

This example illustrates the md5 authentication of the routing information exchange process for RIP using multiple keys. The routing devices in this example are Allied Telesis managed Layer 3 Switches. Switch 1 and Switch 2 are running RIP and exchange routing updates. To configure authentication on Switch 1, define a key chain, specify keys in the key chain and then define the authentication string or passwords to be used by the keys. Then set the time period during which it is valid to receive or send the authentication key by specifying the accept and send lifetimes. After defining the key string, specify the key chain (or the set of keys) that will be used for authentication on the interface and the authentication mode to be used. Configure Switch 2 and Switch 3 to have the same key ID and key string as Switch 1 for the time that updates need to be exchanged.

In `md5` authentication, both the key ID and key string are matched for authentication. Switch 1 will receive only packets that match both the key ID and the key string in the specified key chain (within the accept lifetime) on that interface. In the following example, Switch 2 has the same key ID and key string as Switch 1. For additional security, the accept lifetime and send lifetime are configured such that every fifth day the key ID and key string changes. To maintain continuity, the accept lifetimes should be configured to overlap; however, the send lifetime should not be overlapping.



Switch 1

awplus# `configure terminal`	Enter the Global Configuration mode.
awplus(config)# `router rip`	Define a RIP routing process and enter the Router Configuration mode.
awplus(config-router)# `network 10.10.10.0/24`	Associate network `10.10.10.0/24` with the RIP process.
awplus(config-router)# `redistribute connected`	Enable redistributing from connected routes.
awplus(config-router)# `exit`	Exit the Router Configuration mode and return to the Global Configuration mode.
awplus(config)# `key chain SUN`	Enter the key chain management mode to add keys to the key chain `SUN`.
awplus(config-keychain)# `key 1`	Add authentication key ID (`1`) to the key chain `SUN`.

Switch 1(cont.)

`awplus(config-keychain-key)#`	
`key-string Secret`	Specify a password (`Secret`) to be used by the specified key.
`awplus(config-keychain-key)#`	
`accept-lifetime 12:00:00 Mar 2 2007 14:00:00 Mar 7 2007`	Specify the time period during which authentication key string `Secret` can be received. In this case, key string `Secret` can be received from noon of March 2 to 2 pm March 7, 2007.
`awplus(config-keychain-key)#`	
`send-lifetime 12:00:00 Mar 2 2007 12:00:00 Mar 7 2007`	Specify the time period during which authentication key string `Secret` can be send. In this case, key string `Secret` can be received from noon of March 2 to noon of March 7, 2007.
`awplus(config-keychain-key)#`	
`exit`	Exit the `keychain-key` mode and return to `keychain` mode.
`awplus(config-keychain)#`	
`key 2`	Add another authentication key (`2`) to the key chain `SUN`.
`awplus(config-keychain-key)#`	
`key-string Earth`	Specify a password (`Earth`) to be used by the specified key.
`awplus(config-keychain-key)#`	
`accept-lifetime 12:00:00 Mar 7 2007 14:00:00 Mar 12 2007`	Specify the time period during which authentication key string `Earth` can be received. In this case, key string `Earth` can be received from noon of March 7 to 2 pm March 12, 2007.
`awplus(config-keychain-key)#`	
`send-lifetime 12:00:00 Mar 7 2007 12:00:00 Mar 12 2007`	Specify the time period during which authentication key string `Earth` can be send. In this case, key string `Secret` can be received from noon of March 7 to noon of March 12, 2007.
`awplus(config-keychain-key)#`	
`end`	Enter Privileged Exec mode.
`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`interface vlan2`	Specify interface `vlan2` as the VLAN interface you want to configure on Switch 1.
`awplus(config-if)#`	
`ip rip authentication key-chain SUN`	Enable RIPv2 authentication on the `vlan2` interface and specify the key chain `SUN` to be used for authentication.
`awplus(config-if)#`	
`ip rip authentication mode md5`	Specify the `md5` authentication mode to be used for RIP packets.

Switch 2

awplus#	
configure terminal	Enter the Global Configuration mode.
awplus(config)#	
router rip	Define a RIP routing process and enter the Router Configuration mode.
awplus(config-router)#	
network 10.10.10.0/24	Associate network 10.10.10.0/24 with the RIP process.
awplus(config-router)#	
redistribute connected	Enable redistributing from connected routes.
awplus(config-router)#	
exit	Exit the Router Configuration mode and return to the Global Configuration mode.
awplus(config)#	
key chain MOON	Enter the key chain management mode to add keys to the key chain MOON.
awplus(config-keychain)#	
key 1	Add authentication key ID (1) to the key chain MOON.
awplus(config-keychain-key)#	
key-string Secret	Specify a password (Secret) to be used by the specified key.
awplus(config-keychain-key)#	
accept-lifetime 12:00:00 Mar 2 2007 14:00:00 Mar 7 2007	Specify the time period during which authentication key string Secret can be received. In this case, key string Secret can be received from noon of March 2 to 2 pm March 7, 2007.
awplus(config-keychain-key)#	
send-lifetime 12:00:00 Mar 2 2007 12:00:00 Mar 7 2007	Specify the time period during which authentication key string Secret can be send. In this case, key string Secret can be received from noon of March 2 to noon of March 7, 2007.
awplus(config-keychain)#	
key 2	Add another authentication key (2) to the key chain MOON.
awplus(config-keychain-key)#	
key-string Earth	Specify a password (Earth) to be used by the specified key.
awplus(config-keychain-key)#	
accept-lifetime 12:00:00 Mar 7 2007 14:00:00 Mar 12 2007	Specify the time period during which authentication key string Earth can be received. In this case, key string Earth can be received from noon of March 7 to 2 pm March 12, 2007.
awplus(config-keychain-key)#	
send-lifetime 12:00:00 Mar 7 2007 12:00:00 Mar 12 2007	Specify the time period during which authentication key string Earth can be send. In this case, key string Secret can be received from noon of March 7 to noon of March 12, 2007.

Switch 2(cont.)

`awplus(config-keychain-key)#`	
`end`	Enter Privileged Exec mode.
`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`interface vlan2`	Specify vlan2 as the VLAN interface you want to configure on Switch 2.
`awplus(config-if)#`	
`ip rip authentication key-chain MOON`	Enable RIPv2 authentication on the `vlan2` interface and specify the key chain `MOON` to be used for authentication.
`awplus(config-if)#`	
`ip rip authentication mode md5`	Specify the md5 authentication mode to be used for RIP packets.

Names of Commands Used

key chain
key-string
accept-lifetime
send-lifetime
ip rip authentication key-chain
ip rip authentication mode

Validation Commands

show ip rip
show running-config
show ip protocols rip
show ip rip interface

Chapter 34: RIP Commands

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Introduction

This chapter provides an alphabetical reference of commands used to configure RIP. For more information, see Chapter 33, RIP Configuration.

Command List

accept-lifetime

Use this command to specify the time period during which the authentication key on a key chain is received as valid.

Use the no variant of this command to remove a specified time period for an authentication key on a key chain as set previously with the accept-lifetime command.

Syntax

```
accept-lifetime <start-date>{<end-date>|duration <seconds>|infinite}
no accept-lifetime
```

Parameter	Description	
<start-date>	Specifies the start period - time and date in the format DD MMM YYYY or MMM DD YYYY: *<hh:mm:ss> {<day> <month> <year> | <month> <day> <year>}*	
	<hh:mm:ss>	Time of the day when accept-lifetime starts, in hours, minutes and seconds
	<day>	<1-31> Specifies the day of the month to start.
	<month>	Specifies the month of the year to start (the first three letters of the month, for example, Jan).
	<year>	<1993-2035> Specifies the year to start.
<end-date>	Specifies the end period - time and date in the format DD MMM YYYY or MMM DD YYYY: *<hh:mm:ss> {<day> <month> <year> | <month> <day> <year>}*	
	<hh:mm:ss>	Time of the day when lifetime expires, in hours, minutes and seconds.
	<day>	<1-31> Specifies the day of the month to expire.
	<month>	Specifies the month of the year to expire (the first three letters of the month, for example, Feb).
	<year>	<1993-2035> Specifies the year to expire.
<seconds>	<1-2147483646> Duration of the key in seconds.	
infinite	Never expires.	

Mode Keychain-key Configuration

Examples The following examples show the setting of accept-lifetime for `key1` on the key chain named `mychain`.

```
awplus# configure terminal
awplus(config)# key chain mychain
awplus(config-keychain)# key 1
awplus(config-keychain-key)# accept-lifetime 03:03:01 Dec 3
2007 04:04:02 Oct 6 2008
```

or:

```
awplus# configure terminal
awplus(config)# key chain mychain
awplus(config-keychain)# key 1
awplus(config-keychain-key)# accept-lifetime 03:03:01 3 Dec
2007 04:04:02 6 Oct 2008
```

Related Commands
key
key-string
key chain
send-lifetime

address-family ipv4 (RIP)

This command enters the IPv4 address-family command mode. In this mode you can configure address-family specific parameters for a specific VRF (RIP) instance.

Syntax

```
address-family ipv4 vrf <vrf-name>
no address-family ipv4 vrf <vrf-name>
```

Parameter	Description
ipv4	Configure parameters relating to the RIP exchange of IPv4 prefixes.
vrf	Apply this command to a VRF instance.
<vrf-name>	The name of the VRF instance.

Mode Router Configuration

Usage To leave Address Family mode and return to Router Configuration mode, use the exit-address-family (BGP) command on page 42.56.

Example In this example the address family “green” is entered, and then exited by using the exit-address-family command. I

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# address-family ipv4 vrf green
awplus(config-router-af)#
awplus(config-router-af)# exit-address-family
awplus(config-router)# exit
```

Related Commands exit-address-family (BGP)

cisco-metric-behavior (RIP)

Use this command to enable or disable the RIP routing metric update to conform to Cisco's implementation. This command is provided to allow inter-operation with older Cisco devices that do not conform to the RFC standard for RIP route metrics.

Use the no variant of this command to disable this feature.

Syntax

```
cisco-metric-behavior {enable|disable}
no cisco-metric-behavior
```

Parameter	Description
enable	Enables updating the metric consistent with Cisco.
disable	Disables updating the metric consistent with Cisco.

Default By default, the Cisco metric-behavior is disabled.

Mode Router Configuration

Examples To enable the routing metric update to behave as per the Cisco implementation, enter the commands:

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# cisco-metric-behavior enable
```

To disable the routing metric update to behave as per the default setting, enter the commands:

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# no cisco-metric-behavior
```

Validation Commands show running-config

Related Commands cisco-metric-behavior (RIPng)

clear ip rip route

Use this command to clear specific data from the RIP routing table.

Syntax

```
clear ip rip [vrf <vrf-name>] route {<ip-dest-network/prefix-length>
   |static|connected|rip|ospf|bgp|all}
```

Parameter	Description
`vrf`	Apply this command to a VRF instance.
`<vrf-name>`	The name of the VRF instance.
`<ip-dest-network/prefix-length>`	Removes entries which exactly match this destination address from RIP routing table. Enter the IP address and prefix length of the destination network.
`static`	Removes static entries from the RIP routing table.
`connected`	Removes entries for connected routes from the RIP routing table.
`rip`	Removes only RIP routes from the RIP routing table.
`ospf`	Removes only OSPF routes from the RIP routing table.
`bgp`	Removes only BGP routes from the RIP routing table.
`all`	Clears the entire RIP routing table.

Mode Privileged Exec

Usage Using this command with the `all` parameter, clears the RIP table of all the routes.

Examples To clear the route `10.0.0.0/8` from the RIP routing table, use the following command:

```
awplus# clear ip rip route 10.0.0.0/8
```

To clear RIP routes associated with the VRF instance `red` for OSPF routes, use the following command:

```
awplus# clear ip rip vrf red route ospf
```

To clear the route 10.0.0.0/8 from the RIP routing table for the VRF instance `red`, use the following command:

```
awplus# clear ip rip vrf red route 10.0.0.0/8
```

debug rip

Use this command to specify the options for the displayed debugging information for RIP events and RIP packets.

Use the no variant of this command to disable the specified debug option.

Syntax

```
debug rip {events|nsm|<packet>|all}
no debug rip {events|nsm|<packet>|all}
```

Parameter	Description
`events`	RIP events debug information is displayed.
`nsm`	RIP and NSM communication is displayed.
<packet>	`packet [recv|send] [detail]` Specifies RIP packets only.
`recv`	Specifies that information for received packets be displayed.
`send`	Specifies that information for sent packets be displayed.
`detail`	Displays detailed information for the sent or received packet.
`all`	Displays all RIP debug information.

Default Disabled

Mode Privileged Exec and Global Configuration

Example The following example displays information about the RIP packets that are received and sent out from the device.

```
awplus# debug rip packet
```

Related Commands undebug rip

default-information originate (RIP)

Use this command to generate a default route into the Routing Information Protocol (RIP).

Use the no variant of this command to disable this feature.

Syntax

```
default-information originate
no default-information originate
```

Default Disabled

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# default-information originate
```

default-metric (RIP)

Use this command to specify the metrics to be assigned to redistributed routes.

Use the no variant of this command to reset the metric back to its default (1).

Syntax

```
default-metric <metric>
no default-metric [<metric>]
```

Parameter	Diagnostic
<metric>	<1-16> Specifies the value of the default metric.

Default By default, the metric value is set to 1.

Mode RIP Router Configuration or RIP Router Address Family Configuration for a VRF instance

Usage This command is used with the redistribute (RIP) command to make the routing protocol use the specified metric value for all redistributed routes, regardless of the original protocol that the route has been redistributed from.

Examples This example assigns the cost of 10 to the routes that are redistributed into RIP.

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# default-metric 10
awplus(config-router)# redistribute ospf
awplus(config-router)# redistribute connected
```

This example assigns the cost of 10 to the routes which are redistributed into RIP for the VRF instance blue.

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# address family ipv4 vrf blue
awplus(config-router-af)# default-metric 10
awplus(config-router-af)# redistribute ospf
awplus(config-router-af)# redistribute connected
```

distance (RIP)

This command sets the administrative distance for RIP routes. Your device uses this value to select between two or more routes to the same destination obtained from two different routing protocols. The route with the smallest administrative distance value is added to the Forwarding Information Base (FIB). See "Administrative Distance" on page 31.5 for more information.

The no variant of this command sets the administrative distance for the RIP route to the default of 120.

Syntax

```
distance <1-255> [<ip-addr/prefix-length> [<access-list>]]
no distance [<1-255>] [<ip-addr/prefix-length> [<access-list>]]
```

Parameter	Description
<1-255>	The administrative distance value you are setting for this RIP route.
<ip-addr/ prefix-length>	The network IP address and prefix-length that you are changing the administrative distance for.
<access-list>	Specifies the access-list name. This access list specifies which routes within the network *<ip-address/m>* this command applies to.

Mode RIP Router Configuration or RIP Router Address Family Configuration for a VRF instance

Examples To set the administrative distance to `8` for the RIP routes within the `10.0.0.0/8` network that match the access-list `mylist`, use the commands:

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# distance 8 10.0.0.0/8 mylist
```

To set the administrative distance to the default of `120` for the RIP routes within the `10.0.0.0/8` network that match the access-list `mylist`, use the commands:

```
awplus# configure terminal
awplus (config)# router rip
awplus(config-router)# no distance 8 10.0.0.0/8 mylist
```

This example assigns a cost of 10 to the routes for the VRF instance blue, when redistributed into RIP.

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# address family ipv4 blue
awplus(config-router-af)# distance 10
```

distribute-list (RIP)

Use this command to filter incoming or outgoing route updates using the access-list or the prefix-list. When running VRF-Lite, this command can be applied to a specific VRF instance.

Use the no variant of this command to disable this feature.

Syntax

```
distribute-list {<access-list> |prefix <prefix-list>} {in|out}
   [<interface>]

no distribute-list {<access-list> |prefix <prefix-list>} {in|out}
   [<interface>]
```

Parameter	Description
`prefix`	Filter prefixes in routing updates.
`<access-list>`	Specifies the IPv4 access-list number or name to use.
`<prefix-list>`	Specifies the name of the IPv4 prefix-list to use.
`in`	Filter incoming routing updates.
`out`	Filter outgoing routing updates.
`<interface>`	The interface on which distribute-list applies. For instance: vlan2

Default Disabled

Mode RIP Router Configuration or RIP Router Address Family Configuration for a VRF instance

Usage Filter out incoming or outgoing route updates using access-list or prefix-list. If you do not specify the name of the interface, the filter will be applied to all interfaces.

Examples In this example the following commands are used to apply an access list called myfilter to filter incoming routing updates in VLAN2

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# distribute-list prefix myfilter in
vlan2
```

This example applies the commands of the previous example, but to a specific VRF named blue:

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# address-family ipv4 vrf blue
awplus(config-router-af)# distribute-list prefix myfilter in
vlan2
```

Related Commands access-list extended (named)
ip prefix-list

fullupdate (RIP)

Use this command to specify which routes RIP should advertise when performing a triggered update. By default, when a triggered update is sent, RIP will only advertise those routes that have changed since the last update. When fullupdate is configured, the switch advertises the full RIP route table in outgoing triggered updates, including routes that have not changed. This enables faster convergence times, or allow inter-operation with legacy network equipment, but at the expense of larger update messages.

Use the no variant of this command to disable this feature.

Syntax

```
fullupdate
no fullupdate
```

Default By default this feature is disabled.

Mode RIP Router Configuration or RIP Router Address Family Configuration for a VRF instance

Usage If VRF-Lite is configured, you can apply this command for either the global routing environment, or to a specific VRF instance.

Examples Use the following commands to enable the fullupdate (RIP) function:

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# fullupdate
```

Use the following commands to enable the full update (RIP) function on a the VRF instance named `blue`:

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# address-family ipv4 vrf blue
awplus(config-router-af)# fullupdate
```

ip rip authentication key-chain

Use this command to enable RIPv2 authentication on an interface and specify the name of the key chain to be used.

Use the no variant of this command to disable this function.

Syntax

```
ip rip authentication key-chain <key-chain-name>
no ip rip authentication key-chain
```

Parameter	Description
<key-chain-name>	Specify the name of the key chain. This is an alpha-numeric string, but it cannot include spaces.

Mode Interface Configuration for VLAN interfaces only.

Usage This command can only be used on VLAN interfaces. Use this command to perform authentication on the interface. Not configuring the key chain results in no authentication at all.

The AlliedWare Plus™ implementation provides the choice of configuring authentication for single key or multiple keys at different times. Use the ip rip authentication string command for single key authentication. Use the ip rip authentication key-chain command for multiple keys authentication. See Chapter 33, RIP Configuration for illustrated RIP configuration examples.

For multiple key authentication, use the following steps to configure a route to enable RIPv2 authentication using multiple keys at different times:

Step 1: Define a key chain:

In the Configure mode, identify a key chain with a key chain name using the following command:

```
awplus# configure terminal
awplus(config)# key chain <key-chain-name>
```

where *<key-chain-name>* is the name of the chain to manage, and should not include spaces.

Step 2: Define the key or keys:

In the Keychain mode, specify a key on this key chain using the following command:

```
awplus(config-keychain)# key <keyid>
```

where *<keyid>* (a decimal number in the range 1 to 2147483647) is the Key Identifier number.

Step 3: Define the authentication string or password:

In the Keychain-key mode, define the password used by a key, using the following command:

```
awplus(config-keychain-key)# key-string <key-password>
```

where *<key-password>* is a string of characters that can contain spaces, to be used as a password by the key.

Step 4: Set key management options:

This step can be performed at this stage or later when multiple keys are used.
The options are configured in the keychain-key command mode.

Set the time period during which the authentication key on a key chain is received as valid, using the accept-lifetime command:

```
awplus(config-keychain-key)# accept-lifetime <START> <END>
```

where <*START*> and <*END*> are the beginning and end of the time period.

Set the time period during which the authentication key on a key chain can be sent, using the send-lifetime command:

```
awplus(config-keychain-key)# send-lifetime <START> <END>
```

where <*START*> and <*END*> are the beginning and end of the time period.

Step 5: Enable authentication on an interface:

In the Interface mode, enable authentication on `vlan3` and specify the key chain to be used, using the following command:

```
awplusawpluls# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# ip rip authentication key-chain <key-chain-name>
```

where *<key-chain-name>* is a set of valid authentication keys.

Step 6: Specify the mode of authentication for the given interface:

In the Interface mode, specify whether the interface uses text or MD5 authentication using:

```
awplus(config-if)# ip rip authentication mode {md5|text}
```

Example In the following sample multiple keys authentication RIP configuration, a password *toyota* is set for key 1 in key chain *cars*. Authentication is enabled on `vlan1` and the authentication mode is set to MD5:

```
                    awplus# configure terminal
             awplus(config)# key chain cars
    awplus(config-keychain)# key 1
awplus(config-keychain-key)# key-string toyota
awplus(config-keychain-key)# accept-lifetime 10:00:00 Apr 08
                             2008 duration 43200
awplus(config-keychain-key)# send-lifetime 10:00:00 Apr 08
                             2008 duration 43200
awplus(config-keychain-key)# exit
    awplus(config-keychain)# exit
             awplus(config)# interface vlan1
          awplus(config-if)# ip rip authentication key-chain
                             cars
          awplus(config-if)# ip rip authentication mode md5
           awplus(confi-if)# exit
             awplus(config)# exit
                    awplus#
```

Example In the following example, interface `vlan23` is configured to use key-chain authentication with the keychain *mykey*. See the key command for a description of how a key chain is created.

```
          awplus# configure terminal
   awplus(config)# interface vlan23
awplus(config-if)# ip rip authentication key-chain mykey
```

Related Commands

accept-lifetime
send-lifetime
ip rip authentication mode
ip rip authentication string
key
key chain

ip rip authentication mode

Use this command to specify the type of authentication mode used for RIP v2 packets.

Use the no variant of this command to restore clear text authentication.

Syntax

```
ip rip authentication mode {md5|text}
no ip rip authentication mode
```

Parameter	Description
`md5`	Uses the keyed MD5 authentication algorithm.
`text`	Specifies clear text or simple password authentication.

Default Text authentication is enabled

Mode Interface Configuration for VLAN interfaces only.

Usage This command can only be configured on VLAN interfaces. The AlliedWare Plus™ implementation provides the choice of configuring authentication for single key or multiple keys at different times. Use the ip rip authentication string command for single key authentication. Use the ip rip authentication key-chain command for multiple keys authentication. See Chapter 33, RIP Configuration for illustrated RIP configuration examples.

Use the following steps to configure a route to enable RIPv2 authentication using a single key or password:

Step 1: Define the authentication string or password

In the Interface Configuration mode, specify the authentication string or password used by the key, using the following command:

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip rip authentication string <auth-string>
```

where *<auth-string>* is the authentication string or password and it can include spaces.

Step 2: Specify the mode of authentication for the given interface:

In the Interface Configuration mode, specify if the interface will use text or MD5 authentication, using the following command:

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip rip authentication mode {md5|text}
```

See the sample below to specify *mykey* as the authentication string with MD5 authentication:

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip rip authentication string mykey
awplus(config-if)# ip rip authentication mode md5
```

For multiple keys authentication, use the following steps to configure a route to enable RIPv2 authentication using multiple keys at different times:

Step 1: Define a key chain:

In the Global Configuration mode, identify a key chain with a key chain name using the following command:

```
awplus# configure terminal
awplus(config)# key chain <key-chain-name>
```

where *<key-chain-name>* is the name of the chain to manage, a text string with no spaces.

Step 2: Define the key or keys:

In the Keychain Configuration mode, specify a key on this key chain using the following command:

```
awplus(config-keychain)# key <keyid>
```

where *<keyid>* (a decimal number in the range 1 to 2147483647) is the Key Identifier number.

Step 3: Define the authentication string or password:

In the Keychain-key Configuration mode, define the password used by a key, using the following command:

```
awplus(config-keychain-key)# key-string <key-password>
```

where *<key-password>* is a string of characters that can include spaces, to be used as a password by the key.

Step 4: Set key management options:

This step can be performed at this stage or later when multiple keys are used.
The options are configured in the Keychain-key Configuration mode.

Set the time period during which the authentication key on a key chain is received as valid, using the accept-lifetime command:

```
awplus(config-keychain-key)# accept-lifetime START END
```

where *START* and *END* are the beginning and end of the time period.

Set the time period during which the authentication key on a key chain can be sent, using the

send-lifetime command:

```
awplus(config-keychain-key)# send-lifetime START END
```

where *START* and *END* are the beginning and end of the time period.

Step 5: Enable authentication on an interface:

In the Interface Configuration mode, enable authentication on an interface and specify the key chain to be used, using the following command:

```
awplus(config-if)# ip rip authentication key-chain <key-
                   chain-name>
```

where *<key-chain-name>* is a set of valid authentication keys, as defined in Step 1.

Step 6: Specify the mode of authentication for the given interface:

In the Interface Configuration mode, specify whether the interface uses text or MD5 authentication using:

```
awplus(config-if)# ip rip authentication mode {md5|text}
```

Example In the following sample multiple keys authentication RIP configuration, a password *toyota* is set for key 1 in key chain *cars*. Authentication is enabled on `vlan1` and the authentication mode is set to MD5:

```
                    awplus# configure terminal
             awplus(config)# key chain cars
     awplus(config-keychain)# key 1
awplus(config-keychain-key)# key-string toyota
awplus(config-keychain-key)# accept-lifetime 10:00:00 Apr 08
                            2008 duration 43200
awplus(config-keychain-key)# send-lifetime 10:00:00 Apr 08 2008
                            duration 43200
awplus(config-keychain-key)# exit
     awplus(config-keychain)# exit
              awplus(config)# interface vlan1
           awplus(config-if)# ip rip authentication key-chain
                            cars
           awplus(config-if)# ip rip authentication mode md5
            awplus(confi-if)# exit
              awplus(config)# exit
                    awplus#
```

Example The following example shows md5 authentication configured on `vlan2`, ensuring

authentication of rip packets received on this interface.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip rip authentication mode md5
```

Related Commands ip rip authentication string
ip rip authentication key-chain

ip rip authentication string

Use this command to specify the authentication string or password used by a key.

Use the no variant of this command to remove the authentication string.

Syntax

```
ip rip authentication string <auth-string>
no ip rip authentication string
```

Parameter	Description
<auth-string>	The authentication string or password used by a key. It is an alpha-numeric string and can include spaces.

Mode Interface Configuration for VLAN interfaces only.

Usage This command can only be configured on VLAN interfaces. The AlliedWare Plus™ implementation provides the choice of configuring authentication for single key or multiple keys at different times. Use this command to specify the password for a single key on an interface. Use the ip rip authentication key-chain command for multiple keys authentication. See Chapter 33, RIP Configuration for further RIP configuration examples.

Use the following steps to configure a route to enable RIPv2 authentication using a single key or password:

Step 1: Define the authentication string or password:

In the Interface Configuration mode, specify the authentication string or password used by the key, using the following commands to configure the authentication string on `vlan3`:

```
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# ip rip authentication string <auth-string>
```

where *<auth-string>* is the authentication string or password.

Step 2: Specify the mode of authentication for the given interface:

In the Interface Configuration mode, specify if the interface will use text or MD5 authentication, using the following command:

```
awplus(config-if)# ip rip authentication mode {md5|text}
```

Example See the example below to specify `mykey` as the authentication string with MD5 authentication:

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip rip authentication string mykey
awplus(config-if)# ip rip authentication mode md5
```

Example In the following example, the interface `vlan2` is configured to have an authentication string as `guest`. Any received RIP packet in that interface should have the same string as password.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip rip authentication string guest
```

Related commands ip rip authentication key-chain
ip rip authentication mode

ip rip receive-packet

Use this command to configure the interface to enable the reception of RIP packets.

Use the no variant of this command to disable this feature.

Syntax

```
ip rip receive-packet
no ip rip receive-packet
```

Default Receive-packet is enabled

Mode Interface Configuration for VLAN interfaces only.

Usage This command can only be configured on VLAN interfaces.

Example This example shows packet receiving being turned on for interface `vlan3`.

```
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# ip rip receive-packet
```

Related Commands ip rip send-packet

ip rip receive version

Use this command to specify the version of RIP packets accepted on an interface and override the setting of the version command.

Use the no variant of this command to use the setting specified by the version command on page 34.51.

Syntax

```
ip rip receive version {[1][2]}
no ip rip receive version
```

Parameter	Description
1	Specifies acceptance of RIP version 1 packets on the interface.
2	Specifies acceptance of RIP version 2 packets on the interface.

Default Version 2

Mode Interface Configuration for VLAN interfaces only.

Usage This command can only be configured on VLAN interfaces. This command applies to a specific VLAN interface and overrides any the version specified by the version command.

RIP can be run in version 1 or version 2 mode. Version 2 has more features than version 1; in particular RIP version 2 supports authentication and classless routing. Once the RIP version is set, RIP packets of that version will be received and sent on all the RIP-enabled interfaces.

Example In the following example, interface `vlan3` is configured to receive both RIP version 1 and 2 packets.

```
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# ip rip receive version 1 2
```

Related Commands version

ip rip send-packet

Use this command to enable sending RIP packets through the current interface.

Use the no variant of this command to disable this feature.

Syntax

```
ip rip send-packet
no ip rip send-packet
```

Default Send packet is enabled

Mode Interface Configuration for VLAN interfaces only.

Usage This command can only be configured on VLAN interfaces.

Example This example shows packet sending being turned on for interface `vlan4`.

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ip rip send-packet
```

Related Commands ip rip receive-packet

ip rip send version

Use this command to specify the version of RIP packets sent on an interface and override the setting of the version command.

Use the no variant of this command to use the setting specified by the version command.

Syntax

```
ip rip send version {[1][2]|1-compatible}
no ip rip send version
```

Parameter	Description
1	Specifies sending of RIP version 1 packets out of an interface.
2	Specifies sending of RIP version 2 packets out of an interface.
1-compatible	Specify this parameter to send RIP version 1 compatible packets from a version 2 RIP interface. Note that applying this mechanism causes version 2 RIP to broadcast the packets instead of multicasting them.

Default RIP version 2 is enabled by default.

Mode Interface Configuration for VLAN interfaces only.

Usage This command can only be configured on VLAN interfaces. This command applies to a specific interface and overrides any the version specified by the version command.

RIP can be run in version 1 or version 2 mode. Version 2 has more features than version 1; in particular RIP version 2 supports authentication and classless routing. Once the RIP version is set, RIP packets of that version will be received and sent on all the RIP-enabled interfaces.

Examples In the following example, interface vlan4 is configured to send both RIP version 1 and 2 packets.

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ip rip send version 1 2
```

In the following example, interface vlan2 is configured to send RIP version 1-compatible packets; so it broadcasts both RIP version 1 and 2 packets.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip rip send version 1-compatible
```

In the following example, interface `vlan4` is configured to use the RIP version specified by the version command.

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# no ip rip send version
```

Related Commands version

ip rip split-horizon

Use this command to perform the split-horizon action on the interface. The default is split-horizon poisoned.

Use the no variant of this command to disable this function.

Syntax

```
ip rip split-horizon [poisoned]
no ip rip split-horizon
```

Parameter	Description
poisoned	Performs split-horizon with poisoned reverse.

Default Split horizon poisoned is the default.

Mode Interface Configuration for VLAN interfaces only.

Usage This command can only be configured on VLAN interfaces. Use this command to avoid including routes in updates sent to the same gateway from which they were learned. Using the split horizon command omits routes learned from one neighbor, in updates sent to that neighbor. Using the poisoned parameter with this command includes such routes in updates, but sets their metrics to infinity. Thus, advertising that these routes are not reachable.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip rip split-horizon poisoned
```

key

Use this command to manage, add and delete authentication keys in a key-chain.

Use the no variant of this command to delete the authentication key.

Syntax

```
key <keyid>
no key <keyid>
```

Parameter	Description
<keyid>	<0-2147483647> Key identifier number.

Mode Keychain Configuration

Usage This command allows you to enter the keychain-key mode where a password can be set for the key.

Example The following example configures a key number 1 and shows the change into a keychain-key command mode prompt.

```
awplus# configure terminal
awplus(config)# key chain mychain
awplus(config-keychain)# key 1
awplus(config-keychain-key)#
```

Related Commands

key chain
key-string
accept-lifetime
send-lifetime

key chain

Use this command to enter the key chain management mode and to configure a key chain with a key chain name.

Use the no variant of this command to remove the key chain and all configured keys.

Syntax

```
key chain <key-chain-name>
no key chain <key-chain-name>
```

Parameter	Description
<key-chain-name>	Specify the name of the key chain to manage.

Mode Global Configuration

Usage This command allows you to enter the keychain mode from which you can specify keys on this key chain.

Example The following example shows the creation of a key chain named `mychain` and the change into keychain mode prompt.

```
awplus# configure terminal
awplus(config)# key chain mychain
awplus(config-keychain)#
```

Related Commands

key
key-string
accept-lifetime
send-lifetime

key-string

Use this command to define the password to be used by a key.

Use the no variant of this command to remove a password.

Syntax

```
key-string <key-password>
no key-string
```

Parameter	Description
<key-password>	A string of characters to be used as a password by the key.

Mode Keychain-key Configuration

Usage Use this command to specify passwords for different keys.

Examples In the following example, the password for `key1` in the key chain named `mychain` is set to password prime:

```
awplus# configure terminal
awplus(config)# key chain mychain
awplus(config-keychain)# key 1
awplus(config-keychain-key)# key-string prime
```

In the following example, the password for `key1` in the key chain named `mychain` is removed:

```
awplus# configure terminal
awplus(config)# key chain mychain
awplus(config-keychain)# key 1
awplus(config-keychain-key)# no key-string
```

Related Commands

key
key chain
accept-lifetime
send-lifetime

maximum-prefix

Use this command to configure the maximum number of RIP routes stored in the routing table.

Use the no variant of this command to disable all limiting of the number of RIP routes stored in the routing table.

Syntax

```
maximum-prefix <maxprefix> [<threshold>]
no maximum-prefix
```

Parameter	Description
<maxprefix>	<1-65535> The maximum number of RIP routes allowed.
<threshold>	<1-100> Percentage of maximum routes to generate a warning. The default threshold is 75%.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# maximum-prefix 150
```

neighbor (RIP)

Use this command to specify a neighbor router. It is used for each router to which you wish to send unicast RIP updates.

Use the no variant of this command to stop sending unicast updates to the specific router.

Syntax

```
neighbor <ip-address>
no neighbor <ip-address>
```

Parameter	Description
<ip-address>	The IP address of a neighboring router with which the routing information will be exchanged.

Default Disabled

Mode Router Configuration

Usage Use this command to exchange nonbroadcast routing information. It can be used multiple times for additional neighbors.

The passive-interface (RIP) command disables sending routing updates on an interface. Use the `neighbor` command in conjunction with the passive-interface (RIP) to send routing updates to specific neighbors.

Example

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# passive-interface vlan1
awplus(config-router)# neighbor 1.1.1.1
```

Related Commands passive-interface (RIP)

network (RIP)

Use this command to activate the transmission of RIP routing information on the defined network.

Use the no variant of this command to remove the specified network or VLAN as one that runs RIP.

Syntax

```
network {<network-address>[/<subnet-prefix-length>]|<vlan-name>}
no network {<network-address>[/<subnet-mask>]|<vlan-name>}
```

Parameter	Description
<network-address> [/<subnet-prefix-length>]	Specifies the network address to run RIP. Entering a subnet mask (or prefix length) for the network address is optional. Where no mask is entered, the switch will attempt to apply a mask that is appropriate to the class (A, B, or C) of the address entered, i.e. an IP address of 10.0.0.0 will have a prefix length of 8 applied to it.
<vlan-name>	Specify a VLAN name with up to 32 alphanumeric characters to run RIP.

Default Disabled

Mode RIP Router Configuration or RIP Router Address Family Configuration for a VRF instance

Usage Use this command to specify networks, or VLANs, to which routing updates will be sent and received. The connected routes corresponding to the specified network, or VLANs, will be automatically advertised in RIP updates. RIP updates will be sent and received within the specified network or VLAN.

When running VRF-Lite, this command can be applied to a VRF instance.

Example Use the following commands to activate RIP routing updates on network 172.16.20.0/24:

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# network 172.16.20.0/24
```

To activate RIP routing updates on `vlan3` for VRF instance `blue`.

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# address-family ipv4 vrf blue
awplus(config-router-af)# network vlan3
```

Related Commands

show ip rip
show running-config
clear ip rip route

offset-list (RIP)

Use this command to add an offset to the in and out metrics of routes learned through RIP.

Use the no variant of this command to remove the offset list.

Syntax

```
offset-list <access-list> {in|out} <offset> [<interface>]
no offset-list <access-list> {in|out} <offset> [<interface>]
```

Parameter	Description
<access-list>	Specifies the access-list number or names to apply.
in	Indicates the access list will be used for metrics of incoming advertised routes.
out	Indicates the access list will be used for metrics of outgoing advertised routes.
<offset>	<0-16> Specifies that the offset is used for metrics of networks matching the access list.
<interface>	An alphanumeric string that specifies the interface to match.

Default The default `offset value` is the metric value of the interface over which the updates are being exchanged.

Mode RIP Router Configuration or RIP Router Address Family Configuration for a VRF instance

Usage Use this command to specify the offset value that is added to the routing metric. When the networks match the access list the offset is applied to the metrics. No change occurs if the offset value is zero.

Examples In this example the router examines the RIP updates being sent out from interface `vlan2` and adds `5` hops to the routes matching the ip addresses specified in the access list `8`.

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# offset-list 8 in 5 vlan2
```

To apply this same command within the specific VRF instance named `blue`, use the following commands:

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# address-family ipv4 vrf blue
awplus(config-router-af)# offset-list 8 in 5 vlan2
```

Related Commands access-list (extended numbered)
access-list (standard numbered)

passive-interface (RIP)

Use this command to block RIP broadcasts on the VLAN interface.

Use the no variant of this command to disable this function.

Syntax

```
passive-interface <interface>
no passive-interface <interface>
```

Parameter	Description
<interface>	Specifies the interface name.

Default Disabled

Mode RIP Router Configuration or RIP Router Address Family Configuration for a VRF instance

Usage This command can only be configured for VLAN interfaces.

Examples Use the following commands to block RIP broadcasts on vlan20:

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# passive-interface vlan20
```

To apply this above example to a specific VRF instance named `green`, use the following commands:

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# address-family ipv4 vrf green
awplus(config-router-af)# passive-interface vlan20
```

Related Commands show ip rip

recv-buffer-size (RIP)

Use this command to run-time configure the RIP UDP (User Datagram Protocol) receive-buffer size to improve UDP reliability by avoiding UDP receive buffer overrun.

Use the no variant of this command to reset the configured RIP UDP receive-buffer size to the system default (196608 bits).

Syntax

```
recv-buffer-size <8192-2147483647>

no recv-buffer-size [<8192-2147483647>]
```

Parameter	Description
<8192-2147483647>	Specify the RIP UDP (User Datagram Protocol) buffer size value in bits.

Default 196608 bits is the system default when reset using the no variant of this command.

Mode Router Configuration

Examples

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# recv-buffer-size 23456789

awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# no recv-buffer-size 23456789
```

redistribute (RIP)

Use this command to redistribute information from other routing protocols into RIP. When using VRF-Lite, you can apply this command to a specific VRF instance.

Use the no variant of this command to disable the specified redistribution. The parameters metric and routemap may be used on this command, but have no effect.

Syntax

```
redistribute {connected|static|ospf|bgp} [metric <0-16>] [routemap
   <routemap>]
no redistribute {connected|static|ospf|bgp} [metric] [routemap]
```

Parameter	Description
`routemap`	Specifies route-map that controls how routes are redistributed.
`<routemap>`	The name of the route map.
`connected`	Redistribute from connected routes.
`static`	Redistribute from static routes.
`ospf`	Redistribute from Open Shortest Path First (OSPF).
`bgp`	Redistribute from Border Gateway Protocol (BGP).
`metric <0-16>`	Sets the value of the metric that will be applied to routes redistributed into RIP from other protocols.

Mode RIP Router Configuration or RIP Router Address Family Configuration for a VRF instance

Examples To apply the metric value 15 to static routes being redistributed into RIP, use the commands:

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# redistribute static metric 15
```

To apply the metric value 15 to static routes in address-family ipv4 VRF instance `blue` being redistributed into RIP, use the following commands:

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# address-family ipv4 vrf blue
awplus(config-router-af)# redistribute static metric 15
```

restart rip graceful

Use this command to force the RIP process to restart, and optionally set the grace-period.

Syntax `restart rip graceful [grace-period <1-65535>]`

Mode Privileged Exec

Default The default RIP grace-period is 60 seconds.

Usage After this command is executed, the RIP process immediately shuts down. It notifies the system that RIP has performed a graceful shutdown. Routes that have been installed into the route table by RIP are preserved until the specified grace-period expires.

When a restart rip graceful command is issued, the RIP configuration is reloaded from the last saved configuration. Ensure you first enter the command copy running-config startup-config.

When a master failover happens on a VCStack, the RIP grace-period will be the longest period between the default value (60 seconds is the default RIP grace-period) and the configured RIP grace-period value from this command. So the configured RIP grace-period value will not be used for a VCStack master failover if it is shorter than the default RIP grace-period value.

Example

```
awplus# copy running-config startup-config
awplus# restart rip graceful grace-period 100
```

rip restart grace-period

Use this command to change the grace period of RIP graceful restart.

Use the no variant of this command to disable this function.

Syntax

```
rip restart grace-period <1-65535>
no rip restart grace-period <1-65535>
```

Mode Global Configuration

Default The default RIP grace-period is 60 seconds.

Usage Use this command to enable the Graceful Restart feature on the RIP process. Entering this command configures a grace period for RIP.

When a master failover happens on a VCStack, the RIP grace-period will be the longest period between the default value (60 seconds is the default RIP grace-period) and the configured RIP grace-period value from this command. So the configured RIP grace-period value will not be used for a VCStack master failover if it is shorter than the default RIP grace-period value.

Example

```
awplus# configure terminal
awplus(config)# rip restart grace-period 200
```

route (RIP)

Use this command to configure static RIP routes.

Use the no variant of this command to disable this function.

Syntax

```
route <ip-addr/prefix-length>
no route <ip-addr/prefix-length>
```

Parameter	Description
<ip-addr/prefix-length>	The IPv4 address and prefix length.

Default No static RIP route is added by default.

Mode RIP Router Configuration or RIP Router Address Family Configuration for a VRF instance

Usage Use this command to add a static RIP route. After adding the RIP route, the route can be checked in the RIP routing table.

Example To create a static RIP route to IP subnet `192.168.1.0/24`, use the following commands:

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# route 192.168.1.0/24
```

To create a static RIP route to IP subnet `192.168.1.0/24`, for the VRF instance `red`, use the following commands

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# address-family ipv4 vrf red
awplus(config-router-af)# route 192.168.1.0/24
```

Related Commands

show ip rip
clear ip rip route

router rip

Use this global command to enter Router Configuration mode to enable the RIP routing process.

Use the no variant of this command to disable the RIP routing process.

Syntax

```
router rip
no router rip
```

Mode Global Configuration

Example This command is used to begin the RIP routing process:

```
                awplus# configure terminal
        awplus(config)# router rip
  awplus(config-router)# version 1
  awplus(config-router)# network 10.10.10.0/24
  awplus(config-router)# network 10.10.11.0/24
  awplus(config-router)# neighbor 10.10.10.10
```

Related Commands network (RIP)
version

send-lifetime

Use this command to specify the time period during which the authentication key on a key chain can be sent.

Syntax

```
send-lifetime <start-date>{<end-date>|duration <seconds>|infinite}
no send-lifetime
```

Parameter	Description	
<start-date>	Specifies the start period - time and date in the format DD MMM YYYY or MMM DD YYYY: *<hh:mm:ss> {<day> <month> <year> | <month> <day> <year>}*	
	<hh:mm:ss>	Time of the day when send-lifetime starts, in hours, minutes and seconds
	<day>	<1-31> Specifies the day of the month to start.
	<month>	Specifies the month of the year to start (the first three letters of the month, for example, Jan).
	<year>	<1993-2035> Specifies the year to start.
<end-date>	Specifies the end period - time and date in the format DD MMM YYYY or MMM DD YYYY: *<hh:mm:ss> {<day> <month> <year> | <month> <day> <year>}*	
	<hh:mm:ss>	Time of the day when lifetime expires, in hours, minutes and seconds.
	<day>	<1-31> Specifies the day of the month to expire.
	<month>	Specifies the month of the year to expire (the first three letters of the month, for example, Feb).
	<year>	<1993-2035> Specifies the year to expire.
<seconds>	<1-2147483646> Duration of the key in seconds.	
infinite	Never expires.	

Mode Keychain-key Configuration

Example The following example shows the setting of send-lifetime for key1 on the key chain named mychain.

```
awplus# configure terminal
awplus(config)# key chain mychain
awplus(config-keychain)# key 1
awplus(config-keychain-key)# send-lifetime 03:03:01 Jan 3 2004
04:04:02 Dec 6 2006
```

Related Commands

key
key-string
key chain
accept-lifetime

show debugging rip

Use this command to display the RIP debugging status for these debugging options: nsm debugging, RIP event debugging, RIP packet debugging and RIP nsm debugging.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show debugging rip
```

Mode

User Exec and Privileged Exec

Usage

Use this command to display the debug status of RIP.

Example

```
awplus# show debugging rip
```

show ip protocols rip

Use this command to display RIP process parameters and statistics.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip protocols rip`

Mode User Exec and Privileged Exec

Example

```
awplus# show ip protocols rip
```

Output Figure 34-1: Example output from the **show ip protocols rip** command:

```
Routing Protocol is "rip"
Sending updates every 30 seconds with +/-50%, next due in 12
seconds
Timeout after 180 seconds, garbage collect after 120 seconds
Outgoing update filter list for all interface is not set
Incoming update filter list for all interface is not set
Default redistribution metric is 1
Redistributing: connected static
Default version control: send version 2, receive version 2
Interface         Send  Recv   Key-chain
   vlan25            2     2
Routing for Networks:
  10.10.0.0/24
Routing Information Sources:
  Gateway          BadPackets BadRoutes  Distance Last Update
Distance: (default is 120
```

show ip rip

Use this command to show RIP routes.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip rip
```

Mode

User Exec and Privileged Exec

Example

```
awplus# show ip rip
```

Output

Figure 34-2: Example output from the **show up rip** command

```
awplus#show ip rip
Codes: R - RIP, Rc - RIP connected, Rs - RIP static
       C - Connected, S - Static, O - OSPF, B - BGP
Network         Next Hop Metric From If   Time
C 10.0.1.0/24             1      vlan20
S 10.10.10.0/24           1      vlan20
C 10.10.11.0/24           1      vlan20
S 192.168.101.0/24        1      vlan20
R 192.192.192.0/24        1      --
```

Related Commands

route (RIP)
network (RIP)
clear ip rip route

Equivalent Command

show ip rip vrf interface

show ip rip database

Use this command to display information about the RIP database.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip rip database [full]`

Parameter	Description
`full`	Specify the full RIP database including sub-optimal RIP routes.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip rip database
awplus# show ip rip database full
```

Related Commands show ip rip

show ip rip interface

Use this command to display information about the RIP interfaces. You can specify an interface name to display information about a specific interface.

Syntax `show ip rip interface [<interface>]`

Parameter	Description
<interface>	The interface to display information about. For instance: `vlan2`.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip rip interface
```

show ip rip vrf database

Use this command to display information about the RIP database that is associated with a specific VRF instance.

Entering this command with the full option included, will display information about the full RIP database (including sub-optimal routes) associated with a specific VRF instance.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip rip {vrf <vrf-name>|global} database [full]`

Parameter	Description
`vrf`	Specific VRF instance.
`<vrf-name>`	The name of the VRF instance.
`global`	The global routing and forwarding table.
`full`	Specify the full RIP database including sub-optimal RIP routes.

Mode User Exec and Privileged Exec

Example To display information about the RIP database associated with a VRF instance `blue`, use the command:.

```
awplus# show ip rip vrf blue database
```

Output Figure 34-3: Example output from the **show ip rip vrf blue database** command

```
Codes: R - RIP, Rc - RIP connected, Rs - RIP static
       C - Connected, S - Static, O - OSPF, B - BGP

   Network            Next Hop         Metric From            If       Time
Rc 192.168.30.0/24                          1                 vlan3
R  192.168.45.0/24    192.168.30.1          2 192.168.30.1    vlan3    02:46
```

Related Commands show ip rip

show ip rip vrf interface

Use this command to display information about the RIP interfaces that are associated with a specific VRF instance.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip rip {vrf <vrf-name>|global} interface [<interface-name>]`

Parameter	Description
`vrf`	Specific VRF instance.
`<vrf-name>`	The name of the VRF instance.
`global`	The global routing and forwarding table.
`<interface-name>`	The IP RIP interface (VLAN).

Mode User Exec and Privileged Exec

Example To display information about the RIP database associated with a VRF instance `blue`, use the command:.

```
awplus# show ip rip vrf blue interface
```

Output Figure 34-4: Example output from the **show ip rip vrf blue interface vlan3** command

```
Codes: R - RIP, Rc - RIP connected, Rs - RIP static
       C - Connected, S - Static, O - OSPF, B - BGP

   Network            Next Hop         Metric From            If       Time
Rc 192.168.30.0/24                           1                vlan3
R  192.168.45.0/24    192.168.30.1 2   192.168.30.1           vlan3    02:46
```

Note

The Time parameter operates as follows:

- RIP updates occur approximately every 30 seconds.
- Each update resets a count-down timer to 180 seconds (3 minutes).
- The Time parameter displays the count-down from the last reset.

Related Commands show ip rip

timers (RIP)

Use this command to adjust routing network timers.

Use the no variant of this command to restore the defaults.

Syntax

```
timers basic <update> <timeout> <garbage>
no timers basic
```

Parameter	Description
<update>	<5-2147483647> Specifies the period at which RIP route update packets are transmitted. The default is 30 seconds.
<timeout>	<5-2147483647> Specifies the routing information timeout timer in seconds. The default is 180 seconds. After this interval has elapsed and no updates for a route are received, the route is declared invalid.
<garbage>	<5-2147483647> Specifies the routing garbage collection timer in seconds. The default is 120 seconds.

Default Enabled

Mode RIP Router Configuration or RIP Router Address Family Configuration for a VRF instance

Usage This command adjusts the RIP timing parameters.

The update timer is the time between sending out updates, that contain the complete routing table, to every neighboring router.

If an update for a given route has not been seen for the time specified by the timeout parameter, that route is no longer valid. However, it is retained in the routing table for a short time, with metric 16, so that neighbors are notified that the route has been dropped.

When the time specified by the garbage parameter expires the metric 16 route is finally removed from the routing table. Until the garbage time expires, the route is included in all updates sent by the router.

All the routers in the network must have the same timers to ensure the smooth operation of RIP throughout the network.

Examples

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# timers basic 30 180 120
```

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# address-family ipv4 vrf blue
awplus(config-router-af)# timers basic 30 180 120
```

undebug rip

Use this command to disable the options set for debugging information of RIP events, packets and communication between RIP and NSM.

This command has the same effect as the no debug rip command.

Syntax `undebug rip {all|events|nsm|<packet>}`

Parameter	Description
`all`	Disables all RIP debugging.
`events`	Disables the logging of RIP events.
`nsm`	Disables the logging of RIP and NSM communication.
<packet>	`packet [recv|send] [detail]` Disables the debugging of RIP packets.
`recv`	Disables the logging of received packet information.
`send`	Disables the logging of sent packet information.
`detail`	Disables the logging of sent or received RIP packets.

Mode Privileged Exec

Example

```
awplus# undebug rip packet
```

Related Commands debug rip

version

Use this command to specify a RIP version used globally by the router. If VRF- Lite is configured, you can specify a RIP version either globally, or for a particular VRF instance.

Use the no variant of this command to restore the default version.

Syntax

```
version {1|2}
no version
```

Parameter	Description
1|2	Specifies the version of RIP processing.

Default Version 2

Mode RIP Router Configuration or RIP Router Address Family Configuration for a VRF instance

Usage RIP can be run in version 1 or version 2 mode. Version 2 has more features than version 1; in particular RIP version 2 supports authentication and classless routing. Once the RIP version is set, RIP packets of that version will be received and sent on all the RIP-enabled interfaces.

Setting the version command has no impact on receiving updates, only on sending them. The ip rip send version command overrides the value set by the version command on an interface-specific basis. The ip rip receive version command allows you to configure a specific interface to accept only packets of the specified RIP version. The ip rip receive version command and the ip rip send version command override the value set by this command.

Examples

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# version 1
```

```
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# address-family ipv4 vrf blue
awplus(config-router-af)# version 1
```

Validation Commands show running-config

```
awplus#show running-config
!
router rip
 version 1
!
```

Related Commands ip rip receive version
ip rip send version

Chapter 35: RIPng Configuration

Introduction 35.2
Enabling RIPng 35.2
Troubleshooting RIPng Adjacency 35.5

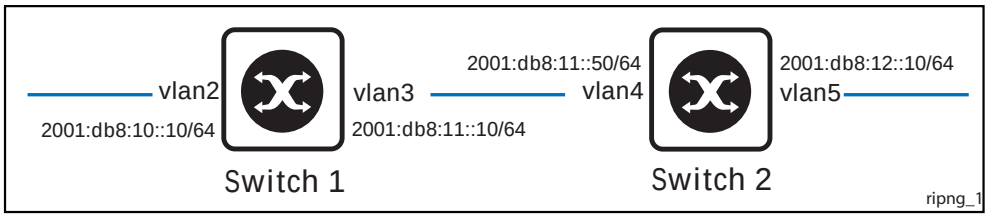
Introduction

This chapter contains a basic RIPng configuration example. To see details on the RIPng commands used in these examples, or to see the outputs of the Validation commands, refer to Chapter 36, RIPng Commands.

Enabling RIPng

This example shows the minimum configuration required for enabling RIPng on an interface. Switch 1 and Switch 2 are two switches connected via network 2001:db8:11::/64.

To enable RIPng, first add IPv6 addresses to interfaces and then enable RIPng on each interface.



Switch 1

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) and enter the Interface Configuration mode.
`awplus(config-if)#`	
`ipv6 address 2001db8:10::10/64`	Configure the IPv6 address on interface `vlan2`.
`awplus(config-if)#`	
`ipv6 router rip`	Enable RIPng routing on interface `vlan2`.
`awplus(config-if)#`	
`exit`	Exit Interface mode and enter Global Configuration mode.
`awplus(config)#`	
`interface vlan3`	Specify the interface (`vlan3`) and enter the Interface Configuration mode.
`awplus(config-if)#`	
`ipv6 address 2001db8:11::10/64`	Configure the IPv6 address on interface `vlan3`.
`awplus(config-if)#`	
`ipv6 router rip`	Enable RIPng routing on interface `vlan3`.
`awplus(config-if)#`	
`exit`	Exit Interface mode and enter Global Configuration mode.

Switch 1(cont.)

`awplus(config)#`	
`router ipv6 rip`	Define a RIPng routing process and enter Router Configuration mode.
`awplus(config-router)#`	
`exit`	Exit Router Configuration mode and return to Global Configuration mode.
`awplus(config)#`	
`exit`	Exit Global Configuration mode and return to Privileged Exec mode.

Switch 2

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`interface vlan5`	Specify the interface (`vlan5`) and enter the Interface Configuration mode.
`awplus(config-if)#`	
`ipv6 address 2001db8:12::10/64`	Configure the IPv6 address on interface `vlan5`.
`awplus(config-if)#`	
`ipv6 router rip`	Enable RIPng routing on interface `vlan5`
`awplus(config-if)#`	
`exit`	Exit Interface mode and enter Global Configuration mode.
`awplus(config)#`	
`interface vlan4`	Specify the interface (`vlan4`) and enter the Interface Configuration mode.
`awplus(config-if)#`	
`ipv6 address 2001db8:11::50/64`	Configure the IPv6 address on interface `vlan4`.
`awplus(config-if)#`	
`ipv6 router rip`	Enable RIPng routing on interface `vlan4`.
`awplus(config-if)#`	
`exit`	Exit Interface mode and enter Global Configuration mode.
`awplus(config)#`	
`router ipv6 rip`	Define a RIPng routing process and enter Router Configuration mode.

Switch 2 (cont.)

`awplus(config-router)#`	
`exit`	Exit Router Configuration mode and return to Global Configuration mode.
`awplus(config)#`	
`exit`	Exit Global Configuration mode and return to Privileged Exec mode.

Names of Commands Used

router ipv6 rip
ipv6 router rip

Validation Commands

show ipv6 rip

Troubleshooting RIPng Adjacency

Follow the steps below to troubleshoot RIPng adjacency:

Step 1. Confirm the Interface is not shutdown

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) and enter the Interface mode.
`awplus(config-if)#`	
`no shutdown`	Ensure the interface is not administratively shutdown.
`awplus(config-if)#`	
`exit`	Exit Interface Configuration mode and enter Global Configuration mode.
`awplus(config)#`	
`exit`	Exit Global Configuration mode and return to Privileged Exec mode.
`awplus#`	
`show ipv6 interface brief`	Use the `show interface` command to make sure that the interface is not administratively shutdown.

Step 2. Confirm RIPng is enabled on the interface

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) and enter the Interface Configuration mode.
`awplus(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) and enter the Interface Configuration mode.
`awplus(config-if)#`	
`ipv6 router rip`	Enable RIPng routing on interface `vlan2`.
`awplus(config-if)#`	
`exit`	Exit Interface Configuration mode and enter Global Configuration mode.
`awplus(config)#`	
`router ipv6 rip`	Define a RIPng routing process and enter Router Configuration mode.

Step 2. Confirm RIPng is enabled on the interface(cont.)

`awplus(config-router)#`	
`exit`	Exit Router Configuration mode and return to Global Configuration mode.
`awplus(config)#`	
`exit`	Exit Global Configuration mode and return to Privileged Exec mode.
`awplus#`	

`show ipv6 rip interface vlan2`	Check the configuration. E.g.:
	`vlan2 is up, line protocol is up`
	`  Routing Protocol: RIPng`
	`  Passive interface: Disabled`
	`  Split horizon: Enabled with Poisoned Reversed`
	`  IPv6 interface address:`
	`  2001:db8:1::10/64`
	`  2001:db8:204:76ff:fec8::/10`

Step 3. Check the Interface is not a Passive Interface

`awplus#`	

`show running-config`	Check that the interface is not configured as a passive interface.
	If it is configured to be passive, this is displayed in the output from the show running config command, e.g.:
	`!`
	`router ipv6 rip`
	`passive interface vlan2`
	`!`

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router ipv6 rip`	Enter the Router Configuration mode.
`awplus(config-router)#`	
`no passive interface port1.0.1`	Remove the passive interface.

Step 4. Ensure RIPng Advertisements get exchanged

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`debug ipv6 rip event`	Check on the interface to make sure that RIPng advertisements are being sent and received.

Step 4. Ensure RIPng Advertisements get exchanged(cont.)

`awplus(config)#`	
`debug ipv6 rip packet detail`	Check on the interface to make sure that RIPng advertisements are being sent and received.
`awplus(config)#`	
`exit`	Exit Global Configuration mode to enter Privileged Exec mode.
`awplus#`	
`terminal monitor`	View log messages, or use a packet sniffer such as Ethereal or Wireshark, to verify RIPng advertisements.

Chapter 36: RIPng Commands

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Introduction

This chapter contains RIPng commands. RIPng (Routing Information Protocol next generation) is an extension of RIPv2 to support IPv6. RFC 2080 specifies RIPng. The differences between RIPv2 and RIPng are:

- RIPng does not support RIP updates authentication
- RIPng does not allow the attachment of arbitrary tags to routes
- RIPng requires the encoding of the next-hop for a set of routes

For more information, see Chapter 35, RIPng Configuration.

Command List

This section provides an alphabetical reference of commands used to configure RIPng for IPv6.

aggregate-address (RIPng)

Use this command to aggregate RIPng routes.

Use the no variant of this command to disable this feature.

Syntax

```
aggregate-address <ipv6-addr/prefix-length>
no aggregate-address <ipv6-addr/prefix-length>
```

Parameter	Description
<ipv6-addr/prefix-length>	Specify the IPv6 Address in the format *X:X::X:X/Prefix-Length*. The prefix-length is a decimal integer between 1 and 128.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# aggregate-address 2001:db8::/32
```

cisco-metric-behavior (RIPng)

Use this command to enable or disable the RIPng routing metric update to conform to Cisco's implementation. This command is provided to allow inter-operation with older Cisco devices that do not conform to the RFC standard for RIP route metrics.

Use the no variant of this command to disable this feature.

Syntax

```
cisco-metric-behavior {enable|disable}
no cisco-metric-behavior
```

Parameter	Description
`enable`	Enables updating the metric consistent with Cisco.
`disable`	Disables updating the metric consistent with Cisco.

Default By default, the Cisco metric-behavior is disabled.

Mode Router Configuration

Examples To enable the routing metric update to behave as per the Cisco implementation, enter the commands:

```
awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# cisco-metric-behavior enable
```

:

To disable the routing metric update to behave as per the default setting, enter the commands:

```
awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# no cisco-metric-behavior
```

Validation Commands show running-config

Related Commands cisco-metric-behavior (RIP)

clear ipv6 rip route

Use this command to clear specific data from the RIPng routing table.

Syntax

```
clear ipv6 rip route {<ipv6-addr/prefix-length>|all|connected|rip|
   static|ospf}
```

Parameter	Description
<ipv6-addr/prefix-length>	Specify the IPv6 Address in format *X:X::X:X/Prefix-Length*. The prefix-length is a decimal integer between 1 and 128. Removes entries which exactly match this destination address from the RIPng routing table.
`connected`	Removes redistributed connected entries from RIPng routing table.
`static`	Removes redistributed static entries from the RIPng routing table.
`rip`	Removes RIPng routes from the RIPng routing table.
`ospf`	Removes redistributed OSPFv3 routes from the RIPng routing table.
`all`	Clears the entire RIPng routing table.

Mode Privileged Exec

Example

```
awplus# clear ipv6 rip route all
awplus# clear ipv6 rip route 2001:db8::/32
```

debug ipv6 rip

Use this command to enable RIPng debugging and specify debugging for RIPng events, RIPng packets, or RIPng communication with NSM processes.

Use the no variant of this command to disable RIPng debugging.

Syntax

```
debug ipv6 rip [all|events|nsm|packet [detail]|recv [detail]|
    send [detail]]

no debug ipv6 rip [all|events|nsm|packet [detail]|recv [detail]|
    send [detail]]
```

Parameter	Description
`all`	Displays all RIPng debugging showing RIPng events debug information, RIPng received packets information, and RIPng sent packets information.
`events`	Displays RIPng events debug information.
`nsm`	Displays RIPng and NSM communication.
`packet`	Displays RIPng packets only.
`recv`	Displays information for received packets.
`send`	Displays information for sent packets.
`detail`	Displays detailed information for the sent or received packet.

Default RIPng debugging is disabled by default.

Mode Privileged Exec and Global Configuration

Example

```
awplus# debug ipv6 rip events
awplus# debug ipv6 rip packet send detail
awplus# debug ipv6 rip nsm
```

Related Commands undebug ipv6 rip

default-information originate (RIPng)

Use this command to generate a default route into RIPng.

Use the no variant of this command to disable this feature.

Syntax

```
default-information originate
no default-information originate
```

Default Disabled

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# default-information originate
```

default-metric (RIPng)

Use this command to specify the metrics to be assigned to redistributed routes.

Use the no variant of this command to reset the metric back to its default (1).

Syntax

```
default-metric <1-16>
no default-metric [<1-16>]
```

Parameter	Description
<1-16>	Metric value.

Default By default, the metric value is set to 1.

Mode Router Configuration

Usage This command is used with the redistribute (RIPng) command to make the routing protocol use the specified metric value for all redistributed routes, regardless of the original protocol that the route has been redistributed from.

Example

```
awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# default-metric 8
```

distribute-list (RIPng)

Use this command to filter incoming or outgoing route updates using the access-list or the prefix-list.

Use the no variant of this command to disable this feature.

Syntax

```
distribute-list [<access-list>|prefix <prefix-list-name>] [in|out]
    [<interface>]

no distribute-list [<access-list>|prefix <prefix-list-name>] [in|out]
    [<interface>]
```

Parameter	Description
<access-list>	Specifies the IPv6 access-list number or name to use.
<prefix-list-name>	Filter prefixes in routing updates. Specify the name of the IPv6 prefix-list to use.
<interface>	The interface for which distribute-list applies. For instance: `vlan2`.
`in`	Filter incoming routing updates.
`out`	Filter outgoing routing updates.

Default Disabled

Mode Router Configuration

Usage Filter out incoming or outgoing route updates using the access-list or the prefix-list. If you do not specify the name of the interface, the filter is applied to all the interfaces.

Example

```
awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# distribute-list prefix myfilter in vlan2
```

Related Commands ipv6 access-list extended (named)
ipv6 nd prefix

ipv6 rip split-horizon

Use this command to perform the split-horizon action on the interface. The default is split-horizon with poisoned reverse.

Use the no variant of this command to disable this function.

Syntax

```
ipv6 rip split-horizon [poisoned]
no ipv6 rip split-horizon
```

Parameter	Description
split-horizon	Perform split-horizon without poisoned reverse
poisoned	Performs split-horizon with poisoned reverse.

Default Split-horizon with poisoned reverse is the default.

Mode Interface Configuration for VLAN interfaces only.

Usage This command can only be configured on VLAN interfaces. Use this command to avoid including routes in updates sent to the same gateway from which they were learned. Using the split horizon command omits routes learned from one neighbor, in updates sent to that neighbor. Using the poisoned parameter with this command includes such routes in updates, but sets their metrics to infinity. Thus, advertising that these routes are not reachable.

Examples

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 rip split-horizon

awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 rip split-horizon poisoned

awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ipv6 rip split-horizon
```

Validation Commands show running-config

ipv6 router rip

Use this command to enable RIPng routing on the interface.

Use the no variant of this command to disable RIPng routing.

Syntax

```
ipv6 router rip
no ipv6 router rip
```

Default Disabled

Mode Interface Configuration for VLAN interfaces only.

Usage This command can only be configured on VLAN interfaces.

Examples

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 router rip
```

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ipv6 router rip
```

neighbor (RIPng)

Use this command to specify a neighbor router.

Use the no variant of this command to disable the specific router.

Syntax

```
neighbor <ipv6-link-local-addr> <interface>
no neighbor <ipv6-link-local-addr> <interface>
```

Parameter	Description
<ipv6-link-local-addr>	Specify the link-local IPv6 address (in the format *X*:*X*::*X*:*X*) of a neighboring router to exchange routing information with.
<interface>	The interface. For instance: `vlan2`.

Mode Router Configuration

Usage Use this command to exchange non broadcast routing information. It can be used multiple times for additional neighbors.

The passive-interface (RIPng) command disables sending routing updates on an interface. Use the `neighbor` command in conjunction with the passive-interface (RIPng) command to send routing updates to specific neighbors.

Examples

```
awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# neighbor 2001:db8:1::1 vlan2

awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# no neighbor 2001:db8:1::1 vlan2
```

Related Commands passive-interface (RIPng)

offset-list (RIPng)

Use this command to add an offset to in and out metrics to routes learned through RIPng.

Use the no variant of this command to remove an offset list.

Syntax

```
offset-list {<access-list-number>|<access-list-name>} {in|out}
    <offset> [<interface>]

no offset-list {<access-list-number>|<access-list-name>} {in|out}
    <offset> [<interface>]
```

Parameter	Description
<access-list-number>	Specify an access-list number to apply to an offset-list.
<access-list-name>	Specify and access-list name to apply to an offset-list.
`in`	Indicates the access-list will be used for metrics of incoming advertised routes
`out`	Indicates the access-list will be used for metrics of outgoing advertised routes
<offset>	`<0-16>` Specifies that the offset is used for metrics of networks matching the access-list
<interface>	The interface to match. For instance: `vlan2`.

Default The default offset value is the metric value of the interface over which the updates are being exchanged.

Mode Router Configuration

Usage Use this command to specify the offset value that is added to the routing metric. When the networks match the access list the offset is applied to the metrics. No change occurs if the offset value is zero.

Example In this example the router examines the RIPng updates being sent out from interface `vlan2` and adds `8` hops to the routes matching the ip addresses specified in the access list `2`.

```
awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# offset-list mylist in 8 vlan2
```

passive-interface (RIPng)

Use this command to enable suppression of routing updates on an interface.

Use the no variant of this command to disable this function.

Syntax

```
passive-interface <interface>
no passive-interface <interface>
```

Parameter	Description
<interface>	The interface. For instance: `vlan2`.

Default Disabled

Mode Router Configuration

Examples

```
awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# passive-interface vlan2

awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# no passive-interface vlan2
```

recv-buffer-size (RIPng)

Use this command to configure the RIPng UDP (User Datagram Protocol) receive-buffer size. This should improve UDP reliability by avoiding UDP receive buffer overruns.

Use the no variant of this command to unset the configured RIPng UDP receive-buffer size and set it back to the system default of 196608 bits.

Syntax

```
recv-buffer-size <8192-2147483647>
no recv-buffer-size [<8192-2147483647>]
```

Default The RIPng UDP receive-buffer-size is 196608 bits by default, and is reset to the default using the no variant of this command.

Mode Router Configuration

Examples

```
awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# recv-buffer-size 23456789

awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# no recv-buffer-size 23456789

awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# no recv-buffer-size
```

redistribute (RIPng)

Use this command to redistribute information from other routing protocols into RIPng.

Use the no variant of this command to disable the specified redistribution. The parameters metric and routemap may be used on this command, but have no effect.

Syntax

```
redistribute {connected|static|ospf} [metric <0-16>]
   [route-map <route-map>]

no redistribute {connected|static|ospf} [metric <0-16>]
   [route-map <route-map>]
```

Parameter	Description
<0-16>	Optional. Specifies the metric value to be used when redistributing information. If a value is not specified, and no value is specified using the default-metric (RIPng) command, the default is zero.
<*route-map*>	Optional. Specifies route-map to be used to redistribute information.
`connected`	Redistribute from connected routes.
`static`	Redistribute from static routes.
`ospf`	Redistribute from Open Shortest Path First (OSPF).

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# redistribute static route-map mymap
awplus(config-router)# redistribute static metric 8
```

route (RIPng)

Use this command to configure static RIPng routes.

Use the no variant of this command to disable this function.

Syntax

```
route <ipv6-addr/prefix-length>
no route <ipv6-addr/prefix-length>
```

Parameter	Description
<ipv6-addr/prefix-length>	Specify the IPv6 Address in format *X:X::X:X/Prefix-Length*. The prefix-length is a decimal integer between 1 and 128.

Mode Router Configuration

Usage Use this command to add a static RIPng route. After adding the RIPng route, the route can be checked in the RIPng routing table.

Example

```
awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# route 2001:db8::1/64
```

Related Commands show ipv6 rip
clear ipv6 rip route

router ipv6 rip

Use this global command to enter Router Configuration mode to enable a RIPng routing process.

Use the no variant of this command to disable the RIPng routing process.

Syntax

```
router ipv6 rip
no router ipv6 rip
```

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)#
```

show debugging ipv6 rip

Use this command to display the RIPng debugging status for the debugging options of: nsm debugging, RIPng event debugging, RIPng packet debugging, and RIPng nsm debugging.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show debugging ipv6 rip`

Mode User Exec and Privileged Exec

Usage Use this command to display the debug status of RIPng.

Example

```
awplus# show debugging ipv6 rip
```

show ipv6 protocols rip

Use this command to display RIPng process parameters and statistics.

For information on output options, see "Controlling "show" Command Output" on page 1.41

Syntax `show ipv6 protocols rip`

Mode User Exec and Privileged Exec

Example

```
awplus# show ipv6 protocols rip
```

Output Figure 36-1: Example output from the **show ipv6 protocols rip** command

```
Routing Protocol is "RIPng"
  Sending updates every 30 seconds with +/-50%, next due in 10
seconds
  Timeout after 180 seconds, garbage collect after 120 seconds
  Outgoing update filter list for all interface is not set
  Incoming update filter list for all interface is not set
  Default redistribute metric is 1
  Redistributing: connected
  Routing for Networks:
    2001:db8:1::/64

Codes: R - RIP, Rc - RIP connected, Rs - RIP static, Ra - RIP
aggregated, Rcx - RIP connect suppressed, Rsx - RIP static
suppressed, C - Connected, S - Static, O - OSPF, B - BGP

   Network          Next Hop                  If     Met Tag
Time
   2001:db8::/64
```

show ipv6 rip

Use this command to show RIPng routes.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 rip`

Mode User Exec and Privileged Exec

Example

```
awplus# show ipv6 rip
```

Output Figure 36-2: Example output from the **show ipv6 rip** command

```
Codes: R - RIP, Rc - RIP connected, Rs - RIP static, Ra - RIP
aggregated, Rcx - RIP connect suppressed, Rsx - RIP static
suppressed, C - Connected, S - Static, O - OSPF, B - BGP

   Network            Next Hop          If      Met Tag   Time

R  2001:db8:1::/48    2001:db8:2::/48   vlan3    3   0    02:28
C  2001:db8:3::/48    ::                vlan2    1   0
Ra 2001:db8:4::/48                      --       1   0
Rs 2001:db8:5::/48    2001:db8:1::/48   vlan3    3   0    02:32
Cs 2001:db8:6::/48    ::                vlan3    1   0
```

Related Commands show ipv6 rip database

show ipv6 rip database

Use this command to display information about the RIPng database.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 rip database [full]`

Parameter	Description
`full`	Display all IPv6 RIPng full database entries including sub-optimal routes.

Mode User Exec and Privileged Exec

Example

```
awplus# show ipv6 rip database
```

Output Table 36-1: Example output from the **show ipv6 rip database** command

```
Codes: R - RIP, Rc - RIP connected, Rs - RIP static, Ra - RIP
aggregated, Rcx - RIP connect suppressed, Rsx - RIP static
suppressed, C - Connected, S - Static, O - OSPF, B - BGP

   Network            Next Hop          If      Met Tag   Time

R  2001:db8:1::/48    2001:db8:2::/48   vlan3    3   0    02:28
C  2001:db8:3::/48    ::                vlan2    1   0
Ra 2001:db8:4::/48                      --       1   0
Rs 2001:db8:5::/48    2001:db8:1::/48   vlan3    3   0    02:32
Cs 2001:db8:6::/48    ::                vlan3    1   0
```

Related Commands show ipv6 rip

show ipv6 rip interface

Use this command to display information about the RIPng interfaces. You can specify an interface name to display information about a specific interface.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 rip interface [<interface>]`

Parameter	Description
<interface>	The interface to display information about. For instance: `vlan2`.

Mode User Exec and Privileged Exec

Example

```
awplus# show ipv6 rip interface
```

Output Figure 36-3: Example output from the **show ipv6 rip interface** command

```
lo is up, line protocol is up
RIPng is not enabled on this interface
vlan1 is up, line protocol is up
RIPng is not enabled on this interface
vlan2 is down, line protocol is down
RIPng is not enabled on this interface
vlan3 is up, line protocol is up
Routing Protocol: RIPng
Passive interface: Disabled
Split horizon: Enabled with Poisoned Reversed
IP interface address:
2001:db8:1::1/64
2001:db8:1::2/64
```

timers (RIPng)

Use this command to adjust the RIPng routing network timers.

Use the no variant of this command to restore the defaults.

Syntax

```
timers basic <update> <timeout> <garbage>
no timers basic
```

Parameter	Description
<update>	<5-2147483647> Specifies the RIPng routing table update timer in seconds. The default is 30 seconds.
<timeout>	<5-2147483647> Specifies the RIPng routing information timeout timer in seconds. The default is 180 seconds. After this interval has elapsed and no updates for a route are received, the route is declared invalid.
<garbage>	<5-2147483647> Specifies the RIPng routing garbage collection timer in seconds. The default is 120 seconds.

Default The default RIPng routing table update timer default is 30 seconds, the default RIPng routing information timeout timer is 180 seconds, and the default RIPng routing garbage collection timer is 120 seconds. The no variant of this command restores the default RIPng routing timers.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router ipv6 rip
awplus(config-router)# timers basic 30 180 120
```

undebug ipv6 rip

Use this command to disable debugging options of RIPng events, RIPng packets, and communication between RIPng and NSM processes.

Syntax `undebug ipv6 rip [all|events|nsm|packet [recv|send][detail]]`

Parameter	Description
`all`	Disables all RIPng debugging.
`events`	Disable the display of RIPng events information.
`nsm`	Disable the display of RIPng and NSM communication.
`packet`	Disable debugging of specified RIPng packets only.
`recv`	Disable the display of information for received packets.
`send`	Disable the display of information for sent packets.
`detail`	Disable the display of detailed information for sent or received packets.

Mode Privileged Exec and Global Configuration

Example

```
awplus# undebug ipv6 rip events

awplus# undebug ipv6 rip all

awplus# undebug ipv6 rip packet send

awplus# undebug ipv6 rip packet recv detail
```

Related Commands debug ipv6 rip

Chapter 37: OSPF Introduction and Configuration

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OSPF Introduction

This chapter introduces OSPF followed by basic configuration examples. To see details on the OSPF commands used in these examples, or to see the outputs of the validation commands, refer to Chapter 38, OSPF Commands.

Features

Open Shortest Path First (OSPF) is an Interior Gateway Routing Protocol, based on Shortest Path First (SPF) or link-state technology. OSPF is defined in RFCs 1245–1247, 1253 and 1583. OSPF was designed specifically for the TCP/IP Internet environment, and supports the following features:

- Authentication of routing updates.
- Tagging of externally-derived routes.
- Fast response to topology changes with low overhead.
- Load sharing over meshed links.

OSPF Components

Autonomous Systems

In SPF-based routing protocols, routers combine to form an Autonomous Systems (AS). These are router systems which operate under a common administration and usually share common routing protocols. Each router maintains a database describing the AS's topology. Each router has an identical database, each component of which describes a particular router and its current state. This includes the state of the interfaces, reachable neighbors, and other information. Information about the AS is distributed between the routers by a process known as "flooding".

Each router runs a routing algorithm, and from the information exchanged about the other AS routers, creates an internal tree-like database of shortest paths with itself as the root. The tree contains a route to each destination in the AS. External routes are added to the tree as "leaves".

Another feature of OSPF is that it enables IP subnets to be configured in a very flexible way. Each route distributed by OSPF has a destination and a mask. During the routing process, routes with the longest mask to a destination are used in preference to those with shorter masks. Host routes are also supported by OSPF; these are considered to be subnets with masks of all ones.

All OSPF protocol exchanges can be authenticated so that only trusted routers participate in the creation of the topology database, and hence the AS's routing. Authentication is disabled by default.

Externally derived routing data can be passed into the AS transparently. The externally derived routing information is kept separate from the OSPF protocol's link state data.

Routing Areas

OSPF allows the grouping of networks into a set, called an Area. The internal topology of an area is hidden from the rest of the AS. This technique minimizes the routing traffic required for the protocol. When multiple areas are used, each area has its own copy of the topological database.

Routing can be between areas (inter-area routing) or within areas (intra-area routing). To link together multiple areas, OSPF uses the concept of a backbone area. The backbone area forms a central network that links to the other areas within the AS. The backbone must have contiguous connectivity with the its other areas. Virtual links can be used to make the backbone contiguous.

At the junction of each area and its backbone is a border router. Packets travelling between areas will do so via the backbone area. Packets are first sent to the area's border router where they will be routed onto the backbone. They will then travel through the backbone to another area border router at the connection to the destination area. The packets are then routed through the destination area to their specific destination.

Adjacencies and Designated Routers

OSPF creates adjacencies between neighboring routers. The reason for forming adjacencies is to exchange topological information. Not every router needs to become adjacent to every other router. Adjacencies are established and maintained with hello packets. These packets are sent periodically on all router interfaces. Bidirectional communication is determined by a router seeing itself listed in hello packets from its neighbors. On broadcast multi-access networks, one of the routers becomes a designated router.

The designated router maintains adjacencies with all the routers within the area by issuing link state advertisements for its area and subnet.

The designated router becomes adjacent to all other routers within the area. Since the topological database is spread over adjacencies, the designated router coordinates the synchronization of the topological database on all the routers within its area.

Selecting the Designated Router

The designated router for a broadcast network is determined dynamically via hello packets. Each router is configured with a priority number, which is advertised in the hello packet. The routers compare their priority numbers, and the router with the highest priority number is elected the designated router. Where routers share the same priority number, as could happen with a common default setting, then the designated router is the router with the highest router ID. On non-broadcast multi-access networks, static configuration information is used to initiate the search for a designated router.

To help in dynamic fallover, OSPF also determines a backup designated router for a network via hello packets. The backup designated router, like the designated router maintains an adjacency to all other routers on the network. If the designated router fails for any reason, the backup designated router takes over.

Link State Advertisements

Link state advertisements are records in the topological database. Routers may generate five different types of link state advertisements Table 37-1 on page 37.4. Each type of link state advertisement describes a different set of features of the Autonomous System (AS).

Link state advertisements age to a maximum age called MaxAge (3600 seconds) while stored in the topological database. When a link state advertisement reaches MaxAge, the router tries to flush it from the routing domain by reflooding the advertisement. A link state advertisement that has reached MaxAge is not used in further routing table calculations. The MaxAge link state advertisement is removed totally from the topological database when it is no longer contained on a neighbor link state retransmission list or none of the neighbors are in exchange or loading state. It is relatively rare for a link state advertisement to reach MaxAge because advertisements are usually replaced by more recent instances by normal refresh processes.

Table 37-1: OSPF link state advertisement type

LSA Type	Meaning
Router Links	The router originates a router links advertisement for each area to which it belongs. The advertisement describes the collected states of the router's links to the area. This advertisement also indicates whether the router is an area border router or an AS boundary router.
Network Links	A network link advertisement is originated for every transit multi-access network. This advertisement is originated by the designated router for the transit network, and describes all the OSPF routers fully adjacent to the designated router.
Summary Links	Summary Link advertisements describe a single route to a destination. The destinations described are external to the area, but internal to the AS. Some condensing of routing information occurs when creating these summary link state advertisements.
AS Summary Links	These are like summary link advertisements, but they describe routes to AS boundary routers.
AS External Links	AS external advertisements describe routes external to the AS.

OSPF Packet Types

The OSPF protocol runs directly over IP, using the assigned number 89. The following table describes OSPF packet types.

Table 37-2: OSPF Packet Types

Packet Type	Purpose
Hello	Used to discover and maintain neighbors.
Link State Request	Used to form adjacencies. The router summarizes all its link state advertisements and passes this information, via database description packets, to the router it is forming an adjacency with.
Link State Update	Used for transmission of link state advertisements between routers. This could be in response to a link state request packet or to flood a new or more recent link state advertisement.
Link State Acknowledgement	Used to make the flooding of link state advertisements reliable. Each link state advertisement received is explicitly acknowledged.

OSPF States

The following table describes the states that neighbors can be in:

Table 37-3: OSPF States

Packet Type	Purpose
Down	This is the initial state. No hello packets have been received from the neighbor recently or at all.
Attempt	This state applies to non-broadcast multi-access networks. The router is making a determined attempt to contact a statically configured neighbor. Hello packets are sent every hello interval.
Init	A hello packet has been seen from the neighbor. However, the hello packet does not list the router as known.
Two-Way	This state is entered when the communication between to neighbors is bidirectional (the hello packet from the neighbor lists this router as a neighbor).
ExStart	This is the first step in creating an adjacency between two routers. The two routers decide which is going to control the exchange between them.
Exchange	In this state, the neighbors exchange database description packets. Each packet summarizes the link state advertisements held by that router.
Loading	After all the database description information has been exchanged, the routers exchange link state advertisements required to update or complete each router's topological database thereby synchronizing the two router's databases.
Full	This is the final state and the adjacency is complete. Reaching this state in itself may cause new instances of some link state advertisements, such as the network and router advertisements related to the two routers.

The following table describes the interface states that the router can be in.

Table 37-4: OSPF Interface States

Packet Type	Purpose
Down	The initial state. No traffic can be routed with the interface in this state.
Loopback	The router's interface to the network is looped back.
Waiting	Interfaces to broadcast and non-broadcast multi-access networks enter this state when they are started. In this state the router tries to determine the designated or backup designated router. The router is not allowed to elect a backup or designated router while in the waiting state. This stops unnecessary changes in the designated router.

Table 37-4: OSPF Interface States(cont.)

Packet Type	Purpose
Point-to-Point	The interface is operational and is connected to a point-to-point network.
DROther	The interface to a broadcast or a non-broadcast multi-access network has not been selected as either the designated router or backup designated router for the network.
Backup	The interface to a broadcast or a non-broadcast multi-access network has been selected as the backup designated router for the network.
DR	The interface to a broadcast or a non-broadcast multi-access network has been selected as the designated router for the network.

OSPF Metrics

The metrics used by OSPF are not simple distance metrics, such as used by RIP for example, but are measurements of the path bandwidth. Interface metrics are normally set using the formula 10^8 / interface speed (in bps). This gives metrics such as 1 for a 100 Mbps Ethernet interface, and 1562 for a 64 kbps serial line.

Automatic Cost Calculation

OSPF interfaces can automatically set the OSPF metric of an IP interface based on its bandwidth, instead of the system administrator having to manually set the OSPF metric. Automatic setting takes into account that the speed of an interface can change over time, when ports change link state or change speed via auto-negotiation or manual setting. If metrics are manually set, some interfaces are preferred when they should be changing to match dynamically changing network configurations.

Routing with OSPF

To route an IP packet, the router looks up the routing table for the entry that best matches the destination of the packet. This entry contains the interface and nexthop router required to forward the IP packet to its destination. The entry that best matches the destination is determined first by the path type, then the longest (most specific) network mask. At this point there may still be multiple routing entries to the destination; if so, then equi-cost multi-path routes exist to the destination. Table Table 37-5 on page 37.7 shows the available path types used when routing packets.

Table 37-5: OSPF Path Types

Path Type	Description
Intra	Route to the destination is within a single OSPF area.
Inter	Route to the destination is within the AS, but spans more than one OSPF area.
Ext1	Route to the destination is via an AS router within the AS. This is an OSPF external route of Type 1. Type 1 external routes add the external metric (as received by the AS router), and the internal OSPF metric to reach the AS router, to determine the final metric to the destination.
Ext2	Route to the destination is via an AS router within the AS. This is an OSPF external route of Type 2. Type 2 external routes use only the external path cost to determine the preferred route. Internal metrics are only used where two or more interfaces present the same external path cost.

Network Types

OSPF treats the networks attached to OSPF interfaces as one of the following network types, depending on the physical media:

- broadcast
- non-broadcast multi-access (nbma)
- point-to-point
- point-to-multipoint
- virtual

By default, VLAN and Ethernet networks are treated as broadcast networks. You can use the ip ospf network command to configure a VLAN interface to be other network types. Configure a VLAN or Ethernet interface as an NBMA interface when:

- Some devices on the network do not support multicast addressing.
- You want to select which devices on the network are to become OSPF neighbors, rather than allow all the devices on the network to become OSPF neighbors.

Passive Interfaces

A passive interface does not take part in normal OSPF interface operations:

- OSPF does not transmit or receive Hello messages via the interface.
- The interface does not experience interface state transitions.
- OSPF does not associate neighbors with the interface.

If the interface is up, OSPF adds the network attached to the interface as a stub network to the router LSA of the area in which the interface resides.

Usage Configure an interface to be passive if you wish its connected route to be treated as an OSPF route (rather than an AS-external route), but do not wish to actually exchange any OSPF packets via this interface.

Examples To configure passive interface mode on interface vlan2, enter the following commands:

```
awplus(config)# router ospf 100
awplus(config-router)# passive-interface vlan2
```

To configure passive interface mode on all interfaces, enter the following commands:

```
awplus(config)# router ospf 100
awplus(config-router)# passive-interface
```

Authenticating OSPF

OSPF packet authentication is described in Appendix D of RFC 2328, and in RFC 1583. RFC 2328 describes authentication set for an interface, whilst RFC 1583 describes authentication set per area. Refer to the RFCs for a detailed description of these methods of authentication.

There are two ways to authenticate an OSPF packet:

- password authentication
- cryptographic authentication

Use the following commands to configure authentication on a specific VLAN interface:

- ip ospf authentication
- ip ospf authentication-key
- ip ospf message-digest-key

Use the following commands to configure authentication for a specific OSPF area.

- area authentication
- ip ospf message-digest-key

Redistributing External Routes

OSPF can import and redistribute BGP, RIP, non-OSPF interface, and statically configured routes. It can also optionally assign any of the following settings to all routes it imports:

- a route metric
- the External metric type
- a tag—a number to label the route

Alternatively, you can assign a route map to select particular routes and set their route parameters. A route map can also filter out a subset of routes, so you do not have to import all routes.

The import settings also allow you to select whether to redistribute subnets (classless network routes), or only classful network routes.

To import and redistribute external routes into OSPF, create a route redistribution definition for the source routing protocol, using the redistribute (into OSPF) command.

Summarizing Routes for Redistribution

OSPF can summaries external routes to be redistributed using a list of administratively defined summary addresses specified as network/mask pairs. The summary addresses replace the original routes in AS external LSAs. Use summary addresses to reduce the number of AS external routes advertised by the router.

You can set the following attributes for summary addresses:

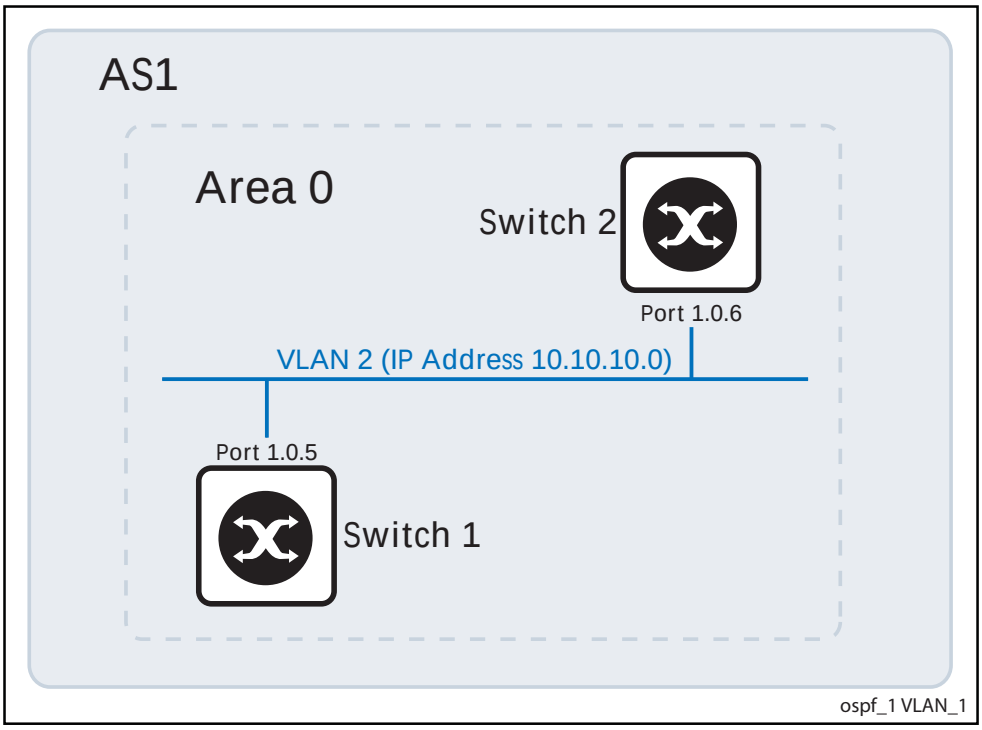
- Whether the summary address is advertised.
- The tag to be inserted in the AS external LSA. The tag overrides tags set by the original route used to select the original routes for redistribution.

To create summary addresses for route redistribution, use the summary-address command.

Enabling OSPF on an Interface

This example shows the minimum configuration required for enabling OSPF on an interface. In this example, the OSPF routers are Allied Telesis managed Layer 3 switches. `Switch 1` and `Switch 2` are two OSPF routers in `Area 0` connecting to network 10.10.10.0/24.

Note Configure one interface so that it belongs to only one area. However, you can configure different interfaces on an OSPF router to belong to different areas.



Switch 1

`awplus#` `configure terminal`	Enter the Global Configuration mode.
`awplus(config)#` `interface port1.0.5`	Set the switchport mode to access
`awplus#` `switchport access vlan2`	Assign port 1.0.5 to VLAN 2
`awplus(config)#` `router ospf 100`	Configure the Routing process and specify the Process ID (`100`)
`awplus(config-router)#` `network 10.10.10.0/24 area 0`	Define the interface (`10.10.10.0/24`) on which OSPF runs and associate the area ID (`0`) with the interface (area ID `0` specifies the backbone area).

Switch 2

`awplus#`	
`configure terminal`	Enter the Global Configuration mode
`awplus(config)#`	
`interface port1.0.6`	Set the switchport mode to access
`awplus#`	
`switchport access vlan2`	Assign port 1.0.6 to VLAN 2
`awplus(config)#`	
`router ospf 200`	Configure the Routing process and specify the Process ID `(200)`. The Process ID should be a unique positive integer identifying the routing process. Note that the process ID used on this switch is different to that used on Switch 1. This is correct configuration as the process ID is a value that is only used within a single OSPF router. Therefore there is no requirement for the process IDs used on one OSPF router to have any relationship with the process IDs used on the other OSPF routers that it interacts with.
`awplus(config-router)#`	
`network 10.10.10.0/24 area 0`	Define the interface (`10.10.10.0/24`) on which OSPF runs and associate the area ID (`0`) with the interface.

Names of Commands Used

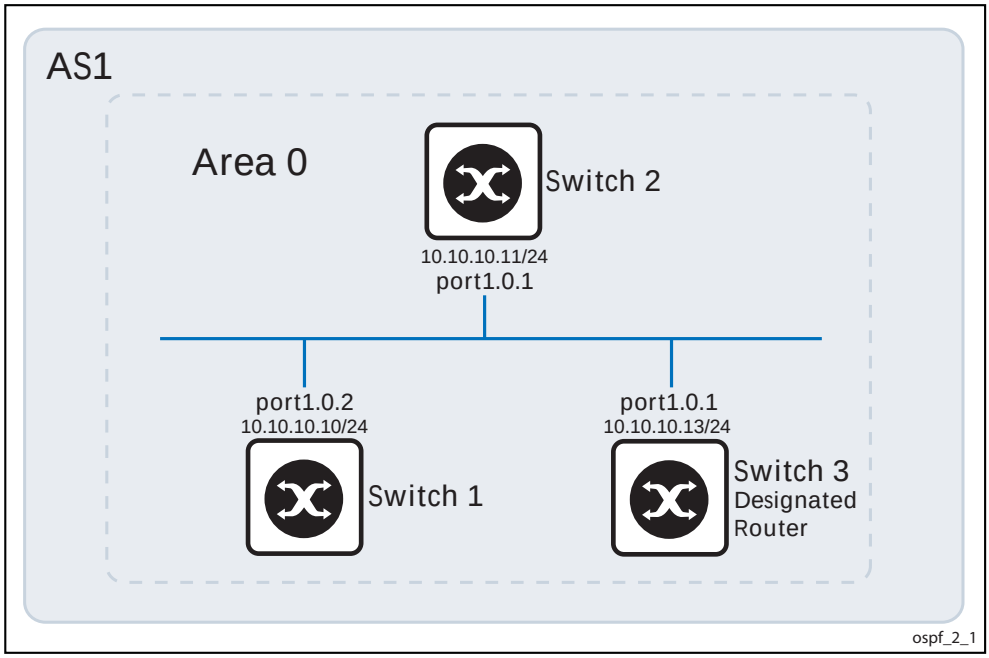
network area
router ospf

Validation Commands

show ip ospf
show ip ospf interface
show ip ospf neighbor
show ip ospf route

Setting priority

This example shows the configuration for setting the priority for an interface. You can set a high priority for an OSPF router to make it the Designated Router (DR). In this example, the OSPF routers are Allied Telesis managed Layer 3 switches. Switch 3 is configured to have a priority of 10, which is higher than the default priority (default priority is 1) of Switch 1 and Switch 2; making it the DR. In this example network the back-up DR would be Switch 2 as it has a higher router ID than Switch 1.



Switch 3

`awplus(config)#` `interface vlan2`	Specify the interface (`vlan2`) to be configured.
`awplus(config-if)#` `ip ospf priority 10`	Specify the router priority to a higher priority (`10`) to make Switch 3 the Designated Router (DR).
`awplus(config-if)#` `exit`	Exit the Interface Configuration mode and return to the Global Configuration mode.
`awplus(config)#` `router ospf 100`	Configure the Routing process and specify the Process ID (`100`). The Process ID should be a unique positive integer identifying the routing process.
`awplus(config-router)#` `network 10.10.10.0/24 area 0`	Define the interface (`10.10.10.0/24`) on which OSPF runs and associate the area ID (`0`) with the interface.

Switch 1

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router ospf 100`	Configure the Routing process and specify the Process ID (`100`). The Process ID should be a unique positive integer identifying the routing process.
`awplus(config-router)#`	
`network 10.10.10.0/24 area 0`	Define the interface (`10.10.10.0/24`) on which OSPF runs and associate the area ID (`0`) with the interface (area ID 0 specifies the backbone area).

Switch 2

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router ospf 200`	Configure the Routing process and specify the Process ID (200). The Process ID should be a unique positive integer identifying the routing process.
`awplus(config-router)#`	
`network 10.10.10.0/24 area 0`	Define the interface (`10.10.10.0/24`) on which OSPF runs and associate the area ID (`0`) with the interface.

Names of Commands Used

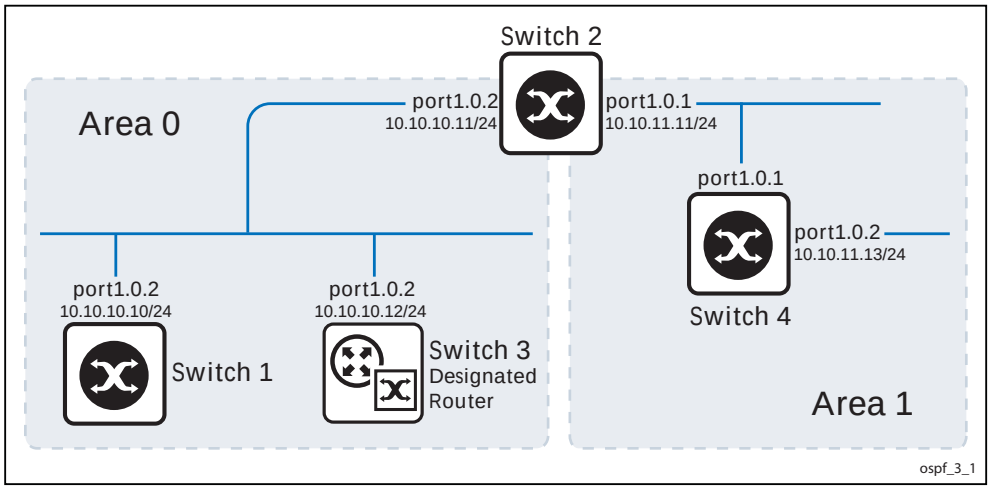
network area
ip ospf priority

Validation Commands

show ip ospf neighbor
show ip ospf interface

Configuring an Area Border Router

This example shows configuration for an Area Border Router (ABR). In this example, the OSPF routers are Allied Telesis managed Layer 3 switches. `Switch 2` is an ABR, where interface `vlan2` is in `Area 0` and interface `vlan3` is in `Area 1`.



Switch 2

`awplus#` `configure terminal`	Enter the Global Configuration mode.
`awplus(config)#` `router ospf 100`	Configure the Routing process and specify the Process ID (`100`). The Process ID should be a unique positive integer identifying the routing process.
`awplus(config-router)#` `network 10.10.10.0/24 area 0`	Define one interface (`10.10.10.0/24`) on which OSPF runs and associate the area ID (`0`) with the interface.
`awplus(config-router)#` `network 10.10.11.0/24 area 1`	Define the other interface (`10.10.11.0/24`) on which OSPF runs and associate the area ID (`1`) with the interface.

Names of Commands Used

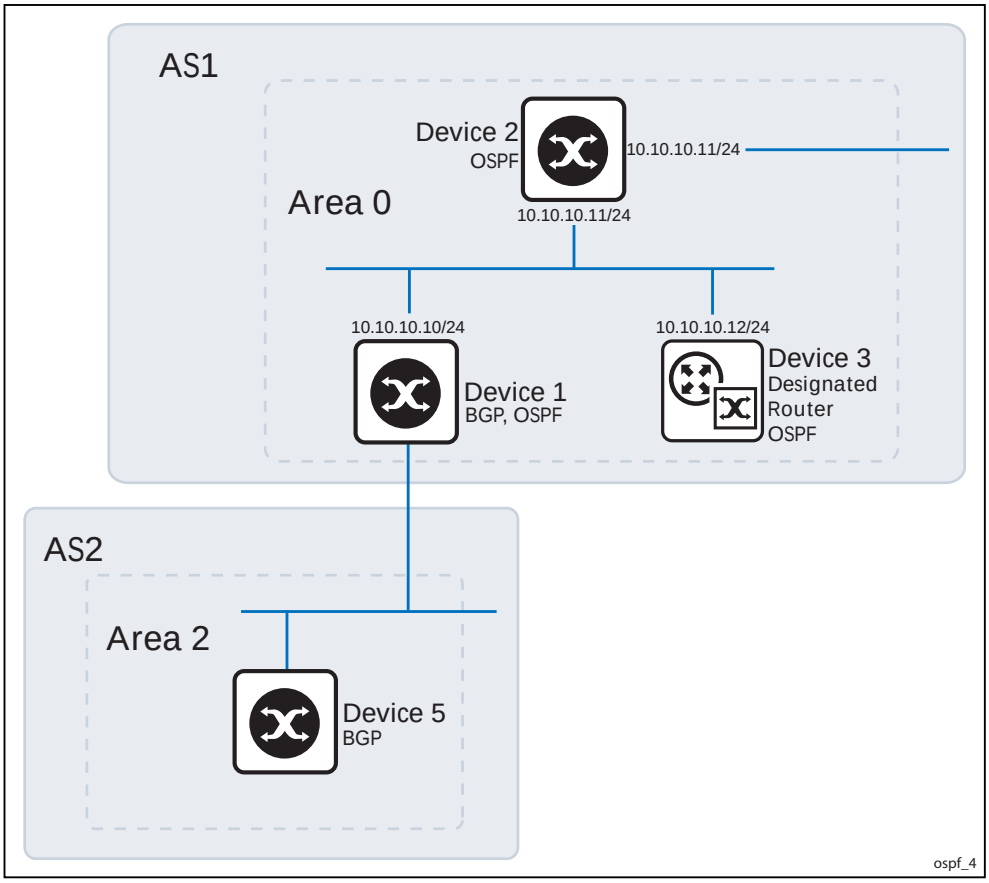
network area

Validation Commands

show ip ospf
show ip ospf interface

Redistributing Routes Into OSPF

In this example the configuration causes BGP routes to be imported into the OSPF routing table and advertised as `Type 5` External LSAs into `Area 0`. In this example, the OSPF routers, labelled "Device 1-5" represent any Allied Telesis managed Layer 3 switches or Allied Telesis routers.



Device 1

`awplus#` `configure terminal`	Enter the Global Configuration mode.
`awplus(config)#` `router ospf 100`	Configure the Routing process and specify the Process ID (`100`). The Process ID should be a unique positive integer identifying the routing process.
`awplus(config-router)#` `network 10.10.10.0/24 area 0`	Define one interface (`10.10.10.0/24`) on which OSPF runs and associate the area ID (`0`) with the interface (area ID 0 specifies the backbone area).
`awplus(config-router)#` `redistribute bgp`	Specify redistributing routes from other routing protocol (BGP) into OSPF.

Names of Commands Used

redistribute (into OSPF)
network area

Validation Commands

show ip ospf database external

OSPF Cost

You can make a route the preferred route by changing its cost. In this example, the OSPF routers are Allied Telesis managed Layer 3 switches. The cost has been configured to make `Switch 2` the next hop for `Switch 1`.

The default cost on each interface is 10. Interface `vlan2` on `Switch 2` has a cost of 100 and interface `vlan3` on Switch 3 has a cost of 150. The total cost for Switch 1 to reach 10.10.14.0/24 (Switch 4) `Switch 2` or via `Switch 3` is:

Switch 2: 10+100 = 110

Switch 3: 10+150 = 160

Therefore, `Switch 1` chooses `Switch 2` as its next hop for destination 10.10.14.0/24, as that path has the lower cost.

Switch 1

`awplus#` `configure terminal`	Enter the Global Configuration mode.
`awplus(config)#` `router ospf 100`	Configure the Routing process and specify the Process ID (`100`). The Process ID should be a unique positive integer identifying the routing process.

`awplus(config-router)#`
`network 10.10.9.0/24 area 0`
`awplus(config-router)#`
`network 10.10.10.0/24 area 0`
`awplus(config-router)#`
`network 10.10.12.0/24 area 0`
	Define interfaces on which OSPF runs and associate the area ID `(0)` with the interface (area ID 0 specifies the backbone area).

Switch 2

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) to be configured.
`awplus(config-if)#`	
`ip ospf cost 100`	Set the OSPF cost of this link to `100`.
`awplus(config-if)#`	
`exit`	Exit the Interface Configuration mode and return to the Global Configuration mode.
`awplus(config)#`	
`router ospf 100`	Configure the Routing process and specify the Process ID (100). The Process ID should be a unique positive integer identifying the routing process.
`awplus(config-router)#`	
`network 10.10.10.0/24 area 0`	Define interfaces on which OSPF runs and associate the area ID `(0)` with the interface.
`awplus(config-router)#`	
`network 10.10.11.0/24 area 0`	Define interfaces on which OSPF runs and associate the area ID `(0)` with the interface.

Switch 3

`awplus(config)#`	
`interface vlan3`	Specify the interface (`vlan3`) to be configured.
`awplus(config-if)#`	
`ip ospf cost 150`	Set the OSPF cost of this link to `100`.
`awplus(config-if)#`	
`exit`	Exit the Interface Configuration mode and return to the Global Configuration mode.
`awplus(config)#`	
`router ospf 100`	Configure the Routing process and specify the Process ID (`100`). The Process ID should be a unique positive integer identifying the routing process.
`awplus(config-router)#`	
`network 10.10.12.0/24 area 0`	Define interfaces on which OSPF runs and associate the area ID `(0)` with the interface.
`awplus(config-router)#`	
`network 10.10.13.0/24 area 0`	

Switch 4

`awplus(config)#`	
`router ospf 100`	Configure the Routing process and specify the Process ID (`100`). The Process ID should be a unique positive integer identifying the routing process.
`awplus(config-router)#`	
`network 10.10.11.0/24 area 0`	Define interfaces on which OSPF runs and associate the area ID `(0)` with the interface.
`awplus(config-router)#`	
`network 10.10.13.0/24 area 0`	
`awplus(config-router)#`	
`network 10.10.14.0/24 area 0`	

Names of Commands Used

network area
ip ospf cost

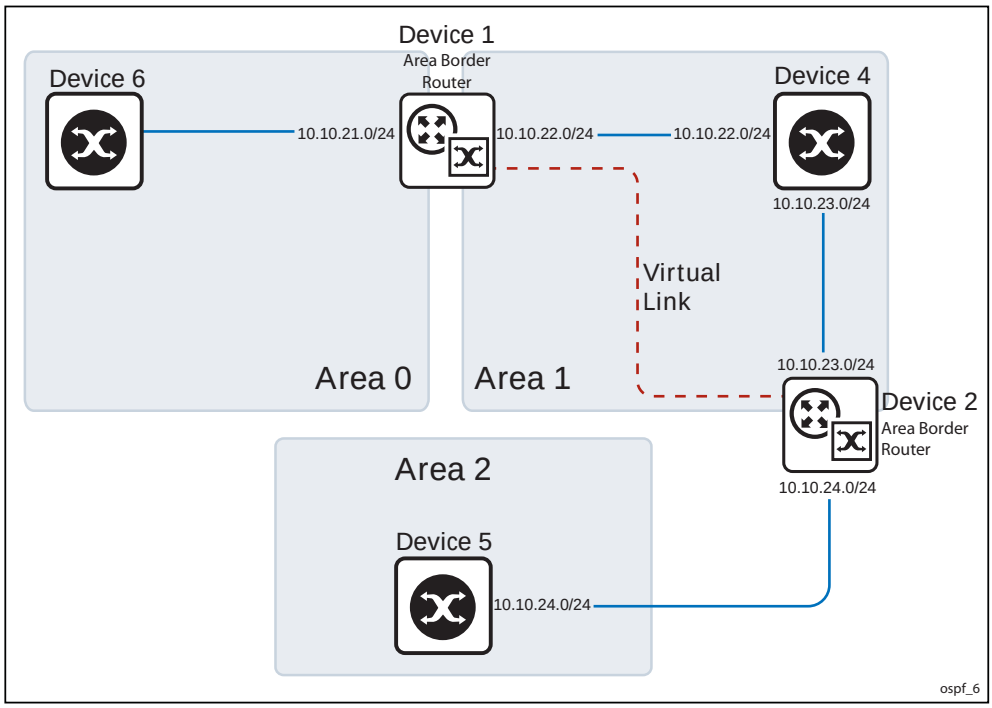
Validation Commands

show ip ospf route

Configuring Virtual Links

Virtual links are used to connect a disjointed non-backbone area to the backbone area, or to repair a non-contiguous backbone area. In this example, the OSPF routers shown represent any Allied Telesis managed Layer 3 switches or Allied Telesis routers.

In the network below, there is no area border router that connects Area2 to the backbone. So a virtual link needs to be created between ABR Device 1 and ABR Device 2 to connect `Area 2` to `Area 0`. Area 1 is used as a transit area.



Device 1

`awplus#` `configure terminal`	Enter the Global Configuration mode.
`awplus(config)#` `router ospf 100`	Configure the Routing process and specify the Process ID (`100`). The Process ID should be a unique positive integer identifying the routing process.
`awplus(config-router)#` `ospf router-id 10.10.21.1`	Configure OSPF Router ID (`10.10.21.1`) for this router.

`awplus(config-router)#`
`network 10.10.21.0/24 area 0`
`awplus(config-router)#`
`network 10.10.22.0/24 area 1`
	Define interfaces on which OSPF runs and associate the area IDs (`0` and `1`) with the interface.

awplus(config-router)#	
area 1 virtual-link 10.10.23.2	Configure a virtual link between Device 1 and Device 2 (10.10.23.2) through transit area 1.

Device 2

awplus(config)#	
router ospf 100	Configure the Routing process and specify the Process ID (100). The Process ID should be a unique positive integer identifying the routing process.
awplus(config-router)#	
ospf router-id 10.10.23.2	Configure OSPF Router ID (10.10.23.2) for this router.
awplus(config-router)#	
network 10.10.23.0/24 area 1	Define interfaces on which OSPF runs and associate the area IDs (1 and 2) with the interface.
awplus(config-router)#	
network 10.10.24.0/24 area 2	
awplus(config-router)#	
area 1 virtual-link 10.10.21.1	Configure a virtual link between Device 2 and Device 1 (10.10.21.1) through transit area 1.

Names of Commands Used

area virtual-link
network area

Validation Commands

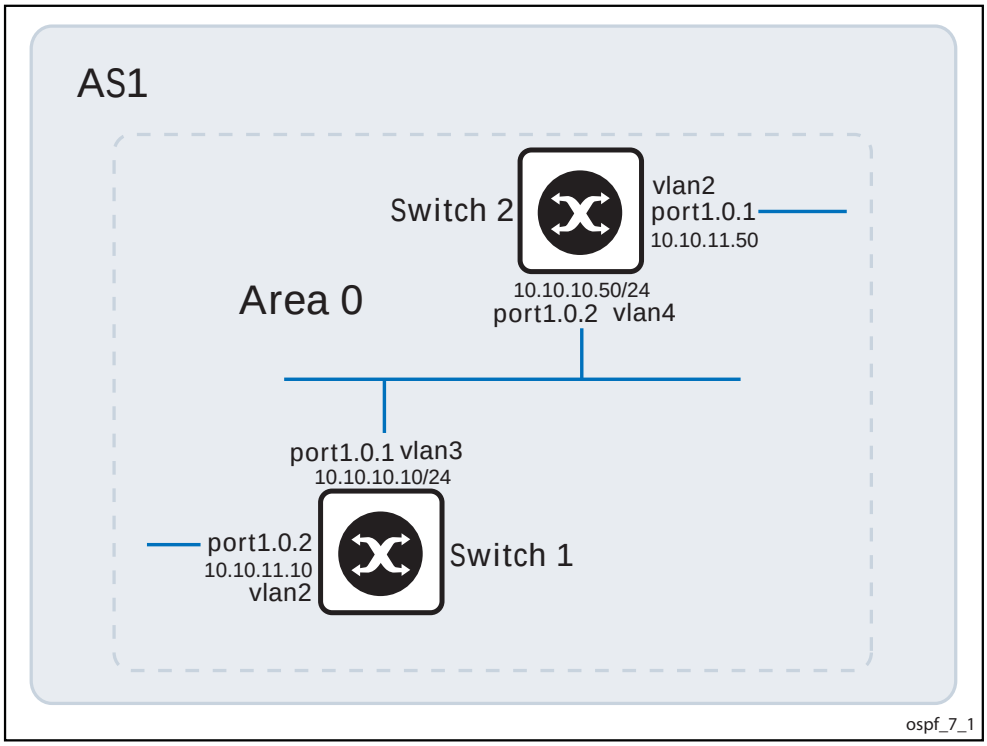
show ip ospf virtual-links
show ip ospf neighbor
show ip ospf
show ip ospf route

OSPF Authentication

In the AlliedWare Plus™ implementation there are three types of OSPF authentications--Null authentication (Type 0), Simple Text (Type 1) authentication and MD5 (Type 2) authentication. With null authentication, routing exchanges over the network are not authenticated. In Simple Text authentication, the authentication type is the same for all OSPF routers that communicate using OSPF in a network. For MD5 authentication, you configure a key and a key-id on each OSPF router. The OSPF router generates a message digest on the basis of the key, key ID and the OSPF packet and adds it to the OSPF packet.

The Authentication type can be configured on a per-interface basis or a per-area basis. Additionally, Interface and Area authentication can be used together. Area authentication is used for an area and interface authentication is used for a specific interface in the area. If the Interface authentication type is different from Area authentication type, Interface authentication type overrides the Area authentication type. If the Authentication type is not specified for an interface, the Authentication type for the area is used. The authentication command descriptions contain details of each type of authentication. Refer to Chapter 38, OSPF Commands for OSPF authentication commands.

In this example, the OSPF routers are Allied Telesis managed Layer 3 switches. Switch 1 and Switch 2 are configured for both the interface and area authentications. The authentication type of interface `vlan2` on Switch 1 and interface `vlan2` on Switch 2 is md5 mode and is defined by the area authentication command on page 38.3; however, the authentication type of interface vlan3 on Switch 1 and interface vlan4 on Switch 2 is plain text mode and is defined by the ip ospf authentication command on page 38.32. This interface command overrides the area authentication command.



Switch 1

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router ospf 100`	Configure the Routing process and specify the Process ID (100). The Process ID should be a unique positive integer identifying the routing process.
`awplus(config-router)#`	
`network 10.10.10.0/24 area 0`	Define interfaces on which OSPF runs and associate the area ID `(0)` with the interface (area ID 0 specifies the backbone area).
`awplus(config-router)#`	
`network 10.10.11.0/24 area 0`	
`awplus(config-router)#`	
`area 0 authentication message-digest`	Enable MD5 authentication on area 0.
`awplus(config-router)#`	
`exit`	Exit the Router Configuration mode and return to the Global Configuration mode.
`awplus(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) you are configuring.
`awplus(config-if)#`	
`ip ospf message-digest-key 1 md5 test`	Register MD5 key `test` for OSPF authentication. The Key ID is 1.
`awplus(config-if)#`	
`exit`	Exit the Interface Configuration mode and return to Global Configuration mode
`awplus(config)#`	
`interface vlan3`	Specify the interface (`vlan3`) you are configuring.
`awplus(config-if)#`	
`ip ospf authentication`	Enable OSPF packet to use text authentication on the current interface (`vlan3`).
`awplus(config-if)#`	
`ip ospf authentication-key test`	Specify an OSPF authentication password test for the neighboring OSPF routers.

Switch 2

`awplus#` `configure terminal`	Enter the Global Configuration mode.
`awplus(config)#` `router ospf 100`	Configure the Routing process and specify the Process ID (100). The Process ID should be a unique positive integer identifying the routing process.

`awplus(config-router)#`
`network 10.10.10.0/24 area 0`
`awplus(config-router)#`
`network 10.10.11.0/24 area 0`
	Define interfaces on which OSPF runs and associate the area ID `(0)` with the interface (area ID 0 specifies the backbone area).

`awplus(config-router)#` `area 0 authentication message-digest`	Enable MD5 authentication on area 0.
`awplus(config-router)#` `exit`	Exit the Router Configuration mode and return to the Global Configuration mode.
`awplus(config)#` `interface vlan2`	Specify the interface (`vlan2`) you are configuring.
`awplus(config-if)#` `ip ospf message-digest-key 1 md5 test`	Register MD5 key `test` for OSPF authentication. The Key ID is 1.
`awplus(config-if)#` `exit`	Exit the Interface Configuration mode and return to Global Configuration mode
`awplus(config)#` `interface vlan4`	Specify the interface (`vlan4`) you are configuring.
`awplus(config-if)#` `ip ospf authentication`	Enable OSPF packet to use text authentication on the current interface (`vlan4`).
`awplus(config-if)#` `ip ospf authentication-key test`	Specify an OSPF authentication password `test` for the neighboring OSPF routers.

Names of Commands Used

ip ospf authentication
ip ospf authentication-key
network area
area authentication

Validation Commands

show running-config
show ip ospf neighbor

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Introduction

This chapter provides an alphabetical reference of commands used to configure OSPF. For more information, see Chapter 37, OSPF Introduction and Configuration.

Command List

area authentication

Use this command to enable authentication for an OSPF area. Specifying the area authentication sets the authentication to Type 1 authentication or the Simple Text password authentication (details in RFC 2328).

The no variant of this command removes the authentication specification for an area.

Syntax

```
area <area-id> authentication [message-digest]
no area <area-id> authentication
```

Parameter	Description	
<area-id>	The OSPF area that you are enabling authentication for. This can be entered in either dotted decimal format or normal decimal format.	
	<ip-addr>	OSPF Area ID expressed in IPv4 address, entered in the form A.B.C.D.
	<0-4294967295>	OSPF Area ID expressed as a decimal number within the range shown.
	For example the values dotted decimal 0.0.1.2 and decimal 258 would both define the same area OSPF Area ID.	
`message-digest`	Enables MD5 authentication in the OSPF area.	

Default By default, no authentication occurs.

Mode Router Configuration

Usage All OSPF packets transmitted in this area must have the same password in their OSPF header. This ensures that only routers that have the correct password may join the routing domain.

Give all routers that are to communicate with each other through OSPF the same authentication password.

Use the ip ospf authentication-key command to specify a Simple Text password. Use the ip ospf message-digest-key command to specify MD5 password.

Example

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# area 1 authentication
```

Related Commands

ip ospf authentication
ip ospf message-digest-key

area default-cost

This command specifies a cost for the default summary route sent into a stub or NSSA area.

The no variant of this command removes the assigned default-route cost.

Syntax

```
area <area-id> default-cost <0-16777215>
no area <area-id> default-cost
```

Parameter	Description	
<area-id>	The OSPF area that you are specifying the default summary route cost for. Use one of the following formats: This can be entered in either dotted decimal format or normal decimal format.	
	<ip-addr>	OSPF Area ID expressed in IPv4 address format A.B.C.D.
	<0-4294967295>	OSPF Area ID expressed as a decimal number within the range shown.
	For example the values dotted decimal 0.0.1.2 and decimal 258 would both define the same area ID.	
`default-cost`	Indicates the cost for the default summary route used for a stub or NSSA area. Default: 1	

Mode Router Configuration

Usage The default-cost option provides the metric for the summary default route, generated by the area border router, into the NSSA or stub area. Use this option only on an area border router that is attached to the NSSA or stub area. Refer to the RFC 3101 for information on NSSA.

Example To set the default cost to 10 in area 1 for the OSPF instance 100, use the commands:

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# area 1 default-cost 10
```

Related Commands

area nssa
area stub

area filter-list

This command configures filters to advertise summary routes on Area Border Routers (ABR).

This command is used to suppress particular intra-area routes from/to an area to/from the other areas. You can use this command in conjunction with either the access-list or prefix-list command.

The no variant of this command removes the filter configuration.

Syntax

```
area <area-id> filter-list {access <access-list>|prefix <prefix-
    list>} {in|out}

no area <area-id> filter-list {access <access-list>|prefix <prefix-
    list>} {in|out}
```

Parameter	Description	
<area-id>	The OSPF area that you are configuring the filter for. Use one of the following formats: This can be entered in either dotted decimal format or normal decimal format.	
	<ip-addr>	OSPF Area ID expressed in IPv4 address format `A.B.C.D`.
	<0-4294967295>	OSPF Area ID expressed as a decimal number within the range shown.
	For example the values dotted decimal 0.0.1.2 and decimal 258 would both define the same area ID.	
`access`	Use access-list to filter summary.	
`prefix`	Use prefix-list to filter summary.	
<access-list>	Name of an access-list.	
<prefix-list>	Name of a prefix-list.	
`in`	Filter routes from the other areas to this area.	
`out`	Filter routes from this area to the other areas.	

Mode Router Configuration

Examples

```
                awplus# configure terminal
        awplus(config)# access-list 1 deny 172.22.0.0
        awplus(config)# router ospf 100
awplus(config-router)# area 1 filter-list access 1 in
```

```
awplus# configure terminal
awplus(config)# access-list 1 deny 172.22.0.0
awplus(config)# router ospf 100
awplus(config-router)# no area 1 filter-list access 1 in
```

area nssa

This command sets an area as a Not-So-Stubby-Area (NSSA). By default, no NSSA area is defined.

Use this command to simplify administration if you are connecting a central site using OSPF to a remote site that is using a different routing protocol. You can extend OSPF to cover the remote connection by defining the area between the central router and the remote router as an NSSA.

There are no external routes in an OSPF stub area, so you cannot redistribute from another protocol into a stub area. A NSSA allows external routes to be flooded within the area. These routes are then leaked into other areas. Although, the external routes from other areas still do not enter the NSSA. You can either configure an area to be a stub area or an NSSA, not both.

The no variant of this command removes this designation.

Syntax

```
area <area-id> nssa [default-information-originate <metric> |
   no-redistribution | no-summary | translator-role <role> ]

no area <area-id> nssa [default-information-originate |
   no-redistribution | no-summary | translator-role ]
```

Parameter	Description	
<area-id>	The OSPF area that you are configuring as an NSSA. Use one of the following formats: This can be entered in either dotted decimal format or normal decimal format.	
	<ip-addr>	OSPF Area ID expressed in IPv4 address format `A.B.C.D`.
	<0-4294967295>	OSPF Area ID expressed as a decimal number within the range shown
	For example the values dotted decimal 0.0.1.2 and decimal 258 would both define the same area ID.	
`default-information-originate`	Originate Type-7 default LSA into NSSA.	
<metric>	The external or internal metric. Specify the following:	
	`metric` *<0-16777214>*	The metric value.
	`metric-type` *<1-2>*	External metric type.
`no-redistribution`	Do not redistribute external route into NSSA.	
`no-summary`	Do not inject inter-area route into NSSA.	
`translator-role`	Specify NSSA-ABR translator-role.	

Parameter(cont.)	Description(cont.)	
<role>	The role type. Specify one of the following keywords:	
	`always`	Router always translate NSSA-LSA to Type-5 LSA.
	`candidate`	Router may translate NSSA-LSA to Type-5 LSA if it is elected.
	`never`	Router never translate NSSA-LSA.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# area 0.0.0.51 nssa
awplus(config-router)# area 3 nssa translator-role candidate
no-redistribution default-information-
originate metric 34 metric-type 2
```

Related Commands area default-cost

area range

This command summarizes OSPF routes at an area boundary. By default, this feature is enabled.

The area range command is used to summarize intra-area routes for an area. The set of summary routes created by this command are then advertised to other areas by the Area Border Routers (ABRs). In this way, routing information is condensed at area boundaries so that routes are exchanged between areas in an efficient manner.

If the network numbers in an area are assigned in a way such that they fall into sets of contiguous routes, the ABRs can be configured to advertise a small set of summary routes that cover the individual networks within the area.

The no variant of this command disables this function.

Syntax

```
area <area-id> range <ip-addr/prefix-length> [advertise|not-
    advertise]

no area <area-id> range <ip-addr/prefix-length>
```

Parameter	Description	
<area-id>	The OSPF area that you summarizing the routes for. Use one of the following formats: This can be entered in either dotted decimal format or normal decimal format.	
	<ip-addr>	OSPF Area ID expressed in IPv4 address format `A.B.C.D`.
	<0-4294967295>	OSPF Area ID expressed as a decimal number within the range shown
	For example the values dotted decimal 0.0.1.2 and decimal 258 would both define the same area ID.	
<ip-addr/prefix-length>	The area range prefix and length.	
`advertise`	Advertise this range as a summary route into other areas.	
`not-advertise`	Does not advertise this range.	

Mode Router Configuration

Usage Multiple ranges can be configured on a single area by multiple instances of this command.

Example

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# area 1 range 192.16.0.0/16
awplus(config-router)# area 1 range 203.18.0.0/16
```

area stub

This command defines an OSPF area as a stub area. By default, no stub area is defined.

Use this command when routers in the area do not require learning about summary LSAs from other areas. You can define the area as a totally stubby area by configuring the Area Border Router of that area using the area stub no-summary command.

There are two stub area router configuration commands: the area stub and area default-cost commands. In all routers attached to the stub area, configure the area by using the area stub command. For an area border router (ABR) attached to the stub area, also use the area default-cost command.

The no variant of this command removes this definition.

Syntax

```
area <area-id>  stub [no-summary]
no area <area-id> stub [no-summary]
```

Parameter	Description	
<area-id>	The OSPF area that you are configuring as a stub area. Use one of the following formats: This can be entered in either dotted decimal format or normal decimal format. For example the values dotted decimal 0.0.1.2 and decimal 258 would both define the same area ID.	
	<ip-addr>	OSPF Area ID expressed in IPv4 address in the format `A.B.C.D`.
	<0-4294967295>	OSPF Area ID expressed as a decimal number within the range shown.
	For example the values dotted decimal 0.0.1.2 and decimal 258 would both define the same area ID.	
`no-summary`	Stops an ABR from sending summary link advertisements into the stub area.	

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# area 1 stub
```

Related Commands area default-cost

area virtual-link

This command configures a link between two backbone areas that are physically separated through other non-backbone areas.

In OSPF, all non-backbone areas must be connected to a backbone area. If the connection to the backbone is lost, the virtual link repairs the connection.

The no variant of this command removes the virtual link.

Syntax

```
area <area-id> virtual-link <ip-addr> [<auth-key>|<msg-key>]

no area <area-id>  virtual-link <ip-addr>[<auth-key>|<msg-key>]

area <area-id>  virtual-link <ip-addr> authentication
   [message-digest|null] [<auth-key>|<msg-key>]

no area <area-id>  virtual-link <ip-addr> authentication
   [message-digest|null] [<auth-key>|<msg-key>]

area <area-id>  virtual-link <ip-addr> [authentication]
   [dead-interval <1-65535>] [hello-interval <1-65535>]
   [retransmit-interval <1-3600>] [transmit-delay <1-3600>]

no area <area-id>  virtual-link <ip-addr>[authentication]
   [dead-interval] [hello-interval] [retransmit-interval] [transmit-
   delay]
```

Parameter	Description	
<area-id>	The area ID of the transit area that the virtual link passes through. Use one of the following formats: This can be entered in either dotted decimal format or normal decimal format.	
	<ip-addr>	OSPF Area ID expressed in IPv4 address format A.B.C.D.
	<0-4294967295>	OSPF Area ID expressed as a decimal number within the range shown.
	For example the values dotted decimal 0.0.1.2 and decimal 258 would both define the same area ID.	
<ip-address>	The OSPF router ID of the virtual link neighbor.	
<auth-key>	Specifies the password used for this virtual link. Use the format: authentication-key <*pswd-short*>	
	<pswd-short>	An 8 character password.
<msg-key>	Specifies a message digest key using the MD5 encryption algorithm. Use the following format: message-digest-key <*1-255*> md5 <*pswd-long*>	
	<1-255>	The key ID.
	<pswd-long>	Authentication password of 16 characters.
authentication	Enables authentication on this virtual link.	
message-digest	Use message-digest authentication.	
null	Use null authentication to override password or message digest.	

Parameter(cont.)	Description(cont.)	
dead-interval	If no packets are received from a particular neighbor for dead-interval seconds, the router considers that neighboring router as being off-line. Default: 40 seconds	
	<1-65535>	The number of seconds in the interval.
hello-interval	The interval the router waits before it sends a hello packet. Default: 10 seconds	
	<1-65535>	The number of seconds in the interval.
retransmit-interval	The interval the router waits before it retransmits a packet. Default: 5 seconds	
	<1-3600>	The number of seconds in the interval.
transmit-delay	The interval the router waits before it transmits a packet. Default: 1 seconds	
	<1-3600>	The number of seconds in the interval.

Mode Router Configuration

Usage You can configure virtual links between any two backbone routers that have an interface to a common non-backbone area. The protocol treats these two routers, joined by a virtual link, as if they were connected by an unnumbered point-to-point network. To configure a virtual link, you require:

- The transit area ID, i.e. the area ID of the non backbone area that the two backbone routers are both connected to.
- The corresponding virtual link neighbor's router ID. To see the router ID use the show ip ospf command.

Configure the hello-interval to be the same for all routers attached to a common network. A short hello-interval results in the router detecting topological changes faster but also an increase in the routing traffic.

The retransmit-interval is the expected round-trip delay between any two routers in a network. Set the value to be greater than the expected round-trip delay to avoid needless retransmissions.

The transmit-delay is the time taken to transmit a link state update packet on the interface. Before transmission, the link state advertisements in the update packet, are incremented by this amount. Set the transmit-delay to be greater than zero. Also, take into account the transmission and propagation delays for the interface.

Example

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# area 1 virtual-link 10.10.11.50 hello 5
dead 10
```

Related Commands area authentication
show ip ospf
show ip ospf virtual-links

auto-cost reference bandwidth

This command controls how OSPF calculates default metrics for the interface.

By default, OSPF calculates the OSPF metric for an interface by dividing the reference bandwidth by the interface bandwidth. The default for the reference bandwidth is 100 Mbps. As a result, if this default is used, there is very little difference between the metrics applied to interfaces of increasing bandwidth beyond 100 Mbps. The auto-cost command is used to alter this reference bandwidth in order to give a real difference between the metrics of high bandwidth links of differing bandwidths. In a network that has multiple links with high bandwidths, specify a larger reference bandwidth value to differentiate the costs on those links.

Use the no variant of this command to assign cost based only on the interface bandwidth.

Syntax

```
auto-cost reference-bandwidth <1-4294967>
no auto-cost reference-bandwidth
```

Parameter	Description
<1-4294967>	The reference bandwidth in terms of Mbits per second (Mbps).

Default 100 Mbps

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# auto-cost reference-bandwidth 1000
```

Related Commands ip ospf cost

bandwidth

Use this command to specify the maximum bandwidth to be used for each VLAN interface. The bandwidth value is in bits. OSPF uses this to calculate metrics for the VLAN interface.

Use the no variant of this command to remove the maximum bandwidth.

Syntax

```
bandwidth  <bandwidth-setting>

no bandwidth
```

Parameter	Description
<bandwidth-setting>	Sets to bandwidth for the interface. Enter a value in the range 1 to 10000000000 bits.

Mode Interface Configuration for a VLAN interface.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# bandwidth 1000000
```

Related Commands

show running-config
show running-config access-list
show interface

capability opaque

This command enables opaque-LSAs. Opaque-LSAs are Type 9, 10 and 11 LSAs that deliver information used by external applications.

By default, opaque-LSAs are enabled.

Use the no variant of this command to disables opaque-LSAs.

Syntax

```
capability opaque
no capability opaque
```

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# no capability opaque
```

capability restart

This command enables OSPF Graceful Restart or restart signaling features. By default, this is enabled.

Use the no variant of this command to disable OSPF Graceful Restart and restart signalling features.

Syntax

```
capability restart [graceful|signaling]
no capability restart
```

Parameter	Description
`graceful`	Enable graceful OSPF restart.
`signaling`	Enable OSPF restart signaling.

Default Graceful restart.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# capability restart graceful
```

clear ip ospf process

This command clears and restarts the OSPF routing process. Specify the Process ID to clear one particular OSPF process. When no Process ID is specified, this command clears all running OSPF processes.

Syntax `clear ip ospf [<0-65535>] process`

Parameter	Description
<0-65535>	The Routing Process ID.

Mode Privileged Exec

Example

```
awplus# clear ip ospf process
```

compatible rfc1583

This command changes the method used to calculate summary route to the that specified in RFC 1583. By default, OSPF uses the method specified in RFC 2328.

RFC 1583 specifies a method for calculating the metric for summary routes based on the minimum metric of the component paths available. RFC 2328 specifies a method for calculating metrics based on maximum cost.

It is possible that some ABRs in an area might conform to RFC 1583 and others support RFC 2328, which could lead to incompatibility in their interoperation. This command addresses this issue by allowing you to selectively disable compatibility with RFC 2328.

Use the no variant of this command to disable RFC 1583 compatibility.

Syntax `compatible rfc1583`

`no compatible rfc1583`

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# compatible rfc1583
```

debug ospf events

This command enables OSPF debugging for OSPF event troubleshooting.

To enable all debugging options, specify debug ospf event with no additional parameters.

The no and undebug variant of this command disable OSPF debugging. Use this command without parameters to disable all the options.

Syntax

```
debug ospf events [abr] [asbr] [lsa] [nssa] [os] [router] [vlink]
no debug ospf events [abr] [asbr] [lsa] [nssa] [os] [router] [vlink]
```

Parameter	Description
abr	Shows ABR events.
asbr	Shows ASBR events.
lsa	Shows LSA events.
nssa	Shows NSSA events.
os	Shows OS interaction events.
router	Shows other router events.
vlink	Shows virtual link events.

Mode Privileged Exec and Global Configuration

Example

```
awplus# debug ospf events asbr lsa
```

Related Commands terminal monitor
undebug ospf events

debug ospf ifsm

This command specifies debugging options for OSPF Interface Finite State Machine (IFSM) troubleshooting.

To enable all debugging options, specify debug ospf ifsm with no additional parameters.

The no and undebug variant of this command disable OSPF IFSM debugging. Use this command without parameters to disable all the options.

Syntax

```
debug ospf ifsm [status] [events] [timers]
no debug ospf ifsm [status] [events] [timers]
```

Parameter	Description
events	Displays IFSM event information.
status	Displays IFSM status information.
timers	Displays IFSM timer information.

Mode Privileged Exec and Global Configuration

Example

```
awplus# no debug ospf ifsm events status
awplus# debug ospf ifsm status
awplus# debug ospf ifsm timers
```

Related Commands terminal monitor
undebug ospf ifsm

debug ospf lsa

This command enables debugging options for OSPF Link State Advertisements (LSA) troubleshooting. This displays information related to internal operations of LSAs.

To enable all debugging options, specify debug ospf lsa with no additional parameters.

The no and undebug variant of this command disable OSPF LSA debugging. Use this command without parameters to disable all the options.

Syntax

```
debug ospf lsa [flooding] [generate] [install] [maxage] [refresh]
no debug ospf lsa [flooding] [generate] [install] [maxage] [refresh]
```

Parameter	Description
`flooding`	Displays LSA flooding.
`generate`	Displays LSA generation.
`install`	Show LSA installation.
`maxage`	Shows maximum age of the LSA in seconds.
`refresh`	Displays LSA refresh.

Mode Privileged Exec and Global Configuration

Examples

```
awplus# undebug ospf lsa refresh
```

Output Figure 38-1: Example output from the **debug ospf lsa** command

```
2002/05/09 14:08:11 OSPF: LSA[10.10.10.10:10.10.10.70]: instance(0x8139cd0)
created with Link State Update
2002/05/09 14:08:11 OSPF: RECV[LS-Upd]: From 10.10.10.70 via vlan5:10.10.10.50
(10.10.10.10 -> 224.0.0.5)
2002/05/09 14:12:33 OSPF: SEND[LS-Upd]: Begin send queue
2002/05/09 14:12:33 OSPF: SEND[LS-Upd]: # of LSAs 1, destination 224.0.0.5
2002/05/09 14:12:33 OSPF: SEND[LS-Upd]: End send queue
2002/05/09 14:12:33 OSPF: SEND[LS-Upd]: To 224.0.0.5 via vlan5:10.10.10.50
```

Related Commands terminal monitor
undebug ospf lsa

debug ospf nfsm

This command enables debugging options for OSPF Neighbor Finite State Machines (NFSMs).

To enable all debugging options, specify debug ospf nfsm with no additional parameters.

The no and undebug variant of this command disable OSPF NFSM debugging. Use this command without parameters to disable all the options.

Syntax

```
debug ospf nfsm [events] [status] [timers]
no debug ospf nfsm [events] [status] [timers]
```

Parameter	Description
`events`	Displays NFSM event information.
`status`	Displays NSFM status information.
`timers`	Displays NFSM timer information.

Mode Privileged Exec and Global Configuration

Examples

```
awplus# debug ospf nfsm events
awplus# no debug ospf nfsm timers
awplus# undebug ospf nfsm events
```

Related Commands terminal monitor
undebug ospf nfsm

debug ospf nsm

This command enables debugging options for the OSPF Network Service Module.

To enable both debugging options, specify debug ospf nsm with no additional parameters.

The no and undebug variant of this command disable OSPF NSM debugging. Use this command without parameters to disable both options.

Syntax

```
debug ospf nsm [interface] [redistribute]
no debug ospf nsm [interface] [redistribute]
```

Parameter	Description
`interface`	Specify NSM interface information.
`redistribute`	Specify NSM redistribute information.

Mode Priviledged Exec and Global Configuration

Examples

```
awplus# debug ospf nsm interface
awplus# no debug ospf nsm redistribute
awplus# undebug ospf nsm interface
```

Related Commands terminal monitor
undebug ospf nsm

debug ospf packet

This command enables debugging options for OSPF packets.

To enable all debugging options, specify debug ospf packet with no additional parameters.

The no and undebug variant of this command disable OSPF packet debugging. Use this command without parameters to disable all options.

Syntax

```
debug ospf packet [dd] [detail] [hello] [ls-ack] [ls-request]
    [ls-update] [recv] [send]

no debug ospf packet [dd] [detail] [hello] [ls-ack] [ls-request]
    [ls-update] [recv] [send]
```

Parameter	Description
dd	Specifies debugging for OSPF database descriptions.
detail	Sets the debug option to detailed information.
hello	Specifies debugging for OSPF hello packets.
ls-ack	Specifies debugging for OSPF link state acknowledgments.
ls-request	Specifies debugging for OSPF link state requests.
ls-update	Specifies debugging for OSPF link state updates.
recv	Specifies the debug option set for received packets.
send	Specifies the debug option set for sent packets.

Mode Privileged Exec and Global Configuration

Examples

```
awplus# debug ospf packet detail

awplus# debug ospf packet dd send detail

awplus# no debug ospf packet ls-request recv detail

awplus# undebug ospf packet ls-request recv detail
```

Related Commands terminal monitor
undebug ospf packet

debug ospf route

This command enables debugging of route calculation. Use this command without parameters to turn on all the options.

To enable all debugging options, specify debug ospf route with no additional parameters.

The no and undebug variant of this command disable OSPF route debugging. Use this command without parameters to disable all options.

Syntax

```
debug ospf route [ase] [ia] [install] [spf]
no debug ospf route [ase] [ia] [install] [spf]
```

Parameter	Description
ia	Specifies the debugging of Inter-Area route calculation.
ase	Specifies the debugging of external route calculation.
install	Specifies the debugging of route installation.
spf	Specifies the debugging of SPF calculation.

Mode Privileged Exec and Global Configuration

Examples

```
awplus# debug ospf route
awplus# no debug ospf route ia
awplus# debug ospf route install
awplus# undebug ospf route install
```

Related Commands terminal monitor
undebug ospf route

default-information originate (OSPF)

This command creates a default external route into an OSPF routing domain.

When you use the default-information originate command to redistribute routes into an OSPF routing domain, then the system acts like an Autonomous System Boundary Router (ASBR). An ASBR does not by default, generate a default route into the OSPF routing domain.

When using this command, also specify the route-map *<route-map>* option to avoid a dependency on the default network in the routing table.

The metric-type is an external link type associated with the default route advertised into the OSPF routing domain. The value of the external route could be either Type 1 or 2. The default is Type 2.

The no variant of this command disables this feature.

Syntax

```
default-information originate [always] [metric <metric>]
   [metric-type <1-2>] [route-map <route-map>]

no default-information originate [always] [metric] [metric-type]
   [route-map]
```

Parameter	Description
`always`	Used to advertise the default route regardless of whether there is a default route.
`metric <metric>`	The metric value used in creating the default route. Enter a value in the range 0 to 16777214. The default metric value is 10. The value used is specific to the protocol.
`metric-type <1-2>`	External metric type for default routes, either OSPF External Type 1 or Type 2 metrics. Enter the value 1 or 2.
`route-map`	Specifies to use a specific route-map.
`<route-map>`	The route-map name. It is a string comprised of any characters, numbers or symbols.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# default-information originate
                       always metric 23 metric-type 2
                       route-map myinfo
```

Related Commands route-map

default-metric (OSPF)

This command sets default metric values for the OSPF routing protocol.

The no variant of this command returns OSPF to using built-in, automatic metric translations, as appropriate for each routing protocol.

Syntax

```
default-metric <1-16777214>
no default-metric [<1-16777214>]
```

Parameter	Description
<1-16777214>	Default metric value appropriate for the specified routing protocol.

Mode Router Configuration

Usage A default metric facilitates redistributing routes even with incompatible metrics. If the metrics do not convert, the default metric provides an alternative and enables the redistribution to continue. The effect of this command is that OSPF will use the same metric value for all redistributed routes. Use this command in conjunction with the redistribute (into OSPF) command.

Examples

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# default-metric 100

awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# no default-metric
```

Related commands redistribute (into OSPF)

distance (OSPF)

This command sets the administrative distance for OSPF routes based on the route type. Your switch uses this value to select between two or more routes to the same destination from two different routing protocols. The route with the smallest administrative distance value is added to the Forwarding Information Base (FIB). See "Administrative Distance" on page 31.5 for more information.

Use the command distance ospf to set the distance for an entire category of OSPF routes, rather than the specific routes that pass an access list.

Use the command distance <1-255>, with no other parameter, to set the same distance for all OSPF route types.

The no variant of this command sets the administrative distance for all OSPF routes to the default of 110.

Syntax

```
distance <1-255>

distance ospf
   {external <1-255>|inter-area <1-255>|intra-area <1-255>}

no distance {ospf|<1-255>}
```

Parameter	Description
<1-255>	The OSPF routes Administrative Distance value.
`external`	Sets the distance for routes from other routing domains, learned by redistribution.
`inter-area`	Sets the distance for all routes from one area to another area.
`intra-area`	Sets the distance for all routes within an area.

Default The default OSPF administrative distance is 110. The default Administrative Distance for each type of route (intra, inter, or external) is 110.

Mode Router Configuration

Usage The administrative distance rates the trustworthiness of a routing information source. The distance could be any integer from 0 to 255. A higher distance value indicates a lower trust rating. For example, an administrative distance of 255 indicates that the routing information source cannot be trusted and should be ignored.

Use this command to set the distance for an entire group of routes, rather than a specific route that passes an access list.

Examples To set the following administrative distances for route types in OSPF 100:

- 20 for inter-area routes
- 10 for intra-area routes
- 40 for external routes

use the commands:

```
awplus(config)# router ospf 100
awplus(config-router)# distance ospf inter-area 20 intra-area 10
external 40
```

To set the administrative distance for all routes in OSPF 100 back to the default of 110, use the commands:

```
awplus(config)# router ospf 100
awplus(config-router)# no distance ospf
```

distribute-list (OSPF)

This command applies a filter to the choice of routes that will be redistributed from another routing protocol into OSPF.

The no variant of this command removes the distribute command.

Syntax

```
distribute-list <list-name>|route-map <route-map_name> in
distribute-list <list-name> out {bgp|connected|rip|static}
no distribute-list <list-name> in
no distribute-list <list-name> out {bgp|connected|rip|static}
```

Parameter	Description
<list-name>	Specifies the name of the access list.
in	Indicates that this applies to incoming advertised routes.
out	Indicates that this applies to outgoing advertised routes.
<route-map-name>	The name of the route-map that the distribute list will apply
bgp	Specifies that this applies to the redistribution of BGP routes.
connected	Specifies that this applies to the redistribution of connected routes.
rip	Specifies that this applies to the redistribution of RIP routes.
static	Specifies that this applies to the redistribution of static routes.

Mode Router Configuration

Example The following example shows the distribution of BGP routing updates based on access list `1` (network 172.10.0.0).

```
awplus# configure terminal
awplus(config)# access-list 1 permit 172.10.0.0
0.0.255.255
awplus(config)# router ospf 100
awplus(config-router)# distribute-list 1 out bgp
awplus(config-router)# redistribute bgp
```

Related Commands redistribute (into OSPF)

enable db-summary-opt

This command enables OSPF database summary list optimization.

The no variant of this command disables database summary list optimization.

Syntax

```
enable db-summary-opt
no enable db-summary-opt
```

Default The default setting is disabled.

Mode Router Configuration

Usage When this feature is enabled, the database exchange process is optimized by removing the LSA from the database summary list for the neighbor, if the LSA instance in the database summary list is the same as, or less recent than, the listed LSA in the database description packet received from the neighbor.

Examples To enable OSPF database summary list optimization, use the commands:

```
awplus# configure terminal
awplus(config)# router ospf
awplus(config-router)# enable db-summary-opt
```

To disable OSPF database summary list optimization, use the commands:

```
awplus# configure terminal
awplus(config)# router ospf
awplus(config-router)# no enable db-summary-opt
```

Validation Commands show running-config

host area

This command configures a stub host entry belonging to a particular area. You can use this command to advertise specific host routes in the router-LSA as stub link. Since stub host belongs to the specified router, specifying cost is optional.

The no variant of this command removes the host area configuration.

Syntax

```
host <ip-address> area <area-id> [cost <0-65535>]
no host <ip-address> area <area-id> [cost <0-65535>]
```

Parameter	Description
<ip-address>	The IPv4 address of the host, in dotted decimal notation.
<area-id>	The OSPF area ID of the transit area that configuring the stub host entry for. Use one of the following formats: ■ dotted decimal format, e.g., 0.0.1.2 ■ normal decimal format in the range <0-4294967295>, e.g., 258.
`cost <0-65535>`	The cost for the stub host entry.

Default By default, no host entry is configured.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# host 172.16.10.100 area 1
awplus(config-router)# host 172.16.10.101 area 2 cost 10
```

ip ospf authentication

This command sets the authentication method used when sending and receiving OSPF packets on the current VLAN interface. The default is to use no authentication.

If no authentication method is specified in this command, then plain text authentication will be used.

The no variant of this command disables the authentication.

Use the ip ospf authentication command on page 38.32 to specify a Simple Text password. Use the ip ospf message-digest-key command on page 38.38 to specify MD5 password.

Syntax

```
ip ospf [<ip-address>] authentication [message-digest|null]
no ip ospf [<ip-address>] authentication
```

Parameter	Description
<ip-address>	The IP address of the interface.
`message-digest`	Use the message digest authentication.
`null`	Use no authentication. It overrides password or message-digest authentication of the interface.

Mode Interface Configuration for a VLAN interface.

Example In this example, interface `vlan1` is configured to have no authentication. This will override any text or MD5 authentication configured on this interface.

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip ospf authentication null
```

Related Commands

ip ospf authentication-key
area authentication
ip ospf message-digest-key

ip ospf authentication-key

This command specifies an OSPF authentication password for the neighboring routers.

This command creates a password (key) that is inserted into the OSPF header when AlliedWare Plus™ software originates routing protocol packets. Assign a separate password to each network for different VLAN interfaces. All neighboring routers on the same network with the same password exchange OSPF routing data.

The key can be used only when authentication is enabled for an area. Use the area authentication command to enable authentication.

Simple password authentication allows a password to be configured for each area. Configure the routers in the same routing domain with the same password.

The no variant of this command removes the OSPF authentication password.

Syntax

```
ip ospf [<ip-address>] authentication-key <pswd-long>
no ip ospf [<ip-address>] authentication-key
```

Parameter	Description
<ip-address>	The IPv4 address of the interface, in dotted decimal notation.
<pswd-long>	Specifies the authentication password. The string by the end of line will be used.

Default By default, an authentication password is not specified.

Mode Interface Configuration for a VLAN interface.

Example In the following example, an authentication key test is created on interface `vlan1` in area 0. Note that first authentication is enabled for area 0.

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# network 10.10.10.0/24 area 0
awplus(config-router)# area 0 authentication
awplus(config-router)# exit
awplus(config)# interface vlan1
awplus(config-if)# ip ospf 3.3.3.3 authentication-key test
```

Related Commands

area authentication
ip ospf authentication

ip ospf cost

This command explicitly specifies the cost of the link-state metric in a router-LSA.

The interface cost indicates the overhead required to send packets across a certain VLAN interface. This cost is stated in the Router-LSA's link. Typically, the cost is inversely proportional to the bandwidth of an interface. By default, the cost of a VLAN interface is calculated according to the following formula:

reference bandwidth/interface bandwidth

To set the VLAN interface cost manually, use this command.

The no variant of this command resets the VLAN interface cost to the default.

Syntax

```
ip ospf [<ip-address>] cost <1-65535>
no ip ospf [<ip-address>] cost
```

Parameter	Description
<ip-address>	The IPv4 address of the interface, in dotted decimal notation.
<1-65535>	The link-state metric.

Default By default the reference bandwidth is 100 Mbps (10^8), but can be set to a different value by the command, auto-cost reference bandwidth command on page 38.14.

Mode Interface Configuration for a VLAN interface.

Example The following example shows setting ospf cost to 10 on interface `vlan25` for IP address 10.10.10.50

```
awplus# configure terminal
awplus(config)# interface vlan25
awplus(config-if)# ip ospf 10.10.10.50 cost 10
```

Related Commands

show ip ospf interface
auto-cost reference bandwidth

ip ospf database-filter

This command turns on the LSA database-filter for a particular VLAN interface.

The no variant of this command turns off the LSA database-filter.

Syntax

```
ip ospf [<ip-address>] database-filter all out
no ip ospf [<ip-address>] database-filter
```

Parameter	Description
<ip-address>	The IPv4 address of the interface, in dotted decimal notation.

Default By default, all outgoing LSAs are flooded to the interface.

Mode Interface Configuration for a VLAN interface.

Usage OSPF floods new LSAs over all interfaces in an area, except the interface on which the LSA arrives. This redundancy ensures robust flooding. However, too much redundancy can waste bandwidth and might lead to excessive link and CPU usage in certain topologies, resulting in destabilizing the network. To avoid this, use the ip ospf database-filter command to block flooding of LSAs over specified interfaces.

Example

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if# ip ospf database-filter all out
```

ip ospf dead-interval

This command sets the interval during which no hello packets are received and after which a neighbor is declared dead.

The dead-interval is the amount of time that OSPF waits to receive an OSPF hello packet from the neighbor before declaring the neighbor is down. This value is advertised in the router's hello packets. It must be a multiple of the hello-interval and be the same for all routers on a specific network.

The no variant of this command returns the interval to the default of 40 seconds. If you have configured this command specifying the IP address of the interface and want to remove the configuration, specify the IP address (no ip ospf *<ip-address>* dead-interval).

Syntax

```
ip ospf [<ip-address>] dead-interval <1-65535>
no ip ospf [<ip-address>] dead-interval
```

Parameter	Description
<ip-address>	The IPv4 address of the interface, in dotted decimal notation.
<1-65545>	The interval in seconds. Default: 40

Mode Interface Configuration for a VLAN interface.

Example The following example shows configuring the dead-interval to 10 seconds on interface `vlan1`.

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip ospf dead-interval 10
```

Related Commands

ip ospf hello-interval
show ip ospf interface

ip ospf disable all

This command completely disables OSPF packet processing on a VLAN interface. It overrides the network area command and disables the processing of packets on the specific interface.

Use the no variant of this command to restore OSPF packet processing on a selected interface.

Syntax

```
ip ospf disable all
no ip ospf disable all
```

Mode Interface Configuration for a VLAN interface.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip ospf disable all
```

ip ospf hello-interval

This command specifies the interval between hello packets.

The hello-interval is advertised in the hello packets. Configure the same hello-interval for all routers on a specific network. A shorter hello interval ensures faster detection of topological changes, but results in more routing traffic.

The no variant of this command returns the interval to the default of 10 seconds.

Syntax

```
ip ospf [<ip-address>] hello-interval <1-65535>
no ip ospf [<ip-address>] hello-interval
```

Parameter	Description
<ip-address>	The IP address of the interface, in dotted decimal notation.
<1-65535>	The interval in seconds. Default: 10

Default The default interval is 10 seconds.

Mode Interface Configuration for a VLAN interface.

Example The following example shows setting the hello-interval to 3 seconds on interface VLAN 2.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip ospf hello-interval 3
```

Related Commands

ip ospf dead-interval
show ip ospf interface

ip ospf message-digest-key

This command registers an MD5 key for OSPF MD5 authentication.

Message Digest Authentication is a cryptographic authentication. A key (password) and key-id are configured on each router. The router uses an algorithm based on the OSPF packet, the key, and the key-id to generate a message digest that gets appended to the packet.

The no variant of this command removes the MD5 key.

Syntax

```
ip ospf [<ip-address>] message-digest-key <key-id> md5 <pswd-long>
no ip ospf [<ip-address>] message-digest-key <key-id>
```

Parameter	Description
<ip-address>	The IPv4 address of the interface, in dotted decimal notation.
<key-id>	A key ID number specified as an integer between 1 and 255.
md5	Use the MD5 algorithm.
<pswd-long>	The OSPF password. This is a string of 1 to 16 characters including spaces.

Default By default, there is no MD5 key registered.

Mode Interface Configuration for a VLAN interface.

Usage Use this command for uninterrupted transitions between passwords. It allows you to add a new key without having to delete the existing key. While multiple keys exist, all OSPF packets will be transmitted in duplicate; one copy of the packet will be transmitted for each of the current keys. This is helpful for administrators who want to change the OSPF password without disrupting communication. The system begins a rollover process until all the neighbors have adopted the new password. This allows neighboring routers to continue communication while the network administrator is updating them with a new password. The router will stop sending duplicate packets once it detects that all of its neighbors have adopted the new password.

Maintain only one password per interface, removing the old password whenever you add a new one. This will prevent the local system from continuing to communicate with the system that is using the old password. Removing the old password also reduces overhead during rollover. All neighboring routers on the same network must have the same password value to enable exchange of OSPF routing data.

Examples The following example shows OSPF authentication on the interface VLAN 5 when IP address has not been specified.

```
awplus# configure terminal
awplus(config)# interface vlan5
awplus(config-if)# ip ospf authentication message-digest
awplus(config-if)# ip ospf message-digest-key 1 md5 yourpass
```

The following example shows configuring OSPF authentication on the interface VLAN 2 for the IP address 1.1.1.1. (If the interface has two IP addresses assigned-- 1.1.1.1 & 2.2.2.2, OSPF authentication will be enabled only for the IP address 1.1.1.1)

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip ospf 1.1.1.1 authentication message-
digest
awplus(config-if)# ip ospf 1.1.1.1 message-digest-key 2 md5
yourpass
```

ip ospf mtu

This command sets the MTU size for OSPF. Whenever OSPF constructs packets, it uses VLAN interface MTU size as Maximum IP packet size. This command forces OSPF to use the specified value, overriding the actual VLAN interface MTU size.

Use the no variant of this command to return the MTU size to the default.

Syntax

```
ip ospf mtu <576-65535>
no ip ospf mtu
```

Default By default, OSPF uses interface MTU derived from the VLAN interface.

Mode Interface Configuration for a VLAN interface.

Usage This command allows an administrator to configure the MTU size recognized by the OSPF protocol. It does not configure the MTU settings on the VLAN interface. OSPF will not recognize MTU size configuration changes made to the kernel until the MTU size is updated through the CLI.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip ospf mtu 1480
```

ip ospf mtu-ignore

Use this command to configure OSPF so that OSPF does not check the MTU size during DD (Database Description) exchange.

Use the no variant of this command to make sure that OSPF checks the MTU size during DD exchange.

Syntax

```
ip ospf [<ip-address>] mtu-ignore
no ip ospf [<ip-address>] mtu-ignore
```

Parameter	Description
<ip-address>	IPv4 address of the interface, in dotted decimal notation.

Mode Interface Configuration for a VLAN interface.

Usage By default, during the DD exchange process, OSPF checks the MTU size described in the DD packets received from the neighbor. If the MTU size does not match the interface MTU, the neighbor adjacency is not established. Using this command makes OSPF ignore this check and allows establishing of adjacency regardless of MTU size in the DD packet.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-router)# ip ospf mtu-ignore
```

ip ospf network

This command configures the OSPF network type to a type different from the default for the particular VLAN interface.

The no variant of this command returns the network type to the default for the particular VLAN interface.

Syntax

```
ip ospf network [broadcast|non-broadcast|point-to-point|
   point-to-multipoint]

no ip ospf network
```

Parameter	Description
`broadcast`	Sets the network type to broadcast.
`non-broadcast`	Sets the network type to NBMA.
`point-to-multipoint`	Sets the network type to point-to-multipoint.
`point-to-point`	Sets the network type to point-to-point.

Mode Interface Configuration for a VLAN interface.

Mode The default is the `broadcast` OSPF network type for a VLAN interface.

Usage This command forces the interface network type to the specified type. Depending on the network type, OSPF changes the behavior of the packet transmission and the link description in LSAs.

Example The following example shows setting the network type to point-to-point on the vlan1 interface.

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip ospf network point-to-point
```

ip ospf priority

This command sets the router priority, which is a parameter used in the election of the designated router for the network.

The no variant of this command returns the router priority to the default of 1.

Syntax

```
ip ospf [<ip-address>] priority <priority>
no ip ospf [<ip-address>] priority
```

Parameter	Description
<ip-address>	The IP address of the interface.
<priority>	*<0-255>* Specifies the Router Priority of the interface.

Default The default priority is 1.

Mode Interface Configuration for a VLAN interface.

Usage Set the priority to help determine the OSPF Designated Router (DR) for a network. If two routers attempt to become the DR, the router with the higher router priority becomes the DR. If the router priority is the same for two routers, the router with the higher router ID takes precedence.

Only routers with nonzero router priority values are eligible to become the designated or backup designated router.

Configure router priority for multiaccess networks only and not for point-to-point networks.

Example The following example shows setting the OSPF priority value to 3 on the `vlan2` interface.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip ospf priority 3
```

Related Commands ip ospf network

ip ospf resync-timeout

Use this command to set the interval after which adjacency is reset if out-of-band resynchronization has not occurred. The interval period starts from the time a restart signal is received from a neighbor.

Use the no variant of this command to return to the default.

Syntax

```
ip ospf [<ip-address>] resync-timeout <1-65535>
no ip ospf [<ip-address>] resync-timeout
```

Parameter	Description
<ip-address>	The IP address of the interface.
<1-65535>	Specifies the resynchronization timeout value of the interface in seconds.

Mode Interface Configuration for a VLAN interface.

Example The following example shows setting the OSPF resynchronization timeout value to 65 seconds on the `vlan2` interface.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip ospf resync-timeout 65
```

ip ospf retransmit-interval

Use this command to specify the time between link-state advertisement (LSA) retransmissions for adjacencies belonging to the interface.

Use the no variant of this command to return to the default of 5 seconds.

Syntax

```
ip ospf [<ip-address>] retransmit-interval <1-65535>
no ip ospf [<ip-address>] retransmit-interval
```

Parameter	Description
<ip-address>	The IP address of the interface.
<1-65535>	Specifies the interval in seconds.

Default The default interval is 5 seconds.

Mode Interface mode for a VLAN interface.

Usage After sending an LSA to a neighbor, the router keeps the LSA until it receives an acknowledgement. In case the router does not receive an acknowledgement during the set time (the retransmit interval value) it retransmits the LSA. Set the retransmission interval value conservatively to avoid needless retransmission. The interval should be greater than the expected round-trip delay between two routers.

Example The following example shows setting the `ospf retransmit interval` to 6 seconds on the `vlan2` interface.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip ospf retransmit-interval 6
```

ip ospf transmit-delay

Use this command to set the estimated time it takes to transmit a link-state-update packet on the VLAN interface.

Use the no variant of this command to return to the default of 1 second.

Syntax

```
ip ospf [<ip-address>] transmit-delay <1-65535>
no ip ospf [<ip-address>] transmit-delay
```

Parameter	Description
<ip-address>	The IP address of the VLAN interface.
<1-65535>	Specifies the time, in seconds, to transmit a link-state update.

Default The default interval is 1 second.

Mode Interface Configuration for a VLAN interface.

Usage The transmit delay value adds a specified time to the age field of an update. If the delay is not added, the time in which the LSA transmits over the link is not considered. This command is especially useful for low speed links. Add transmission and propagation delays when setting the transmit delay value.

Example The following example shows setting the OSPF transmit delay time to 3 seconds on the `vlan2` interface.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip ospf transmit-delay 3
```

max-concurrent-dd

Use this command to set the limit for the number of Database Descriptors (DD) that can be processed concurrently.

Use the no variant of this command to reset the limit for the number of Database Descriptors (DD) that can be processed concurrently.

Syntax

```
max-concurrent-dd <1-65535>
no max-concurrent-dd
```

Parameter	Description
<1-65535>	Specify the number of DD processes.

Mode Router Configuration

Usage This command is useful when a router's performance is affected from simultaneously bringing up several OSPF adjacencies. This command limits the maximum number of DD exchanges that can occur concurrently per OSPF instance, thus allowing for all of the adjacencies to come up.

Example The following example sets the max-concurrent-dd value to 4, so that only 4 DD exchanges will be processed at a time.

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router# max-concurrent-dd 4
```

maximum-area

Use this command to set the maximum number of OSPF areas.

Use the no variant of this command to set the maximum number of OSPF areas to the default.

Syntax

```
maximum-area <1-4294967294>
no maximum-area
```

Parameter	Description
<1-4294967294>	Specify the maximum number of OSPF areas.

Default The default for the maximum number of OSPF areas is 4294967294.

Mode Router Configuration

Usage Use this command in router OSPF mode to specify the maximum number of OSPF areas.

Examples The following example sets the maximum number of OSPF areas to 2:

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# maximum-area 2
```

The following example removes the maximum number of OSPF areas and resets to default:

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# no maximum-area
```

neighbor (OSPF)

Use this command to inform the router of other neighboring routers that are connected to the same NBMA network.

Use the no variant of this command to remove a configuration.

Syntax

```
neighbor <ip-address> [<cost>]{<priority>|<poll-interval>}
no neighbor <ip-address> [<cost>]{<priority>|<poll-interval>}
```

Parameter	Description
<ip-address>	Specifies the interface IP address of the neighbor.
<priority>	`priority` *<0-255>* Specifies the router priority value of the non-broadcast neighbor associated with the specified IP address. The default is 0. This keyword does not apply to point-to-multipoint interfaces.
<poll-interval>	`poll-interval` *<1-65535>* Dead neighbor polling interval in seconds. It is recommended to set this value much higher than the hello interval. The default is 120 seconds.
<cost>	`cost` *<1-65535>* Specifies the link-state metric to this neighbor.

Mode Router Configuration

Usage To configure a neighbor on an NBMA network manually, use the `neighbor` command and include one neighbor entry for each known nonbroadcast network neighbor. The IP address used in this command is the neighbor's primary IP address on the interface where that neighbor connects to the NBMA network.

The poll interval is the reduced rate at which routers continue to send hello packets, when a neighboring router has become inactive. Set the poll interval to be much larger than hello interval.

Examples This example shows a neighbor configured with a priority value, poll interval time, and cost.

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# neighbor 1.2.3.4 priority 1 poll-
interval 90
awplus(config-router)# neighbor 1.2.3.4 cost 15
```

network area

Use this command to enable OSPF routing with a specified Area ID on any interfaces with IP addresses that match the specified network address.

Use the no variant of this command to disable OSPF routing on the interfaces.

Syntax

```
network <network-address> area <area-id>
no network <network-address> area <area-id>
```

Parameter	Description
<network-address>	{*<ip-network/m>*|*<ip-addr> <reverse-mask>*}
<ip-network/m>	IP address of the network, entered in the form A.B.C.D/M. Dotted decimal notation followed by a forward slash, and then the subnet mask length.
<ip-addr>	IPv4 network address, entered in the form A.B.C.D.
<reverse-mask>	Reverse mask in dotted decimal format. Note that the term reverse-mask is sometimes referred to as a Wildcard mask.
<area-id>	{*<ip-addr>*|*<0-4294967295>*}
<ip-addr>	OSPF Area ID in IPv4 address format, in the form A.B.C.D.
<0-4294967295>	OSPF Area ID as 4 octets unsigned integer value.

Default No network area is configured by default.

Mode Router Configuration

Usage OSPF routing can be enabled per IPv4 subnet. The network address can be defined using either the prefix length or a wild card mask. A wild card mask is comprised of consecutive `0's` as network bits and consecutive `1's` as host bits.

Examples The following commands show the use of the network area command with OSPF multiple instance support disabled:

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# network 10.0.0.0/8 area  3
awplus(config-router)# network 10.0.0.0/8 area 1.1.1.1
```

The following commands disable OSPF routing with Area ID 3 on all interfaces:

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# no network 10.0.0.0/8 area3
```

ospf abr-type

Use this command to set an OSPF Area Border Router (ABR) type.

Use the no variant of this command to revert the ABR type to the default setting (Cisco).

Syntax

```
ospf abr-type {cisco|ibm|standard}
no ospf abr-type {cisco|ibm|standard}
```

Parameter	Description
`cisco`	Specifies an alternative ABR using Cisco implementation (RFC 3509). This is the default ABR type.
`ibm`	Specifies an alternative ABR using IBM implementation (RFC 3509).
`standard`	Specifies a standard behavior ABR (RFC 2328).

Default ABR type `Cisco`

Mode Router Configuration

Usage Specifying the ABR type allows better interoperation between different implementations. This command is specially useful in a multi-vendor environment. The different ABR types are:

- Cisco ABR Type: By this definition, a router is considered an ABR if it has more than one area actively attached and one of them is the backbone area.
- IBM ABR Type: By this definition, a router is considered an ABR if it has more than one area actively attached and the backbone area is configured. In this case the configured backbone need not be actively connected.
- Standard ABR Type: By this definition, a router is considered an ABR if it has more than one area actively attached to it.

Example

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# ospf abr-type ibm
```

ospf restart grace-period

Use this command to configure the grace-period for restarting OSPF routing.

Use the no variant of this command to revert to the default grace-period.

Syntax

```
ospf restart grace-period <1-1800>

no ospf restart grace-period
```

Parameter	Description
<1-1800>	Specifies the grace period in seconds.

Default In the AlliedWare Plus™ OSPF implementation, the default OSPF grace-period is 120 seconds.

Mode Global Configuration

Usage Use this command to enable the OSPF Graceful Restart feature and set the restart grace-period. Changes from the default restart grace-period are displayed in the running-config. The restart grace-period is not displayed in the running-config if it has been reset to the default using the no variant of this command.

When a master failover happens on a VCStack, the OSPF grace-period will be the longest period between the default value (120 seconds is the default OSPF grace-period) and the configured OSPF grace-period value from this command. So the configured OSPF grace-period value will not be used for a VCStack master failover if it is shorter than the default OSPF grace-period.

Example To set the OSPF restart grace-period to 250 seconds, use the commands:

```
awplus# configure terminal
awplus(config)# ospf restart grace-period 250
```

To reset the OSPF restart grace-period to the default (120 seconds), use the commands:

```
awplus# configure terminal
awplus(config)# no ospf restart grace-period
```

Validation Commands show running-config

Related Commands ospf restart helper
restart ospf graceful

ospf restart helper

Use this command to configure the helper behavior for the OSPF Graceful Restart feature.

Use the no variant of this command to revert to the default grace-period.

Syntax

```
ospf restart helper
   {max-grace-period <grace-period>|only-reload|only-upgrade}

ospf restart helper {never router-id <router-id>}

no ospf restart helper [max-grace-period]
```

Parameter	Description
max-grace-period	Specify help if received grace-period is less than a specified value.
<grace-period>	Maximum grace period accepted in seconds in range *<1-1800>*.
never	Specify the local policy to never to act as a helper for this feature.
only-reload	Specify help only on software reloads not software upgrades.
only-upgrade	Specify help only on software upgrades not software reloads.
router-id	Enter the router-id keyword to specify the OSPF Router ID that is never to act as a helper for the OSPF Graceful Restart feature.
<router-id>	*<A.B.C.D>* Specify the OSPF Router ID in dotted decimal format A.B.C.D

Default In the AlliedWare Plus™ OSPF implementation, the default OSPF grace-period is 120 seconds.

Mode Global Configuration

Usage The ospf restart helper command requires at least one parameter, but you may use more than one in the same command (excluding parameter never).

The no version of this command turns off the OSPF restart helper, while the no ospf restart helper max-grace-period command resets the max-grace-period, rather than the helper policy itself.

Example

```
awplus# configure terminal
awplus(config)# ospf restart helper only-reload

awplus# configure terminal
awplus(config)# ospf restart helper never router-id 10.10.10.1

awplus# configure terminal
awplus(config)# no ospf restart helper max-grace-period
```

Related Commands ospf restart grace-period
restart ospf graceful

ospf router-id

Use this command to specify a router ID for the OSPF process.

Use the no variant of this command to disable this function.

Syntax

```
ospf router-id <ip-address>
no ospf router-id
```

Parameter	Description
<ip-address>	Specifies the router ID in IPv4 address format.

Mode Router Configuration

Usage Configure each router with a unique router-id. In an OSPF router process that has active neighbors, a new router-id takes effect at the next reload or when you restart OSPF manually.

Example The following example shows a specified router ID 2.3.4.5.

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# ospf router-id 2.3.4.5
```

Related Commands show ip ospf

overflow database

Use this command to limit the maximum number of Link State Advertisements (LSAs) that can be supported by the current OSPF instance.

Use the no variant of this command to have no limit on the maximum number of LSAs.

Syntax

```
overflow database <0-4294967294> {hard|soft}
no overflow database
```

Parameter	Description
<0-4294967294>	The maximum number of LSAs.
`hard`	Shutdown occurs if the number of LSAs exceeds the specified value.
`soft`	Warning message appears if the number of LSAs exceeds the specified value.

Mode Router Configuration

Usage Use hard with this command if a shutdown is required if the number of LSAs exceeds the specified number. Use soft with this command if a shutdown is not required, but a warning message is required, if the number of LSAs exceeds the specified number.

Example The following example shows setting the database overflow to 500, and a shutdown to occur, if the number of LSAs exceeds 500.

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# overflow database 500 hard
```

overflow database external

Use this command to configure the size of the external database and the time the router waits before it tries to exit the overflow state.

Use the no variant of this command to revert to default.

Syntax

```
overflow database external <max-lsas> <recover-time>
no overflow database external
```

Parameter	Description
<max-lsas>	*<0-2147483647>* The maximum number of Link State Advertisements (LSAs). Note that this value should be the same on all routers in the AS.
<recover-time>	*<0-65535>* the number of seconds the router waits before trying to exit the database overflow state. If this parameter is 0, router exits the overflow state only after an explicit administrator command.

Mode Router Configuration

Usage Use this command to limit the number of AS-external-LSAs a router can receive, once it is in the wait state. It takes the number of seconds specified as the *<recover-time>* to recover from this state.

Example The following example shows setting the maximum number of LSAs to 5 and the time to recover from overflow state to be 3:

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# overflow database external 50 3
```

passive-interface (OSPF)

Use this command to suppress the sending of Hello packets on all interfaces, or on a specified interface. If you use the passive-interface command without the optional parameters then all interfaces are put into passive mode.

Use the no variant of this command to allow the sending of Hello packets on all interfaces, or on the specified interface. If you use the no variant of this command without the optional parameters then all interfaces are removed from passive mode.

Syntax

```
passive-interface [<interface>][<ip-address>]
no passive-interface [<interface>][<ip-address>]
```

Parameter	Description
<interface>	The name of the interface.
<ip-address>	IP address of the interface, entered in the form A.B.C.D.

Mode Router Configuration

Usage Configure an interface to be passive if you wish its connected route to be treated as an OSPF route (rather than an AS-external route), but do not wish to actually exchange any OSPF packets via this interface.

Examples To configure passive interface mode on interface vlan2, enter the following commands:

```
awplus(config)# router ospf 100
awplus(config-router)# passive-interface vlan2
```

To configure passive interface mode on all interfaces, enter the following commands:

```
awplus(config)# router ospf 100
awplus(config-router)# passive-interface
```

To remove passive interface mode on interface vlan2, enter the following commands:

```
awplus(config)# router ospf 100
awplus(config-router)# no passive-interface vlan2
```

To remove passive interface mode on all interfaces, enter the following commands:

```
awplus(config)# router ospf 100
awplus(config-router)# no passive-interface
```

redistribute (into OSPF)

Use this command to redistribute routes from other routing protocols, static routes and connected routes into an ospf routing table.

Use the no variant of this command to disable this function.

Syntax

```
redistribute {bgp|connected|rip|static} {metric|metric-type|
   route-map|tag}

no redistribute {bgp|connected|rip|static} {metric|metric-type|
   route-map|tag}
```

Parameter	Description
bgp	Specifies that this applies to the redistribution of BGP routes.
connected	Specifies that this applies to the redistribution of connected routes.
rip	Specifies that this applies to the redistribution of RIP routes.
static	Specifies that this applies to the redistribution of static routes.
metric	metric *<0-16777214>* Specifies the external metric.
metric-type	metric-type {1|2} Specifies the external metric-type.
route-map	route-map *WORD* Specifies name of the route-map.
tag	tag *<0-4294967295>* Specifies the external route tag.

Mode Router Configuration

Usage You use this command to inject routes, learnt from other routing protocols, into the OSPF domain to generate AS-external-LSAs. If a route-map is configured by this command, then that route-map is used to control which routes are redistributed and can set metric and tag values on particular routes.

The metric, metric-type, and tag values specified on this command are applied to any redistributed routes that are not explicitly given a different metric, metric-type, or tag value by the route map.

Example The following example shows redistribution of bgp routes into ospf routing table `100`, with metric `12`.

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# redistribute bgp metric 12
```

restart ospf graceful

Use this command to force the OSPF process to restart, and optionally set the grace-period.

Syntax

```
restart ospf graceful [grace-period <1-1800>]
```

Parameter	Description
`grace-period`	Specify the grace period.
<1-1800>	The grace period in seconds.

Default In the AlliedWare Plus™ OSPF implementation, the default OSPF grace-period is 120 seconds.

Mode Privileged Exec

Usage After this command is executed, the OSPF process immediately shuts down. It notifies the system that OSPF has performed a graceful shutdown. Routes installed by OSPF are preserved until the grace-period expires.

When a restart ospf graceful command is issued, the OSPF configuration is reloaded from the last saved configuration. Ensure you first enter the command copy running-config startup-config.

When a master failover happens on a VCStack, the OSPF grace-period will be the longest period between the default value (120 seconds is the default OSPF grace-period) and the configured OSPF grace-period value from this command. So the configured OSPF grace-period value will not be used for a VCStack master failover if it is shorter than the default OSPF grace-period.

Example

```
awplus# copy running-config startup-config
awplus# restart ospf graceful grace-period 200
```

Related Commands ospf restart grace-period
ospf restart helper

router ospf

Use this command to enter Router Configuration mode to configure an OSPF routing process. You must specify the process ID with this command for multiple OSPF routing processes on the switch.

Use the no variant of this command to terminate an OSPF routing process.

Use the no parameter with the process-id parameter, to terminate and delete a specific OSPF routing process. If no process-id is specified on the no variant of this command, then all OSPF routing processes are terminated, and all OSPF configuration is removed.

Syntax

```
router ospf [<process-id>] [<vrf-instance>]
no router ospf [<process-id>]
```

Parameter	Description
<process-id>	A positive number from 1 to 65535, that is used to define a routing process.
<vrf-instance>	The VRF instance to be associated with the OSPF routing process.

Default No routing process is defined by default.

Mode Global Configuration

Usage The process ID of OSPF is an optional parameter for the no variant of this command only. When removing all instances of OSPF, you do not need to specify each Process ID, but when removing particular instances of OSPF you must specify each Process ID to be removed.

When using VRF-Lite, this command can be used to associate a process-id with a VRF instance that has been created using the ip vrf command on page 46.10.

Example To enter Router Configuration mode to configure an existing OSPF routing process `100`, use the commands:

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)#
```

To enter Router Configuration mode to configure an existing OSPF routing process `100` for VRF instance `red`, use the commands:

```
awplus# configure terminal
awplus(config)# router ospf 100 red
awplus(config-router)#
```

router-id

Use this command to specify a router ID for the OSPF process.

Use the no variant of this command to force OSPF to use the previous OSPF router-id behavior.

Syntax

```
router-id <ip-address>
no router-id
```

Parameter	Description
<ip-address>	Specifies the router ID in IPv4 address format.

Mode Router Configuration

Usage Configure each router with a unique router-id. In an OSPF router process that has active neighbors, a new router-id is used at the next reload or when you restart OSPF manually.

Example The following example shows a fixed router ID 10.10.10.60

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# router-id 10.10.10.60
```

Related Commands show ip ospf

show debugging ospf

Use this command to display which OSPF debugging options are currently enabled.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show debugging ospf`

Mode User Exec and Privileged Exec

Example

```
awplus# show debugging ospf
```

Output Figure 38-2: Example output from the **show debugging ospf** command

```
OSPF debugging status:
  OSPF packet Link State Update debugging is on
  OSPF all events debugging is on
```

show ip ospf

Use this command to display general information about all OSPF routing processes. Include the process ID parameter with this command to display information about specified instances.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip ospf
show ip ospf <process-id>
```

Parameter	Description
<process-id>	*<0-65535>* The ID of the router process for which information will be displayed. If this parameter is included, only the information for the specified routing process is displayed.

Mode User Exec and Privileged Exec

Examples To display general information about all OSPF routing processes, use the command:

```
awplus# show ip ospf
```

To display general information about OSPF routing process `100`, use the command:

```
awplus# show ip ospf 100
```

Table 38-1: Example output from the **show ip ospf** command

```
Route Licence: Route : Limit=0, Allocated=0, Visible=0, Internal=0
Route Licence: Breach: Current=0, Watermark=0
Routing Process "ospf 10" with ID 192.168.1.1
Process uptime is 10 hours 24 minutes
Process bound to VRF default
Conforms to RFC2328, and RFC1583 Compatibility flag is disabled
Supports only single TOS(TOS0) routes
Supports opaque LSA
Supports Graceful Restart
SPF schedule delay min 0.500 secs, SPF schedule delay max 50.0 secs
Refresh timer 10 secs
Number of incomming current DD exchange neighbors 0/5
Number of outgoing current DD exchange neighbors 0/5
Number of external LSA 0. Checksum 0x000000
Number of opaque AS LSA 0. Checksum 0x000000
Number of non-default external LSA 0
External LSA database is unlimited.
Number of LSA originated 0
Number of LSA received 0
Number of areas attached to this router: 2
   Area 0 (BACKBONE) (Inactive)
        Number of interfaces in this area is 0(0)
        Number of fully adjacent neighbors in this area is 0
        Area has no authentication
        SPF algorithm executed 0 times
        Number of LSA 0. Checksum 0x000000
```

Table 38-1: Example output from the **show ip ospf** command (cont.)

```
    Area 1 (Inactive)
        Number of interfaces in this area is 0(0)
        Number of fully adjacent neighbors in this area is 0
        Number of fully adjacent virtual neighbors through this area is 0
        Area has no authentication
        SPF algorithm executed 0 times
        Number of LSA 0. Checksum 0x000000
```

Table 38-2: Example output from the **show ip ospf <process-id>** command

```
Routing Process "ospf 100" with ID 10.10.11.146
Process uptime is 0 minute
Conforms to RFC2328, and RFC1583Compatibility flag is disabled
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Refresh timer 10 secs
Number of external LSA 0. Checksum Sum 0x0
Number of non-default external LSA 0
External LSA database is unlimited.
Number of areas attached to this router: 1
   Area 1
        Number of interfaces in this area is 1(1)
        Number of fully adjacent neighbors in this area is 0
        Number of fully adjacent virtual neighbors through this area is 0
        Area has no authentication
        SPF algorithm executed 0 times
        Number of LSA 1. Checksum Sum 0x00e3e2
```

Table 38-3: Parameters in the output of the **show ip ospf** command

Output Parameter		Meaning
`Route Licence: Route:`	`Limit`	The maximum number of OSPF routes which may be used for forwarding.
	`Allocated`	The current total number of OSPF routes allocated in the OSPF module.
	`Visible`	The current number of OSPF routes which may be used for forwarding.
	`Internal`	The number of OSPF internal routes used for calculating paths to ASBRs.
`Number of external LSA`		The number of external link-state advertisements
`Number of opaque AS LSA`		Number of opaque link-state advertisements

Related Commands router ospf

show ip ospf border-routers

Use this command to display the ABRs and ASBRs for all OSPF instances. Include the process ID parameter with this command to view data about specified instances.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip ospf border-routers
show ip ospf <process-id> border-routers
```

Parameter	Description
<process-id>	*<0-65535>* The ID of the router process for which information will be displayed.

Mode User Exec and Privileged Exec

Output Figure 38-3: Example output from the **show ip ospf border-routers** command

```
OSPF process 1 internal Routing Table
Codes: i - Intra-area route, I - Inter-area route
i 10.15.0.1 [10] via 10.10.0.1, vlan2, ASBR, Area 0.0.0.0
i 172.16.10.1 [10] via 10.10.11.50, vlan3, ABR, ASBR, Area
0.0.0.0
```

show ip ospf database

Use this command to display a database summary for OSPF information. This command displays BGP tags for prefixes. Include the process ID parameter with this command to display information about specified instances.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip ospf database [self-originate|max-age]
show ip ospf <process-id> database [self-originate|max-age]
```

Parameter	Description
<process-id>	*<0-65535>* The ID of the router process for which information will be displayed.
`self-originate`	Displays self-originated link states.
`max-age`	Displays LSAs in MaxAge list. It maintains the list of the all LSAs in the database which have reached the max-age which is 3600 seconds.

Mode User Exec and Privileged Exec

Examples To display the ABRs and ASBRs for all OSPF instances, use the command:

```
awplus# show ip ospf border-routers
```

To display the ABRs and ASBRs for the specific OSPF instance `721`, use the command:

```
awplus# show ip ospf 721 border-routers
```

Output Figure 38-4: Example output from the **show ip ospf database** command

```
       OSPF Router process 1 with ID (10.10.11.60)
                Router Link States (Area 0.0.0.1)
Link ID         ADV Router      Age  Seq#       CkSum  Link
count
10.10.11.60     10.10.11.60       32 0x80000002 0x472b 1
       OSPF Router process 100 with ID (10.10.11.60)
                Router Link States (Area 0.0.0.0)
Link ID         ADV Router      Age  Seq#       CkSum  Link
count
10.10.11.60     10.10.11.60      219 0x80000001 0x4f5d 0
```

Example

```
awplus# show ip ospf database external 1.2.3.4 self-originate
awplus# show ip ospf database self-originate
```

Figure 38-5: Example output from the **show ip ospf database self-originate** command

```
       OSPF Router process 100 with ID (10.10.11.50)
                Router Link States (Area 0.0.0.1 [NSSA])
Link ID         ADV Router      Age  Seq#       CkSum  Link
count
10.10.11.50     10.10.11.50     20  0x80000007  0x65c3 2
                Area-Local Opaque-LSA (Area 0.0.0.1 [NSSA])
Link ID         ADV Router      Age  Seq#       CkSum Opaque ID
67.1.4.217      10.10.11.50     37 0x80000001  0x2129 66777
                AS-Global Opaque-LSA
Link ID         ADV Router      Age  Seq#       CkSum Opaque ID
67.1.4.217      10.10.11.50     37 0x80000001  0x2daa 66777
```

show ip ospf database asbr-summary

Use this command to display information about the Autonomous System Boundary Router (ASBR) summary LSAs.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip ospf database asbr-summary [<ip-addr>]
   [self-originate|<advrouter>]
```

Parameter	Description
<advrouter>	adv-router <*ip-address*>
adv-router	Displays all the LSAs of the specified router.
<ip-addr>	A link state ID, as an IP address.
self-originate	Displays self-originated link states.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ip ospf database asbr-summary 1.2.3.4 self-
originate

awplus# show ip ospf database asbr-summary self-originate

awplus# show ip ospf database asbr-summary 1.2.3.4 adv-router
2.3.4.5
```

show ip ospf database external

Use this command to display information about the external LSAs.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip ospf database external [<ip-addr>] [self-originate|
    <advrouter>]
```

Parameter	Description
<advrouter>	adv-router <*ip-address*>
adv-router	Displays all the LSAs of the specified router.
<ip-addr>	A link state ID, as an IP address.
self-originate	Displays self-originated link states.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ip ospf database external 1.2.3.4 self-originate

awplus# show ip ospf database external self-originate

awplus# show ip ospf database external 1.2.3.4 adv-router
        2.3.4.5
```

Output Figure 38-6: Example output from the **show ip ospf database external self-originate** command

```
       OSPF Router process 100 with ID (10.10.11.50)
                AS External Link States
  LS age: 298
  Options: 0x2 (*|-|-|-|-|-|E|-)
  LS Type: AS-external-LSA
  Link State ID: 10.10.100.0 (External Network Number)
  Advertising Router: 10.10.11.50
  LS Seq Number: 80000001
  Checksum: 0x7033
  Length: 36
  Network Mask: /24
        Metric Type: 2 (Larger than any link state path)
        TOS: 0
        Metric: 20
        Forward Address: 10.10.11.50
        External Route Tag: 0
```

show ip ospf database network

Use this command to display information about the network LSAs.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip ospf database network [<ip-addr>]
    [self-originate|<advrouter>]
```

Parameter	Description
<advrouter>	adv-router **<***ip-address***>**
adv-router	Displays all the LSAs of the specified router.
<ip-addr>	A link state ID, as an IP address.
self-originate	Displays self-originated link states.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ip ospf database network 1.2.3.4 self-originate

awplus# show ip ospf database network self-originate

awplus# show ip ospf database network 1.2.3.4 adv-router
        2.3.4.5
```

Output Figure 38-7: Example output from the **show ip ospf database network** command

```
        OSPF Router process 200 with ID (192.30.30.2)
                  Net Link States (Area 0.0.0.0)
  LS age: 1387
  Options: 0x2 (*|-|-|-|-|-|E|-)
  LS Type: network-LSA
  Link State ID: 192.10.10.9 (address of Designated Router)
  Advertising Router: 192.30.30.3
  LS Seq Number: 80000001
  Checksum: 0xe1b0
  Length: 32
  Network Mask: /24
        Attached Router: 192.20.20.1
        Attached Router: 192.30.30.3
  LS age: 1648
  Options: 0x2 (*|-|-|-|-|-|E|-)
  LS Type: network-LSA
 Link State ID: 192.30.30.3 (address of Designated Router)
  Advertising Router: 192.30.30.3
  LS Seq Number: 8000000f
  Checksum: 0xe864
  Length: 32
  Network Mask: /24
        Attached Router: 192.30.30.2
        Attached Router: 192.30.30.3
```

Figure 38-8: Example output from the **show ip ospf database network** command

```
      OSPF Router process 200 with ID (192.30.30.2)
                Net Link States (Area 0.0.0.0)
LS age: 1175
Options: 0x2 (*|-|-|-|-|-|E|-)
LS Type: network-LSA
Link State ID: 192.10.10.9 (address of Designated Router)
Advertising Router: 192.30.30.3
LS Seq Number: 80000002
Checksum: 0xdfb1
Length: 32
Network Mask: /24
      Attached Router: 192.20.20.1
      Attached Router: 192.30.30.3
LS age: 1327
Options: 0x2 (*|-|-|-|-|-|E|-)
LS Type: network-LSA
Link State ID: 192.20.20.2 (address of Designated Router)
Advertising Router: 192.20.20.2
LS Seq Number: 8000000d
Checksum: 0xbce6
Length: 32
Network Mask: /24
      Attached Router: 192.20.20.1
      Attached Router: 192.20.20.2
LS age: 1278
Options: 0x2 (*|-|-|-|-|-|E|-)
LS Type: network-LSA
Link State ID: 192.30.30.3 (address of Designated Router)
Advertising Router: 192.30.30.3
Advertising Router: 192.30.30.3
LS Seq Number: 80000001
Checksum: 0x0556
Length: 32
Network Mask: /24
      Attached Router: 192.30.30.2
      Attached Router: 192.30.30.3
LS age: 1436
Options: 0x2 (*|-|-|-|-|-|E|-)
LS Type: network-LSA
Link State ID: 192.40.40.2 (address of Designated Router)
Advertising Router: 192.20.20.2
LS Seq Number: 8000000e
Checksum: 0xf173
Length: 32
Network Mask: /24
      Attached Router: 192.20.20.2
      Attached Router: 192.30.30.2
```

show ip ospf database nssa-external

Use this command to display information about the NSSA external LSAs.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip ospf database nssa-external [<ip-address>]
   [self-originate|<advrouter>]
```

Parameter	Description
<advrouter>	adv-router <*ip-address*>
adv-router	Displays all the LSAs of the specified router.
<ip-address>	A link state ID, as an IP address.
self-originate	Displays self-originated link states.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ip ospf database nssa-external 1.2.3.4
       self-originate

awplus# show ip ospf database nssa-external self-originate

awplus# show ip ospf database nssa-external 1.2.3.4
       adv-router 2.3.4.5
```

Output Figure 38-9: Example output from the **show ip ospf database nssa-external adv-router** command

```
      OSPF Router process 100 with ID (10.10.11.50)
               NSSA-external Link States (Area 0.0.0.0)
               NSSA-external Link States (Area 0.0.0.1 [NSSA])
 LS age: 78
 Options: 0x0 (*|-|-|-|-|-|-|-)
 LS Type: AS-NSSA-LSA
 Link State ID: 0.0.0.0 (External Network Number For NSSA)
 Advertising Router: 10.10.11.50
 LS Seq Number: 80000001
 Checksum: 0xc9b6
 Length: 36
 Network Mask: /0
       Metric Type: 2 (Larger than any link state path)
       TOS: 0
       Metric: 1
       NSSA: Forward Address: 0.0.0.0
--More--
      OSPF Router process 100 with ID (10.10.11.50)
               NSSA-external Link States (Area 0.0.0.0)
               NSSA-external Link States (Area 0.0.0.1 [NSSA])
 LS age: 78
 Options: 0x0 (*|-|-|-|-|-|-|-)
 LS Type: AS-NSSA-LSA
 Link State ID: 0.0.0.0 (External Network Number For NSSA)
 Advertising Router: 10.10.11.50
 LS Seq Number: 80000001
 Checksum: 0xc9b6
 Length: 36
 Network Mask: /0
       Metric Type: 2 (Larger than any link state path)
       TOS: 0
       Metric: 1
       NSSA: Forward Address: 0.0.0.0
       External Route Tag: 0
                NSSA-external Link States (Area 0.0.0.1 [NSSA])
```

show ip ospf database opaque-area

Use this command to display information about the area-local (link state type 10) scope LSAs. Type-10 Opaque LSAs are not flooded beyond the borders of their associated area.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip ospf database opaque-area [<ip-address>]
   [self-originate|<advrouter>]
```

Parameter	Description
<advrouter>	adv-router <*ip-address*>
adv-router	Displays all the LSAs of the specified router.
<ip-address>	A link state ID, as an IP address.
self-originate	Displays self-originated link states.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ip ospf database opaque-area 1.2.3.4 self-
        originate

awplus# show ip ospf database opaque-area self-originate

awplus# show ip ospf database opaque-area 1.2.3.4 adv-router
        2.3.4.5
```

Output Figure 38-10: Example output from the **show ip ospf database opaque-area** command

```
       OSPF Router process 100 with ID (10.10.11.50)
                Area-Local Opaque-LSA (Area 0.0.0.0)
  LS age: 262
  Options: 0x2 (*|-|-|-|-|-|E|-)
  LS Type: Area-Local Opaque-LSA
  Link State ID: 10.0.25.176 (Area-Local Opaque-Type/ID)
  Opaque Type: 10
  Opaque ID: 6576
  Advertising Router: 10.10.11.50
  LS Seq Number: 80000001
  Checksum: 0xb413
  Length: 26
```

show ip ospf database opaque-as

Use this command to display information about the link-state type 11 LSAs. This type of link-state denotes that the LSA is flooded throughout the Autonomous System (AS).

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip ospf database opaque-as [<ip-address>]
   [self-originate|<advrouter>]
```

Parameter	Description
<advrouter>	adv-router **<***ip-address***>**
adv-router	Displays all the LSAs of the specified router.
<ip-address>	A link state ID, as an IP address.
self-originate	Displays self-originated link states.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ip ospf database opaque-as 1.2.3.4 self-
        originate

awplus# show ip ospf database opaque-as self-originate

awplus# show ip ospf database opaque-as 1.2.3.4 adv-router
        2.3.4.5
```

Output Figure 38-11: Example output from the **show ip ospf database opaque-as** command

```
       OSPF Router process 100 with ID (10.10.11.50)
                AS-Global Opaque-LSA
  LS age: 325
  Options: 0x2 (*|-|-|-|-|-|E|-)
  LS Type: AS-external Opaque-LSA
  Link State ID: 11.10.9.23 (AS-external Opaque-Type/ID)
  Opaque Type: 11
  Opaque ID: 657687
  Advertising Router: 10.10.11.50
  LS Seq Number: 80000001
  Checksum: 0xb018
  Length: 25
```

show ip ospf database opaque-link

Use this command to display information about the link-state type 9 LSAs. This type denotes a link-local scope. The LSAs are not flooded beyond the local network.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip ospf database opaque-link [<ip-address>]
   [self-originate|<advrouter>]
```

Parameter	Description
<advrouter>	adv-router <*ip-address*>
adv-router	Displays all the LSAs of the specified router.
<ip-address>	A link state ID, as an IP address.
self-originate	Displays self-originated link states.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ip ospf database opaque-link 1.2.3.4 self-
        originate

awplus# show ip ospf database opaque-link self-originate

awplus# show ip ospf database opaque-link 1.2.3.4 adv-router
        2.3.4.5
```

Output Figure 38-12: Example output from the **show ip ospf database opaque-link** command

```
       OSPF Router process 100 with ID (10.10.11.50)
                Link-Local Opaque-LSA (Link hme0:10.10.10.50)
LS age: 276
Options: 0x2 (*|-|-|-|-|-|E|-)
LS Type: Link-Local Opaque-LSA
Link State ID: 10.0.220.247 (Link-Local Opaque-Type/ID)
Opaque Type: 10
Opaque ID: 56567
Advertising Router: 10.10.11.50
LS Seq Number: 80000001
Checksum: 0x744e
Length: 26
                Link-Local Opaque-LSA (Link hme1:10.10.11.50)
```

show ip ospf database router

Use this command to display information only about the router LSAs.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip ospf database router [<ip-address>]
   [self-originate|<advrouter>]
```

Parameter	Description
<advrouter>	adv-router <*ip-address*>
adv-router	Displays all the LSAs of the specified router.
<ip-address>	A link state ID, as an IP address.
self-originate	Displays self-originated link states.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ip ospf database router 1.2.3.4 self-originate

awplus# show ip ospf database router self-originate

awplus# show ip ospf database router 1.2.3.4 adv-router
        2.3.4.5
```

Output Figure 38-13: Example output from the **show ip ospf database router** command

```
      OSPF Router process 100 with ID (10.10.11.50)
                Router Link States (Area 0.0.0.0)
LS age: 878
Options: 0x2 (*|-|-|-|-|-|E|-)
Flags: 0x3 : ABR ASBR
LS Type: router-LSA
Link State ID: 10.10.11.50
Advertising Router: 10.10.11.50
LS Seq Number: 80000004
Checksum: 0xe39e
Length: 36
 Number of Links: 1
  Link connected to: Stub Network
   (Link ID) Network/subnet number: 10.10.10.0
   (Link Data) Network Mask: 255.255.255.0
    Number of TOS metrics: 0
     TOS 0 Metric: 10
                Router Link States (Area 0.0.0.1)
LS age: 877
Options: 0x2 (*|-|-|-|-|-|E|-)
Flags: 0x3 : ABR ASBR
LS Type: router-LSA
Link State ID: 10.10.11.50
Advertising Router: 10.10.11.50
LS Seq Number: 80000003
Checksum: 0xee93
Length: 36
 Number of Links: 1
  Link connected to: Stub Network
   (Link ID) Network/subnet number: 10.10.11.0
   (Link Data) Network Mask: 255.255.255.0
    Number of TOS metrics: 0
     TOS 0 Metric: 10
```

show ip ospf database summary

Use this command to display information about the summary LSAs.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip ospf database summary [<ip-address>]
    [self-originate|<advrouter>]
```

Parameter	Description
<advrouter>	adv-router <*ip-address*>
adv-router	Displays all the LSAs of the specified router.
<ip-address>	A link state ID, as an IP address.
self-originate	Displays self-originated link states.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ip ospf database summary 1.2.3.4 self-originate

awplus# show ip ospf database summary self-originate

awplus# show ip ospf database summary 1.2.3.4 adv-router
        2.3.4.5
```

Output Figure 38-14: Example output from the **show ip ospf database summary** command

```
       OSPF Router process 100 with ID (10.10.11.50)
                Summary Link States (Area 0.0.0.0)
                Summary Link States (Area 0.0.0.1)
  LS age: 1124
  Options: 0x2 (*|-|-|-|-|-|E|-)
  LS Type: summary-LSA
  Link State ID: 10.10.10.0 (summary Network Number)
  Advertising Router: 10.10.11.50
  LS Seq Number: 80000001
  Checksum: 0x41a2
  Length: 28
  Network Mask: /24
        TOS: 0  Metric: 10
```

Figure 38-15: Example output from the **show ip ospf database summary self-originate** command

```
        OSPF Router process 100 with ID (10.10.11.50)
                  Summary Link States (Area 0.0.0.0)
   LS age: 1061
   Options: 0x2 (*|-|-|-|-|-|E|-)
   LS Type: summary-LSA
   Link State ID: 10.10.11.0 (summary Network Number)
   Advertising Router: 10.10.11.50
   LS Seq Number: 80000001
   Checksum: 0x36ac
   Length: 28
   Network Mask: /24
         TOS: 0  Metric: 10
                  Summary Link States (Area 0.0.0.1)
   LS age: 1061
   Options: 0x2 (*|-|-|-|-|-|E|-)
LS Type: summary-LSA
   Link State ID: 10.10.11.0 (summary Network Number)
   Advertising Router: 10.10.11.50
   LS Seq Number: 80000001
   Checksum: 0x36ac
   Length: 28
   Network Mask: /24
         TOS: 0  Metric: 10
                  Summary Link States (Area 0.0.0.1)
   LS age: 1061
   Options: 0x2 (*|-|-|-|-|-|E|-)
   LS Type: summary-LSA
   Link State ID: 10.10.10.0 (summary Network Number)
   Advertising Router: 10.10.11.50
   LS Seq Number: 80000001
   Checksum: 0x41a2
   Length: 28
   Network Mask: /24
         TOS: 0  Metric: 10
```

Figure 38-16: Example output from the **show ip ospf database summary adv-router <*ip-address*>** command

```
        OSPF Router process 100 with ID (10.10.11.50)
                  Summary Link States (Area 0.0.0.0)
   LS age: 989
   Options: 0x2 (*|-|-|-|-|-|E|-)
   LS Type: summary-LSA
   Link State ID: 10.10.11.0 (summary Network Number)
   Advertising Router: 10.10.11.50
   LS Seq Number: 80000001
   Checksum: 0x36ac
   Length: 28
   Network Mask: /24
         TOS: 0  Metric: 10
                 Summary Link States (Area 0.0.0.1)
   LS age: 989
   Options: 0x2 (*|-|-|-|-|-|E|-)
LS Type: summary-LSA
   Link State ID: 10.10.11.0 (summary Network Number)
   Advertising Router: 10.10.11.50
   LS Seq Number: 80000001
   Checksum: 0x36ac
   Length: 28
   Network Mask: /24
         TOS: 0  Metric: 10
```

show ip ospf interface

Use this command to display interface information for OSPF.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip ospf interface [<interface-name>]`

Parameter	Description
<interface-name>	The VLAN name, for example vlan3.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ip ospf interface vlan2
```

Output Figure 38-17: Example output from the **show ip ospf interface** command

```
vlan2 is up, line protocol is up
  Internet Address 1.1.1.1/24, Area 0.0.0.0, MTU 1500
  Process ID 0, Router ID 33.33.33.33, Network Type BROADCAST,
Cost: 10
  Transmit Delay is 1 sec, State Waiting, Priority 1, TE Metric
0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40,
Retransmit 5
    Hello due in 00:00:02
  Neighbor Count is 0, Adjacent neighbor count is 0
  Crypt Sequence Number is 1106347721
  Hello received 0 sent 1, DD received 0 sent 0
  LS-Req received 0 sent 0, LS-Upd received 0 sent 0
  LS-Ack received 0 sent 0, Discarded 0
```

show ip ospf neighbor

Use this command to display information on OSPF neighbors. Include the ospf-id parameter with this command to display information about specified instances.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip ospf [<ospf-id>] neighbor <neighbor-ip-addr> [detail]
show ip ospf [<ospf-id>] neighbor detail [all]
show ip ospf [<ospf-id>] neighbor [all]
show ip ospf [<ospf-id>] neighbor interface <ip-addr>
```

Parameter	Description
<ospf-id>	<0-65535> The ID of the router process for which information will be displayed.
<neighbor-ip-addr>	The Neighbor ID, entered as an IP address.
all	Include downstatus neighbor.
detail	Detail of all neighbors.
<ip-addr>	IP address of the interface.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ip ospf neighbor detail
awplus# show ip ospf neighbor 1.2.3.4
awplus# show ip ospf neighbor interface 10.10.10.50 detail
        all
```

Output Note that before a device enters OSPF Graceful Restart it first informs its OSPF neighbors. In the show output, the * symbol beside the Dead Time parameter indicates that the switch has been notified of a neighbor entering the graceful restart state, as shown in Figure 38-19.

Figure 38-18: Example output from the **show ip ospf neighbor** command

```
OSPF process 1:
Neighbor ID     Pri   State           Dead Time   Address         Interface
10.10.10.50       1   Full/DR         00:00:38    10.10.10.50     vlan1
OSPF process 100:
Neighbor ID     Pri   State           Dead Time   Address         Interface
10.10.11.50       1   Full/Backup     00:00:31    10.10.11.50     vlan2
awplus#show ip ospf 1 neighbor
OSPF process 1:
Neighbor ID     Pri   State           Dead Time   Address         Interface
10.10.10.50       1   Full/DR         00:00:38    10.10.10.50     vlan1
```

Figure 38-19: Example output from the **show ip ospf <ospf-id> neighbor** command

```
OSPF process 100:
Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.0.3      50   2-Way/DROther   00:01:59*   192.168.200.3   vlan200
```

Figure 38-20: Example output from the **show ip ospf neighbor detail** command

```
Neighbor 10.10.10.50, interface address 10.10.10.50
   In the area 0.0.0.0 via interface vlan5
   Neighbor priority is 1, State is Full, 5 state changes
   DR is 10.10.10.50, BDR is 10.10.10.10
   Options is 0x42 (*|O|-|-|-|-|E|-)
   Dead timer due in 00:00:38
   Neighbor is up for 00:53:07
   Database Summary List 0
   Link State Request List 0
   Link State Retransmission List 0
   Crypt Sequence Number is 0
   Thread Inactivity Timer on
   Thread Database Description Retransmission off
   Thread Link State Request Retransmission off
   Thread Link State Update Retransmission on
Neighbor 10.10.11.50, interface address 10.10.11.50
   In the area 0.0.0.0 via interface vlan2
   Neighbor priority is 1, State is Full, 5 state changes
   DR is 10.10.11.10, BDR is 10.10.11.50
   Options is 0x42 (*|O|-|-|-|-|E|-)
   Dead timer due in 00:00:31
   Neighbor is up for 00:26:50
   Database Summary List 0
   Link State Request List 0
   Link State Retransmission List 0
   Crypt Sequence Number is 0
   Thread Inactivity Timer on
   Thread Database Description Retransmission off
   Thread Link State Request Retransmission off
   Thread Link State Update Retransmission on
```

show ip ospf route

Use this command to display the OSPF routing table. Include the `process ID` parameter with this command to display the OSPF routing table for specified instances.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip ospf [<ospf-id>] route`

Parameter	Description
<ospf-id>	<0-65535> The ID of the router process for which information will be displayed. If this parameter is included, only the information for this specified routing process is displayed.

Mode User Exec and Privileged Exec

Examples To display the OSPF routing table, use the command:

```
awplus# show ip ospf route
```

Output Figure 38-21: Example output from the **show ip ospf route** command for a specific process

```
OSPF process 1:
Codes: C - connected, D - Discard, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
O  10.10.0.0/24 [10] is directly connected, vlan1, Area 0.0.0.0
O  10.10.11.0/24 [10] is directly connected, vlan2, Area 0.0.0.0
O  10.10.11.100/32 [10] is directly connected, lo, Area 0.0.0.0
E2 10.15.0.0/24 [10/50] via 10.10.0.1, vlan1
IA 172.16.10.0/24 [30] via 10.10.11.50, vlan2, Area 0.0.0.0
E2 192.168.0.0/16 [10/20] via 10.10.11.50, vlan2
```

show ip ospf virtual-links

Use this command to display virtual link information.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip ospf virtual-links
```

Mode

User Exec and Privileged Exec

Examples

To display virtual link information, use the command:

```
awplus# show ip ospf virtual-links
```

Output

Figure 38-22: Example output from the **show ip ospf virtual-links** command

```
Virtual Link VLINK0 to router 10.10.0.9 is up
  Transit area 0.0.0.1 via interface vlan5
  Transmit Delay is 1 sec, State Point-To-Point,
  Timer intervals configured, Hello 10, Dead 40, Wait 40,
Retransmit 5
    Hello due in 00:00:02
    Adjacency state Full
Virtual Link VLINK1 to router 10.10.0.123 is down
  Transit area 0.0.0.1 via interface *
  Transmit Delay is 1 sec, State Down,
  Timer intervals configured, Hello 10, Dead 40, Wait 40,
Retransmit 5
    Hello due in inactive
    Adjacency state Down
```

show ip protocols ospf

Use this command to display OSPF process parameters and statistics.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip protocols ospf`

Mode User Exec and Privileged Exec

Examples To display OSPF process parameters and statistics, use the command:

```
awplus# show ip protocols ospf
```

Output Figure 38-23: Example output from the **show ip protocols ospf** command

```
Routing Protocol is "ospf 200"
  Invalid after 0 seconds, hold down 0, flushed after 0
  Outgoing update filter list for all interfaces is
    Redistributed kernel filtered by filter1
  Incoming update filter list for all interfaces is
  Redistributing: kernel
  Routing for Networks:
    192.30.30.0/24
    192.40.40.0/24
  Routing Information Sources:
    Gateway         Distance      Last Update
  Distance: (default is 110)
    Address         Mask            Distance List
```

summary-address

Use this command to suppress external routes that have the specified address range.

Use the no variant of this command to allow external routes that have the specified address range.

Syntax

```
summary-address <ip-addr/prefix-length> [not-advertise]
    [tag <0-4294967295>]

no summary-address <ip-addr/prefix-length> [not-advertise]
    [tag <0-4294967295>]
```

Parameter	Description
<ip-addr/prefix-length>	Specifies the base IP address of the summary address.The range of addresses given as IPv4 starting address and a prefix length.
`not-advertise`	Set the not-advertise option if you do not want OSPF to advertise either the summary address or the individual networks within the range of the summary address.
`tag <0-4294967295>`	The tag parameter specifies the tag value that OSPF places in the AS external LSAs created as a result of redistributing the summary route. The tag overrides tags set by the original route.

Default The default tag value for a summary address is 0.

Mode Router Configuration

Usage An address range is a pairing of an address and a mask that is almost the same as IP network number. For example, if the specified address range is 192.168.0.0/255.255.240.0, it matches: 192.168.1.0/24, 192.168.4.0/22, 192.168.8.128/25 and so on.

Redistributing routes from other protocols into OSPF requires the router to advertise each route individually in an external LSA. Use the `summary address` command to advertise one summary route for all redistributed routes covered by a specified network address and mask. This helps decrease the size of the OSPF link state database.

Examples The following example uses the `summary-address` command to aggregate external LSAs that match the network 172.16.0.0/16 and assign a Tag value of 3.

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# summary-address 172.16.0.0/16 tag 3
```

timers spf

Use this command to adjust route calculation timers.

Use the no variant of this command to return to the default timer values.

Syntax

```
timers spf <spf-delay> <spf-holdtime>
no timers spf
```

Parameter	Description
<spf-delay>	*<0-2147483647>* Specifies the delay between receiving changed routing information and embarking on an SPF calculation.
<spf-holdtime>	*<0-2147483647>* Specifies the hold time between consecutive SPF calculations.

Default The default SPF delay value is 5 seconds. The default SPF holdtime value is 10 seconds.

Mode Router Configuration

Usage This command configures the delay time between the receipt of a topology change and the calculation of the Shortest Path First (SPF). This command also configures the hold time between two consecutive SPF calculations.

Examples To set the SPF delay value to 7 seconds and SPF holdtime to 12 seconds, use the commands:

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# timers spf 7 12
```

To reset the SPF delay and SPF holdtimes to to the default values, use the commands:

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# no timers spf
```

Related Commands timers spf exp

timers spf exp

Use this command to adjust route calculation timers using exponential back-off delays.

Use no form of this command to return to the default exponential back-off timer values.

Syntax

```
timers spf exp <min-holdtime> <max-holdtime>
no timers spf exp
```

Parameter	Description
<min-holdtime>	*<0-2147483647>* Specifies the minimum delay between receiving a change to the SPF calculation in milliseconds. The default SPF min-holdtime value is 50 milliseconds.
<max-holdtime>	*<0-2147483647>* Specifies the maximum delay between receiving a change to the SPF calculation in milliseconds. The default SPF max-holdtime value is 50 seconds.

Mode Router Configuration

Default The default SPF min-holdtime is 50 milliseconds. The default SPF max-holdtime is 40 seconds.

Usage This command configures the minimum and maximum delay time between the receipt of a topology change and the calculation of the Shortest Path First (SPF).

Examples To set the minimum delay time to 5 milliseconds and maximum delay time to 10 milliseconds, use the commands:

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# timers spf exp 5 10
```

To reset the minimum and maximum delay times to the default values, use the commands:

```
awplus# configure terminal
awplus(config)# router ospf 100
awplus(config-router)# no timers spf exp
```

Related Commands timers spf

undebug ospf events

This command applies the functionality of the no debug ospf events command on page 38.18.

undebug ospf ifsm

This command applies the functionality of the no debug ospf ifsm command on page 38.19.

undebug ospf lsa

This command applies the functionality of the no debug ospf lsa command on page 38.20.

undebug ospf nfsm

This command applies the functionality of the no debug ospf nfsm command on page 38.21.

undebug ospf nsm

This command applies the functionality of the no debug ospf nsm command on page 38.22.

undebug ospf packet

This command applies the functionality of the no debug ospf packet command on page 38.23.

undebug ospf route

This command applies the functionality of the no debug ospf route command on page 38.24.

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OSPFv3 Introduction

This chapter introduces OSPFv3 followed by basic configuration examples. OSPFv3 is documented in RFC 2740 and is in essence OSPFv2 with changes and additions necessary for OSPF's operation within an IPv6 network. This introduction focuses on the differences between the two protocol versions, rather than to re-introduce OSPF as a routing method. See the chapter, Chapter 37, OSPF Introduction and Configuration for an introductory overview of OSPF on AlliedWare Plus™ switches.

To see details on the OSPF commands used in the examples, refer to the chapter, Chapter 40, OSPFv3 for IPv6 Commands.

Features

Not version-specific

Open Shortest Path First (OSPF) is an Interior Gateway Routing Protocol, based on Shortest Path First (SPF) or link-state technology. OSPF is defined in RFCs 1245–1247, 1253 and 1583. The protocol was designed specifically for the TCP/IP Internet environment, and supports the following features:

- Tagging of externally-derived routes.
- Fast response to topology changes with low overhead.
- Load sharing over meshed links.

Specific to OSPFv3

The specific features and enhancements of OSPFv3 are introduced to enable OSPF to run over IPv6 networks. These aspects are covered later in this chapter.

Licensing

OSPF is a licensed feature, and can be obtained either with a "Base License" or a "Full License." The table below shows the basic licensing structure for running OSPFv3. Note that licensing structures can vary with sales regions. We therefore recommend that you discuss your licensing options with you local Allied Telesis distributor or reseller.

OSPF Version	Base License	Full License
OSPFv3	Not bundled as part of the AlliedWare Plus release, but is separately available as a basic license pack that will support up to 64 routes.	Purchased separately. No licensed route limit, but is subject to a practical limit of 8,000 routes.

Routing Overview

The basic function of a routing protocol is to establish the best path for packets to travel in order to reach their destination. The method of establishing the best path can be based on various different network measurements, such as the hop-count, bandwidth, or delay that a particular path may present, or could be based on static routes that are manually entered. This information is then fed into a mathematical algorithm such as those invented by Belman-Ford (for RIP), or Dijkstra (for OSPF), in order to calculate a best path to the destination.

A very brief overview of OSPF's general principles and components is presented in this chapter. For a further explanation refer to Chapter 37, OSPF Introduction and Configuration.

OSPF Components

Autonomous Systems

Routers combine to form Autonomous Systems (AS) that share a common management and protocol suite. Each router within an area has an identical database, which contains components that describe other routers, their paths and states.

Routing Areas

OSPF allows the grouping of networks into a set, called an Area. The internal topology of an area is hidden from the rest of the AS. This technique minimizes the routing traffic required for the protocol. When multiple areas are used, each area has its own copy of the topological database. Routing can be between areas (inter-area routing) or within areas (intra-area routing). A backbone area forms the central path between all other areas. A router that forms a connection between an area and the backbone is known as an area border router.

Relationships Between Routers

Neighbors and Adjacencies

By transmitting hello messages, routers that share a common physical connection initially form neighbor relationships. Neighbors that meet a common set of configuration factors can then form adjacent relationships through which they can exchange topological information.

Designated Router

On broadcast multi-access networks, one of the routers becomes a designated router. By issuing its link state advertisements, the designated router maintains adjacencies with all the routers within a broadcast domain. The designated router therefore coordinates and synchronizes the topological databases for all routers on the link.

The designated router is selected through the exchange of hello packets. The router transmitting the highest priority number will be elected the designated router. Where a tie exists, selection will be based on the highest transmitted router ID.

Backup Designated Router

For network efficiency and resiliency, the routers also elect a backup designated router, which is able to act as the designated router in the event of failure of the designated router.

OSPFv3 Packet Types

The OSPF protocol contains five basic packet types for its messages. The OSPFv3 protocol retains these basic types, although the structure of some of them has changed slightly. The basic message packet types are:

- hello packet
- database description packet
- link state request packet
- link state update packet
- link state acknowledgment packet

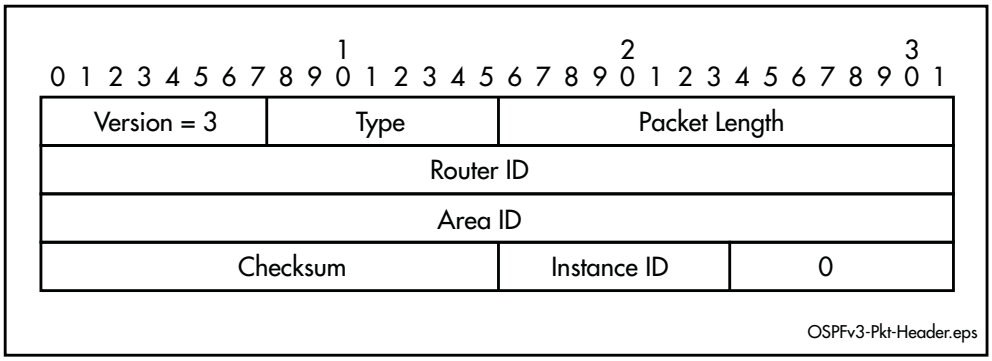
Also note that at the IP packet level, protocol number 89, previously assigned to OSPFv2 is now shared by both OSPFv2 and OSPFv3. These are the values contained within the protocol field of the IPv4 packets, and the Next Header field of IPv6 packets.

The five OSPFv3 message types are now described in greater detail.

OSPFv3 packet header

All OSPFv3 packets carry the common header component shown in Figure 39-1.

Figure 39-1: OSPFv3 common packet header



Because this packet component forms a common prefix for all the OSPFv3 packets, its components are expanded in greater detail than for the specific packet types that follow. Table 39-1 shows the meaning of each field within the common header component.

Table 39-1: OSPFv3 common packet header components

Packet Field	Purpose
Version	Denotes the OSPF version, i.e. 2 for OSPFv2, and 3 for OSPFv3.
Type	Denotes the packet type: « 1 = Hello packet « 2 = Database Description packet « 3 = Link State Request « 4 = Link State Update « 5 = Link State Acknowledgment
Packet Length	The packet length, in bytes, including the standard OSPFv3 header.
Router ID	The ID of the transmitting router.

Table 39-1: OSPFv3 common packet header components(cont.)

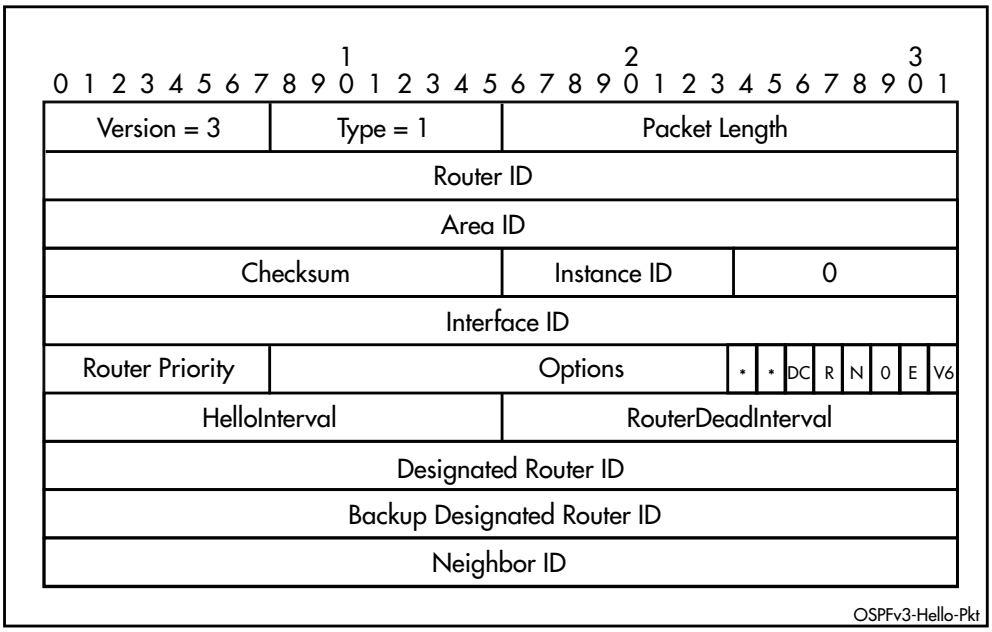
Packet Field	Purpose
Area ID	A 32 bit number that identifies the (single) area to which the packet belongs.
Checksum	The standard IPv6 packet checksum.
Instance ID	OSPFv3 is capable of running multiple OSPF instances over a single link. Each Instance is identified by its Instance ID. Note that the Instance ID is only of local (link) significance. Also note that the term “instance” is sometimes used in a totally different context in referring to specific LSA element components.
0	Reserved and normally set to 0.

Hello message packet

These messages are sent on all links. Their function is to establish and maintain neighbor relationships between routers.

Figure 39-2 shows the structure and content of the Hello packet. It follows the same basic format as the OSPFv2 hello packet, but without the Authentication or Network Mask fields, and with an additional field for the Instance ID.

Figure 39-2: OSPFv3 hello message type

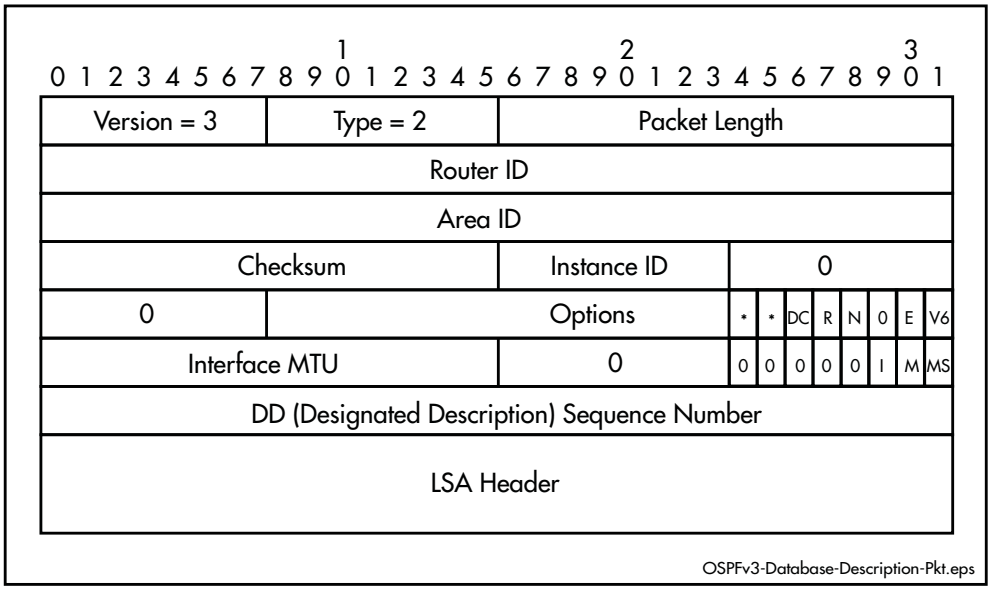


Database description packet

These packet types are exchanged as router adjacencies are established. They contain descriptions that define the link-state.

Figure 39-3 shows the structure and content of the database description packet. It follows the same basic format as that used for OSPFv2, but without the Authentication or Network Mask fields, and with an additional field for the Instance ID.

Figure 39-3: OSPFv3 database description packet

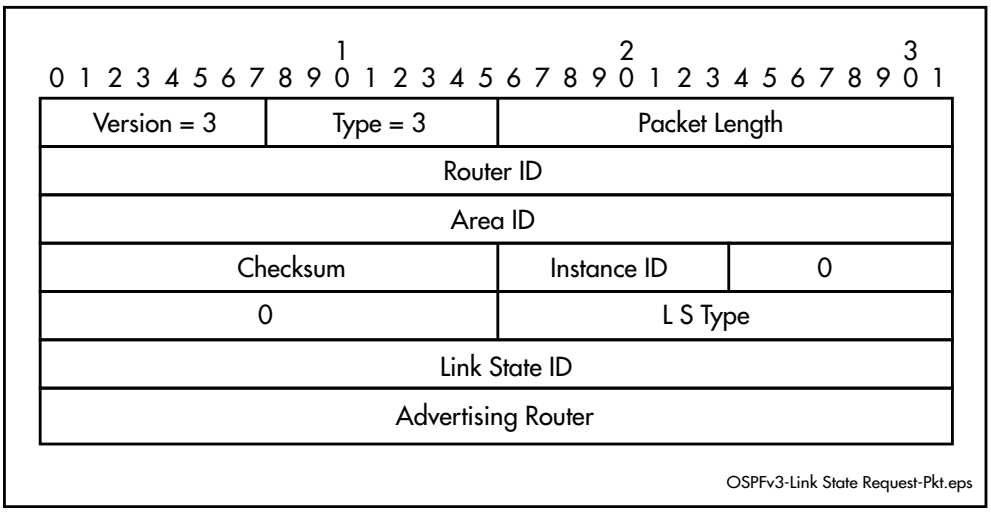


Link state request packet

Routers use these packets to request transmissions of specific portions (instances) of the Link State database, usually to replace out-of-date components. The requesting router knows exactly which database components it requires, based on their link state ID, sequence number, age, and checksum.

Figure 39-4 shows the structure and content of the a link state request packet. It follows the same basic format as that used for OSPFv2, but without the AuType, Authentication and network-mask fields, and with an additional field for the Instance ID.

Figure 39-4: OSPFv3 link-state request packet

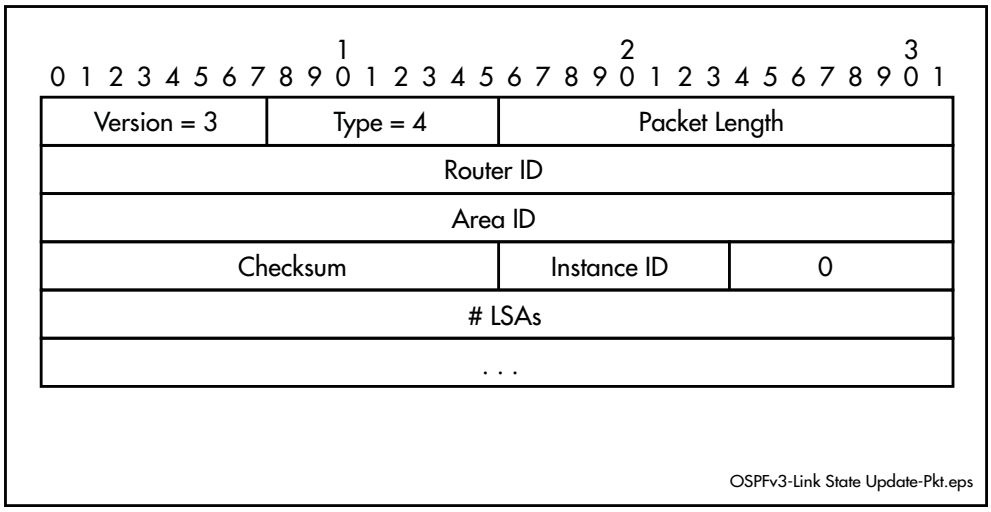


Link state update packet

These packet types are used to implement LSA flooding. They carry LSA information between a router and its immediate neighbors, often in response to link state requests.

Figure 39-5 shows the structure and content of the link state update packet. It follows the same basic format as that used for OSPFv2, but without the Authentication or Network-Mask fields, and with an additional field for the Instance ID.

Figure 39-5: OSPFv3 link-state update packet

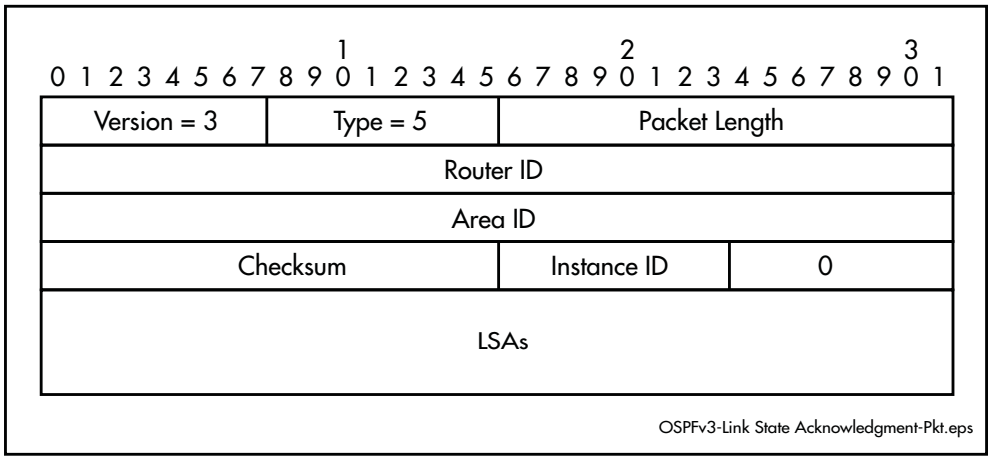


Link state acknowledgment packet

These multicast packet types are used to provide explicit acknowledgment of flooded LSAs. If a router transmits a link-state update, but does not receive acknowledgments from all neighbors, it will continue to retransmit the link state update until all neighbors have acknowledged it. This constitutes the guaranteed delivery mechanism within OSPF. A single packet can acknowledge multiple LSAs.

Figure 39-6 shows the structure and content of the link state acknowledgment packet. It follows the same basic format as that used for OSPFv2, but without the Authentication or Network Mask fields, and with an additional field for the Instance ID.

Figure 39-6: OSPFv3 link state acknowledgment packet



Link State Advertisements (LSAs)

Link state advertisements (LSAs) are records in the topological database. Nine different types of link state advertisements exist, see Table 39-2. Only the common header components are documented. A description of the LSAs themselves is outside the scope of this document.

Link state advertisements age to a maximum (MaxAge) of 3600 seconds, which limits their storage period in the topological database. When a link state advertisement reaches MaxAge, the router tries to flush it from the routing domain by reflooding the advertisement. A link state advertisement that has reached MaxAge is not used in further routing table calculations.

LSA types

Table 39-2 shows the LSA types supported by OSPFv3. Each type of link state advertisement describes a different set of features of the Autonomous System (AS).

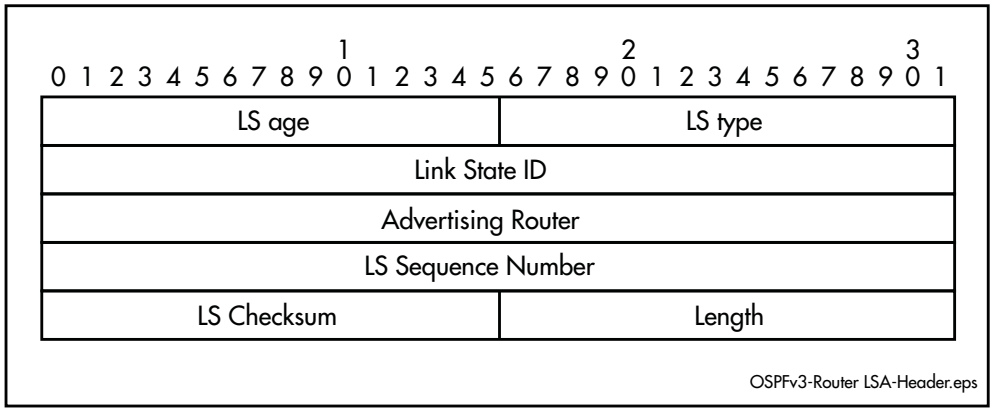
Table 39-2: OSPFv3 LSA header types

LSA Function Code	LS Type	Description
1	0x2001	Router LSA
2	0x2002	Network LSA
3	0x2003	Inter-Area-Prefix-LSA
4	0x2004	Inter-Area-Router-LSA
5	0x4005	AS-External-LSA
6	0x2006	Deprecated (may be reassigned)
7	0x2007	NSSA-LSA
8	0x0008	Link-LSA
9	0x2009	Intra-Area-Prefix-LSA
11	0x000b	Grace-LSA

LSA Header

Figure 39-7 shows the structure and content of the 20 byte header that is common to all OSPFv3 Link State Advertisements (LSAs). This header provides sufficient information to identify the link state type, its ID, and its advertising router.

Figure 39-7: OSPFv3 LSA header



OSPFv3 States

The following table describes the eight states that routers can pass through as they establish their neighbor relationships.

Table 39-3: OSPF states

Packet Type	Purpose
Down	This is the initial state. No hello packets have been received from the neighbor recently, or at all.
Attempt	This state applies to non-broadcast multi-access networks. The router is making a determined attempt to contact a statically configured neighbor. Hello packets are sent every hello interval.
Init	A hello packet has been seen from the neighbor, however the hello packet does not list the router as known.
Two-Way	This state is entered when the communication between two neighbors is bidirectional (the hello packet from the neighbor lists this router as a neighbor).
ExStart	This is the first step in creating an adjacency between two routers. The two routers decide which is going to control the exchange between them.
Exchange	In this state, the neighbors exchange database description packets. Each packet summarizes the link state advertisements held by that router.
Loading	After all the database description information has been exchanged, the routers exchange link state advertisements required to update or complete each router's topological database, thereby synchronizing the two routers' databases.
Full	This is the final state, and the adjacency is complete. Reaching this state in itself may cause new instances of some link state advertisements, such as the network and router advertisements related to the two routers.

OSPFv3 Metrics

The metrics used by OSPF are not simple distance metrics, such as used by RIP for example, but are measurements of the path bandwidth. Interface metrics are normally set using the formula 10^8 / interface speed (in bps). This gives metrics such as 1 for a 100 Mbps Ethernet interface, and 1562 for a 64 kbps serial line.

Automatic Cost Calculation

OSPF interfaces can automatically set the OSPF metric of an IP interface based on its bandwidth, instead of the system administrator having to manually set the OSPF metric. Automatic setting takes into account that the speed of an interface can change over time, when ports change link state or change speed via auto-negotiation or manual setting. If metrics are manually set, some interfaces are preferred when they should be changing to match dynamically changing network configurations.

Network Types

OSPF treats the networks attached to OSPF interfaces as one of the following network types, depending on the physical media:

- broadcast
- non-broadcast multi-access (NBMA)
- point-to-point
- point-to-multipoint
- virtual

By default, Ethernet networks are treated as broadcast networks. You can use the ip ospf network command on page 38.41 to configure a VLAN interface to be a different network type. Configure a VLAN or Ethernet interface as an Non-Broadcast Multi-Access (NBMA) interface when:

- some devices on the network do not support multicast addressing.
- you want to select which devices on the network are to become OSPF neighbors, rather than allow all the devices on the network to become OSPF neighbors.

Passive Interfaces

A passive interface does not take part in normal OSPF interface operations:

- OSPF does not transmit or receive Hello messages via the interface.
- The interface does not experience interface state transitions.
- OSPF does not associate neighbors with the interface.

If the interface is up, OSPF adds the network that is attached to the interface, as a stub network to the router LSA of the area in which the interface resides.

Examples To configure the passive interface mode on interface vlan2, enter the following commands:

```
awplus(config)# router ipv6 ospf
awplus(config-router)# passive-interface vlan2
```

To configure the passive interface mode on all interfaces, enter the following commands:

```
awplus(config)# router ipv6 ospf
awplus(config-router)# passive-interface
```

Redistributing External Routes

OSPFv3 can import and redistribute BGP, RIP, non-OSPF interface, and statically configured routes. It can also optionally assign the following settings to all routes it imports:

- a route metric
- the External metric type

Alternatively, you can assign a route map to select particular routes and set their route parameters. A route map can also filter out a subset of routes, so you do not have to import all routes.

The import settings also allow you to select whether to redistribute subnets (classless network routes), or only classful network routes.

To import and redistribute external routes into OSPF, create a route redistribution definition for the source routing protocol, using the redistribute (IPv6 OSPF) command on page 40.29.

Differences between OSPFV2 and OSPFv3

Whilst the fundamental principles of OSPFv2 are maintained from those standardized for OSPF with IPv6 (OSPFv3), the following items, listed below, represent the major areas that are applied differently for OSPFv3. For more detail refer to RFC 2740.

- Protocol processing applied per-link rather than per-subnet
- Removed address semantics
- Neighbors are identified by Router ID
- New link-local flooding scope for link state advertisements
- Uses link-local addresses
- Support provided for multiple instances per link
- OSPF-specific authentication has been removed
- Unknown LSAs are handled more effectively
- Modified packet types
- Modified LSA types

The following sections expand on these points.

Protocol processing applied per-link rather than per-subnet

OSPFv3 nodes use links to communicate at the link layer. You can also assign multiple subnets, and multiple IPv6 addresses, to a single link. In addition, two nodes can be assigned to and communicate over the same link without having to share the same subnet.

Thus the term link can be compared with the OSPFv2 terms network and subnet. This change has resulted in changes within the Hello packets and Network Link State Advertisements (LSAs).

Removed address semantics

Address semantics have been removed from OSPFv3 protocol packets and network Link State Advertisements (LSAs).

The intention of this change is to enable the core features to be protocol independent. The major changes in this respect are described below:

Note Although the 32 bit Router and ID fields still exist in IPv6 packets, and can still be entered in dotted decimal format, for OSPFv3, they are simply 32-bit-long labels, which no longer represent IP addresses.

Neighbors are identified by Router ID

OSPFv2 neighbors were identified by IPv4 addresses on multipoint networks and by router ID on point-to-point networks. OSPFv3 removes this inconsistency by identifying all neighbors by their router ID.

New link-local flooding scope for link state advertisements

OSPFv3 contains the following flooding scopes:

- Area scope flooding (in OSPFv2)
- Autonomous System (AS) flooding (in OSPFv2)
- Link-local flooding (new in OSPFv3)

Uses link-local unicast addresses

On all OSPF interfaces except virtual links, OSPF packets are sent using the interface's associated link-local unicast address as the source address.

Support provided for multiple OSPF instances per link

An Instance field has been added to OSPFv3 hello and LSA packets. By assigning separate instances, multiple routers to be attached to a single broadcast link in such a way that separate adjacencies may be configured for selected router groups. See "Configuring Instances and Processes" on page 39.26.

Unknown LSAs are handled more effectively

In OSPFv2 routers discarded unknown LSA types. In OSPFv3 unknown LSA types are given either link-local flooding scope, or are stored and flooded as if being understood. The options determining which action to take, and flooding scope, is contained in components within the LSA type field.

Configuring OSPFv3

The following examples show firstly the configuration for a basic three-switch single-area OSPFv3 network. This network is then modified to become a two-area network.

The configuration command sequences shown are presented for understanding, and do not necessarily represent the most efficient configuration method.

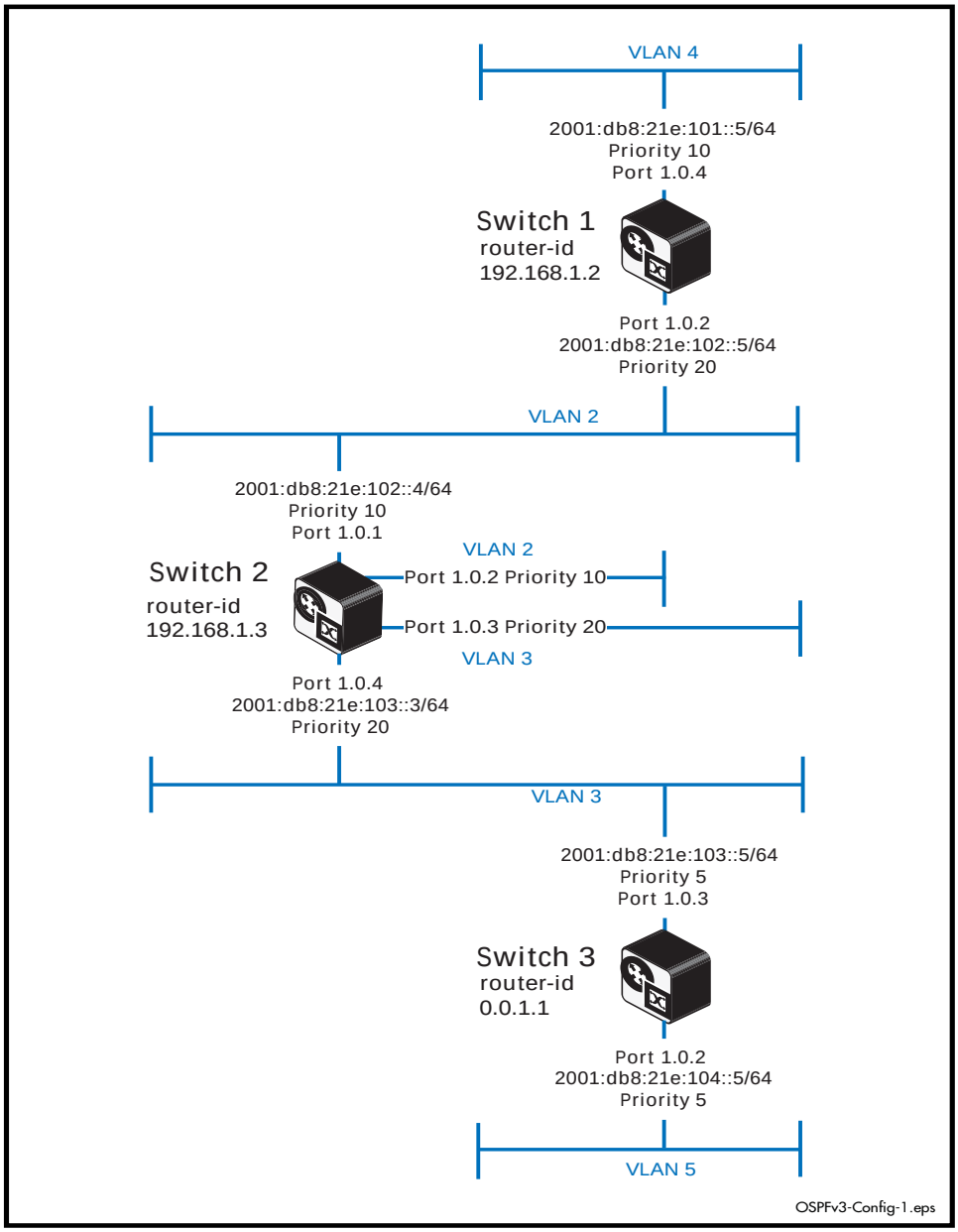
Note

The IPv6 addresses shown use the address space 2001:0db8::/32, defined in RFC 3849 for documentation purposes. These addresses should not be used for practical networks (other than for testing purposes) nor should they appear on any public network.

Example 1: Single-Area Network Configuration

Figure 39-8 shows a basic three-switch, single-area configuration. Setting the priority value of 20 to VLAN 20 on switch 1 and to the value 10 on switch 2 will ensure that switch 1 will become the designated router for this VLAN. Similarly, the priority settings on VLAN 3, of 20 on switch 2, and 5 on switch 3, will ensure that switch 2 becomes the designated router for VLAN 3.

Figure 39-8: Basic single-area OSPFv3 configuration



Switch 1 Configuration (Single-Area Network)

Table 39-4: Example 1—single-area network configuration—Switch 1

Create and enable VLANs	
awplus#	
configure terminal	Enter Global Configuration mode.
awplus(config)#	
vlan database	Enter VLAN database mode.
awplus(config-vlan)#	
vlan 2,4 state enable	Create and enable VLANs 2 and 4.
awplus(config-vlan)#	
exit	Return to Global Configuration mode.
For VLAN 4, assign IPv6 addresses and configure OSPF	
awplus(config)#	
interface vlan4	Select VLAN 4 for configuring.
awplus(config-if)#	
ipv6 address 2001:db8:21e:101::5/64	Assign an IPv6 address to VLAN 4.
awplus(config-if)#	
ipv6 router ospf area 0 tag process1	Assign VLAN 4 to OSPF area 0. In this configuration, any address within the subnet 2001:db8:21e:101 will be part of OSPF area 0.
Note that the tag named “process1” denotes a separate router process. Its name can comprise any string of alphanumeric characters. Also note that this tag is local to the router on which it is set and does not appear in any OSPF packets or LSAs. For more information on processes and instances, see “Configuring Instances and Processes” on page 39.26.	
awplus(config-if)#	
ipv6 ospf priority 10	Set the priority for the router to become the designated router for a particular VLAN. The router with the highest priority becomes the designated router for that VLAN. Defaults to 1.
awplus(config-if)#	
exit	Return to Global Configuration mode.
For VLAN 2, assign IPv6 addresses and configure OSPF	
awplus(config)#	
interface vlan2	Select VLAN 2 for configuring.
awplus(config-if)#	
ipv6 address 2001:db8:21e:102::5/64	Assign an IPv6 address to VLAN 2.
awplus(config-if)#	
ipv6 router ospf area 0 tag process1	Assign VLAN 2 to OSPF area 0. In this configuration, any address within the subnet 2001:db8:21e:102 will be part of OSPF area 0.

Table 39-4: Example 1—single-area network configuration—Switch 1(cont.)

`awplus(config-if)#`	
`ipv6 ospf priority 20`	Set the priority for the router to become the designated router for a particular VLAN. The router with the highest priority becomes the designated router for that VLAN. Defaults to 1.
Configure switch ports and assign them to their VLANs	
`awplus(config)#`	
`interface port1.0.4`	Select port 1.0.4 for configuring.
`awplus(config-if)#`	
`switchport access vlan 4`	Assign port 1.0.4 to VLAN 4.
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`interface port1.0.2`	Select port1.0.2 for configuring.
`awplus(config-if)#`	
`switchport access vlan 2`	Assign port 1.0.2 to VLAN 2.
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
Set router ID and allocate memory to IPv6	
`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`platform routing ratio ipv4andipv6`	Allocate memory resources to IPv6. Note that `ipv4andipv6` is the default platform routing ratio.
`awplus(config)#`	
`router ipv6 ospf process1`	Configure an IPv6 OSPF routing process.
`awplus(config-router)#`	
`router-id 192.168.0.1`	Set the router ID.
`awplus(config)#`	
`ipv6 forwarding`	Turn on IPv6 forwarding.

Switch 2 Configuration (Single-Area Network)

Table 39-5: Example 1—single-area network configuration—Switch 2

Create and enable VLANs 2 and 3	
`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`vlan database`	Enter VLAN database mode.

Table 39-5: Example 1—single-area network configuration—Switch 2(cont.)

awplus(config-vlan)#	
vlan 2,3 state enable	Create and enable VLANs 2 and 3.
awplus(config-vlan)#	
exit	Return to Global Configuration mode.
For VLAN 2, assign IPv6 addresses and configure OSPF	
awplus(config)#	
interface vlan2	Select VLAN 2 for configuring.
awplus(config-if)#	
ipv6 address 2001:db8:21e:102::4/64	Assign an IPv6 address to VLAN 2.
awplus(config-if)#	
ipv6 router ospf area 0	Assign VLAN 2 to OSPF area 0. In this configuration, any address within the subnet 2001:db8:21e:102 will be part of OSPF area 0.
awplus(config-if)#	
ipv6 ospf priority 10	Set the priority for the router to become the designated router for a particular VLAN. The router with the highest priority becomes the designated router for that VLAN. Defaults to 1.
awplus(config-if)#	
exit	Return to Global Configuration mode.
For VLAN 3, assign IPv6 addresses and configure OSPF	
awplus(config)#	
interface vlan3	Select VLAN 3 for configuring.
awplus(config-if)#	
ipv6 address 2001:db8:21e:103::3/64	Assign an IPv6 address to VLAN 3.
awplus(config-if)#	
ipv6 router ospf area 0	Assign VLAN 3 to OSPF area 0. In this configuration, any address within the subnet 2001:db8:21e:103 will be part of OSPF area 0.
awplus(config-if)#	
ipv6 ospf priority 20	Set the priority for the router to become the designated router for a particular VLAN. The router with the highest priority becomes the designated router for that VLAN. Defaults to 1.
Configure switch ports and assign them to their VLANs	
awplus(config)#	
interface port1.0.1	Select port 1.0.1 for configuring.
awplus(config-if)#	
switchport access vlan 2	Assign port 1.0.1 to VLAN 2.
awplus(config-if)#	
exit	Return to Global Config mode.

Table 39-5: Example 1—single-area network configuration—Switch 2(cont.)

`awplus(config)#`	
`interface port1.0.2`	Select port1.0.2 for configuring.
`awplus(config-if)#`	
`switchport access vlan 2`	Assign port 1.0.2 to VLAN 2.
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`interface port1.0.3`	Select port1.0.3 for configuring.
`awplus(config-if)#`	
`switchport access vlan 3`	Assign port 1.0.3 to VLAN 3.
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`interface port1.0.4`	Select port1.0.4 for configuring.
`awplus(config-if)#`	
`switchport access vlan 3`	Assign port 1.0.4 to VLAN 3.
Set router ID and allocate memory to IPv6	
`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`platform routing ratio ipv4andipv6`	Allocate memory resources to IPv6. Note that `ipv4andipv6` is the default platform routing ratio.
`awplus(config)#`	
`router ipv6 ospf process1`	Configure an IPv6 routing process.
`awplus(config-router)#`	Set the router ID. Note that:
`router-id 192.168.0.5`	■ In this configuration, the router-id value 192.168.0.5 makes this switch most likely to be selected as the designated router. ■ Although 192.168.0.5 appears to be an IPv4 address from the 192.168 range of private addresses, it is not an IPv4 address at all. It is simply a 32-bit, dot-separated integer.
`awplus(config)#`	
`ipv6 forwarding`	Turn on IPv6 forwarding.

Switch 3 Configuration (Single-Area Network)

Table 39-6: Example 1—single-area network configuration—Switch 3

Create and enable VLANs 3 and 5	
`awplus#`	
`configure terminal`	Enter Global Configuration mode.

Table 39-6: Example 1—single-area network configuration—Switch 3(cont.)

awplus(config)#	
vlan database	Enter VLAN database mode.
awplus(config-vlan)#	
vlan 3,5 state enable	Create and enable VLANs 3 and 5.
awplus(config-vlan)#	
exit	Return to Global Configuration mode.
For VLAN 3, assign IPv6 addresses and configure OSPF	
awplus(config)#	
interface vlan 3	Select VLAN 3 for configuring.
awplus(config-if)#	
ipv6 address 2001:db8:21e:103::5/64	Assign an IPv6 address to VLAN 3.
awplus(config-if)#	
ipv6 router ospf area 0	Assign VLAN 3 to OSPF area 0. In this configuration, any address within the subnet 2001:db8:21e:103 will be part of OSPF area 0.
awplus(config-if)#	
ipv6 ospf priority 5	Set the priority for the router to become the designated router for a particular VLAN. The router with the highest priority becomes the designated router for that VLAN. Defaults to 1.
awplus(config-if)#	
exit	Return to Global Configuration mode.
For VLAN 5, assign IPv6 addresses and configure OSPF	
awplus(config)#	
interface vlan5	Select VLAN 5 for configuring.
awplus(config-if)#	
ipv6 address 2001:db8:21e:104::5/64	Assign an IPv6 address to VLAN 5.
awplus(config-if)#	
ipv6 router ospf area 0	Assign VLAN 5 to OSPF area 0. In this configuration, any address within the subnet 2001:db8:21e:104 will be part of OSPF area 0.
awplus(config-if)#	
ipv6 ospf priority 5	Set the priority for the router to become the designated router for a particular VLAN. The router with the highest priority becomes the designated router for that VLAN. Defaults to 1.
Configure switch ports and assign them to their VLANs	
awplus(config)#	
interface port1.0.3	Select port 1.0.3 for configuring.
awplus(config-if)#	
switchport access vlan 3	Assign port 1.0.3 to VLAN 3

Table 39-6: Example 1—single-area network configuration—Switch 3(cont.)

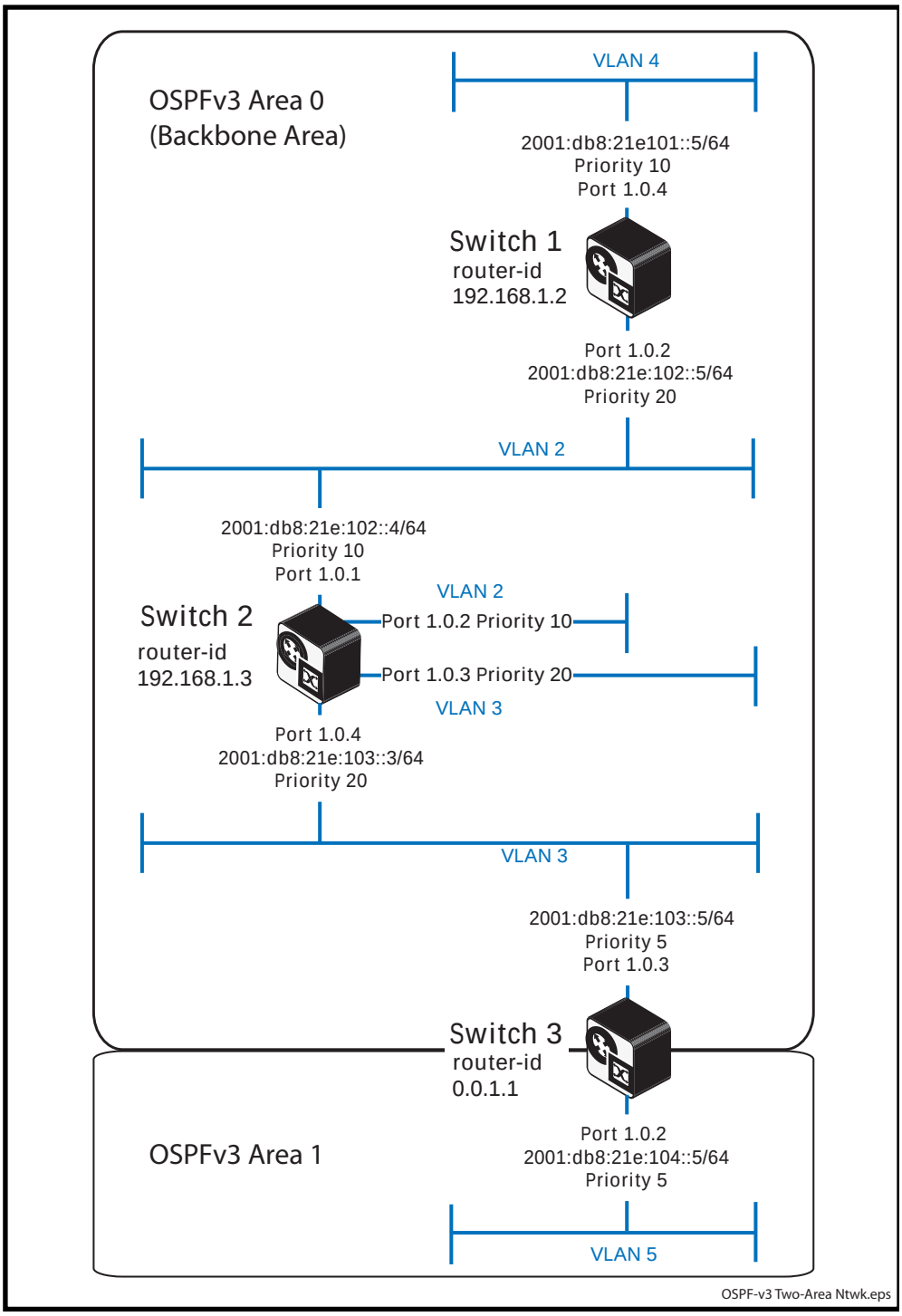
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
`awplus(config)#`	
`interface port1.0.2`	Select port1.0.2 for configuring.
`awplus(config-if)#`	
`switchport access vlan 5`	Assign port 1.0.2 to VLAN 5.
`awplus(config-if)#`	
`exit`	Return to Global Configuration mode.
Set router ID and allocate memory to IPv6	
`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`platform routing ratio ipv4andipv6`	Allocate memory resources to IPv6. Note that `ipv4andipv6` is the default platform routing ratio.
`awplus(config)#`	
`router ipv6 ospf process1`	Configure an IPV6 routing process.
`awplus(config-router)#`	
`router-id 0.0.1.1`	Set the router ID. Note that the router-id value 0.0.1.1 has been selected for the following reasons: ■ so that it is unlikely to be selected as a designated router. ■ to illustrate that it, although it has an IPv4 address format, it is not an IPv4 address.
`awplus(config)#`	
`ipv6 forwarding`	Turn on IPv6 forwarding.

Example 2: Two-Area Network Configuration

Figure 39-9 shows a basic three-switch, two-area configuration. Setting the priority value of 20 to VLAN 2 on Switch 1 and to the value 10 on Switch 2 will ensure that Switch 1 will become the designated router for this VLAN. Similarly the priority settings on VLAN 3 of 20 on Switch 2, and 5 on Switch 3 will ensure that Switch 2 will become the designated router for VLAN 3.

Note that Switch 3 now becomes the area border router for areas 0 and 1.

Figure 39-9: Basic two-area OSPFv3 configuration



The commands used to configure this two-area network are the same as those used in the previous example, except for the configuration of VLAN 5 on switch 3, which now becomes part of Area 1. The revised configuration for switch 3 and VLAN 5 is shown in below.

Table 39-7: Example 2—two-area network—revised configuration for Switch 3

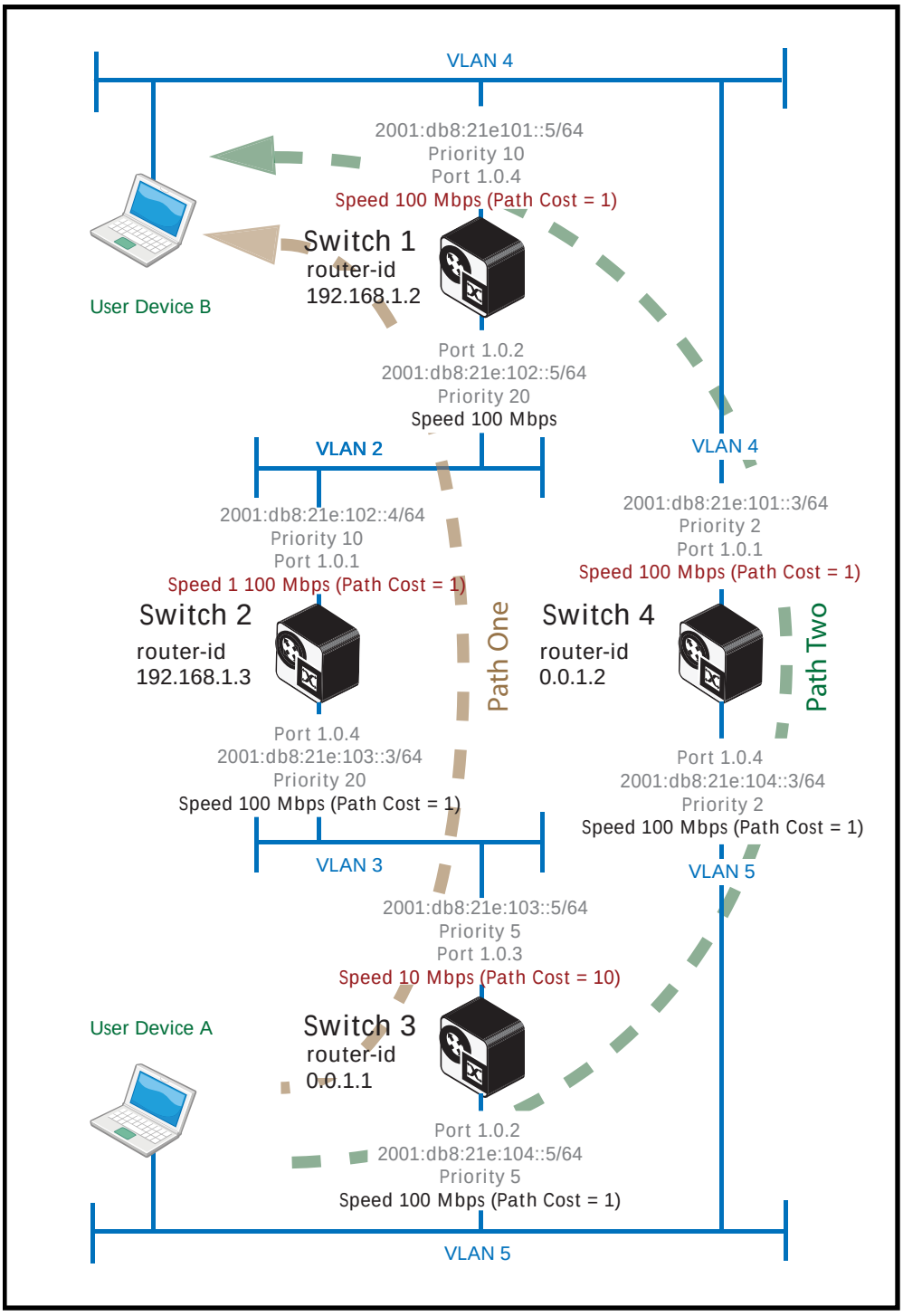
Set VLANs 3 and 5 to be part of area 1	
`awplus(config)#`	
`interface vlan5`	Select VLAN 5 for configuring.
`awplus(config-if#`	
`ipv6 address 2001:db8:21e:104::5/64`	Assign IPv6 address to VLAN 5.
`awplus(config-if)#`	
`ipv6 router ospf area 1`	Assign VLAN 5 to OSPF area 1. In this configuration, any address within the subnet 2001:db8:21e:104 will be part of OSPF area 1.

Setting Up the Metrics

OSPF selects its preferred routes by measuring the cost of each path to a given destination. Each path (or link) has a metric value applied, which by default is 100 000 000 divided by the link bandwidth. The preferred route will be the one that presents the lowest total path cost.

Figure 39-10 shows the previously configured single-area network of Figure 39-8, but with an additional path provided by Switch 4. The diagram also shows port speeds and their resultant path costs.

Figure 39-10: OSPFv3 multipath metrics example



Using the procedure shown in "Switch 1 Configuration (Single-Area Network)" on page 39.16, add Switch 4 to the configuration, applying the port numbers, VLANs, and settings shown in Figure 39-10 on page 39.24.

Setting the metric values

The metric values shown are derived from the data rate configured for each port and (unless manually changed) use the formula 10^8 / port bandwidth in bps.

Example To set the speed of a tri-speed port to 100 Mbps, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# speed 100
```

The above example will produce a path cost of 100 000 000 / port speed (in bps), or 100 000 000 /100 000 000 = 1

If the port speed and its resultant metric value does not produce the required best paths and you do not want to change the port speed, you can change the metric by using the ipv6 ospf cost command on page 40.18. The following section explains how to do this.

Best path selection

Figure 39-10 on page 39.24 shows two paths from User Device A to User Device B, labeled Path One and Path Two. The metric cost for each of these paths is found by adding the individual output path costs: For traffic flowing from User Device A, to User Device B, these are:

Path Cost for Path One = 10 + 1 + 1 = 12

Path Cost for Path Two = 1

The preferred route will be via the paths that offer the lowest total path cost. Traffic will therefore travel from User Device A, to User Device B via Path Two.

However, you can manually adjust the cost metrics to favour one path over another. For example, you can apply the ipv6 ospf cost command on page 40.18 to manually force the preference for a particular path.

Example Using the configuration shown in Figure 39-10 on page 39.24 use the ipv6 ospf cost command on page 40.18 set Path One to be the preferred path.

Existing path cost for Path One is, 10 + 1 + 1 = 12

Existing path cost for Path Two = 1

Setting the cost of Path Two to be greater than 12, will force OSPF's path selection algorithm to select Path One as the preferred path between User Device A and User Device B.

Use the following commands on switch 4 to force the path cost on switchport 1.0.1 to have the metric value of 20:

```
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ip ipv6 ospf 2001:0db8:21e:101::5/64 cost 20
```

This has set a higher metric cost for data traveling from Device A to Device B, via Path Two. You now need to set the same metric cost for data traveling in the direction from Device B, to Device A.

```
awplus# configure terminal
awplus(config)# interface vlan5
awplus(config-if)# ip ipv6 ospf 2001:0db8:21e:104::5/64 cost 20
```

Traffic traveling from devices A to B, and B to A, will now use Path One in preference to Path Two.

Configuring Instances and Processes

OSPFv3 introduces the capability of sharing physical links (or VLANs) with multiple OSPF routing instances. This is achieved by inserting an Instance ID field in the OSPFv3 Hello, and Link State packets, see "OSPFv3 packet header" on page 39.4. In a multi-instance network, the OSPF hello and LSA frames belonging to different instances can coexist alongside each other, each sharing a physical link and each establishing its own set of metric values and path preferences. New instances are created using the ipv6 router ospf command on page 40.26.

Some OSPFv2 (and OSPFv3) switches and routers also have a similar (and older) function called processes. Processes enable more than one OSPF environment to be configured on the same switch (or router), but not the same VLAN. Processes exist only within the switch or router on which they are created. Although their existence is not explicitly conveyed between OSPF routers, the packets from each process contains its own router ID and will thus appear as if generated by a different OSPF router. New processes are created also using the ipv6 router ospf command on page 40.26.

Although instances and processes apply a similar function and each can be individually created, there are interactions between them that require you to apply some specific rules when creating multi-instance networks. The following table shows those combinations of instances and processes that are workable, and those that are not.

Table 39-8: Functional combinations of OSPFv3 instances and processes

VLAN	Instances	Processes	Workable Combination
VLAN 5	Instance 1	Process A	Yes
VLAN 5 & VLAN 7	Instance 1	Process D	Yes
VLAN 5	Instance 1	Process D	Yes
If you now add a second instance so that VLAN 5 shares both instances using Process D			
VLAN 5	Instance 2	Process D	No
To make the above configuration work requires adding a new process.			
VLAN 5	Instance 1	Process D	Yes
VLAN 5	Instance 2	Process E	Yes

Example To apply the settings shown in the last two rows of Table 39-8, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan5
awplus(config-if)# ipv6 router ospf area 1 tag D instance-id 1
awplus(config-if)# ipv6 router ospf area 2 tag E instance-id 2
```

Chapter 40: OSPFv3 for IPv6 Commands

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undebug ipv6 ospf ifsm 40.47
undebug ipv6 ospf lsa 40.47
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Command List

This chapter provides an alphabetical reference of commands used to configure OSPFv3 for IPv6. For more information on this topic, see Chapter 39, OSPFv3 for IPv6 Introduction and Configuration.

abr-type

Use this command to set an OSPF Area Border Router (ABR) type.

Use the no variant of this command to revert the ABR type to the default setting (Cisco).

Syntax

```
abr-type {cisco|ibm|standard}
no abr-type {cisco|ibm|standard}
```

Parameter	Description
`cisco`	Specifies an alternative ABR using Cisco implementation (RFC 3509). This is the default ABR type.
`ibm`	Specifies an alternative ABR using IBM implementation (RFC 3509).
`standard`	Specifies a standard behavior ABR (RFC 2328).

Default ABR type `cisco`

Mode Router Configuration

Usage Specifying the ABR type allows better interoperation between different implementations. This command is specially useful in a multi-vendor environment. The different ABR types are:

- Cisco ABR Type: By this definition, a router is considered an ABR if it has more than one area actively attached and one of them is the backbone area.
- IBM ABR Type: By this definition, a router is considered an ABR if it has more than one area actively attached and the backbone area is configured. In this case the configured backbone need not be actively connected.
- Standard ABR Type: By this definition, a router is considered an ABR if it has more than one area actively attached to it.

Example

```
awplus# configure terminal
awplus(config)# router ipv6 ospf 100
awplus(config-router)# abr-type ibm
```

area default-cost (OSPFv3 for IPv6)

This command specifies a cost for the default summary route sent into a stub area.

The no variant of this command removes the assigned default-route cost.

Syntax

```
area <area-id> default-cost <0-16777215>
no area <area-id> default-cost
```

Parameter	Description	
<area-id>	The OSPF area that you are specifying the summary route default-cost for. This can be entered in either dotted decimal format or normal decimal format. Use one of the following formats:	
	<ip-addr>	OSPF area-ID expressed in IPv4 address format A.B.C.D.
	<0-4294967295>	OSPF area-ID expressed as a decimal number within the range shown.
	For example, the values 0.0.1.2 and decimal 258 would both define the same area-ID.	
`default-cost`	Indicates the cost for the default summary route used for a stub area. Default: 1	

Mode Router Configuration

Usage The default-cost option provides the metric for the summary default route, generated by the area border router, into the stub area. Use this option only on an area border router that is attached to the stub area.

Example To set the default cost to 10 in area 1 for the OSPF process P2, use the commands:

```
awplus# configure terminal
awplus(config)# router ipv6 ospf P2
awplus(config-router)# area 1 default-cost 10
```

Related Commands area stub (IPv6 OSPF)

area range (IPv6 OSPF)

This command summarizes OSPF routes at an area boundary. By default, this feature is disabled.

The area range command is used to summarize intra-area routes for an area. The set of summary routes created by this command are then advertised to other areas by the Area Border Routers (ABRs). In this way, routing information is condensed at area boundaries so that routes are exchanged between areas in an efficient manner.

If the network numbers in an area are arranged into sets of contiguous routes, the ABRs can be configured to advertise a small set of summary routes that cover the individual networks within the area.

The no variant of this command disables this function.

Syntax

```
area <area-id> range <ipv6address/prefix-length> [advertise|not-
    advertise]

no area <area-id> range <ipv6address/prefix-length>
```

Parameter	Description	
<area-id>	The OSPF area that you summarizing the routes for. Use one of the following formats: This can be entered in either dotted decimal format or normal decimal format.	
	<A.B.C.D>	OSPF area-ID expressed in IPv4 address format A.B.C.D.
	<0-4294967295>	OSPF area-ID expressed as a decimal number within the range shown.
	For example the values 0.0.1.2 and decimal 258 would both define the same area-ID.	
<ip-addr/ prefix-length>	The IPv6 address uses the format X:X::X:X/Prefix-Length. The prefix-length is usually set between 0 and 64, or has the value 128.	
advertise	Advertise this range as a summary route into other areas.	
not-advertise	Do not advertise this range.	

Default The area range is not configured by default. The area range is advertised if it is configured.

Mode Router Configuration

Usage Multiple ranges can be configured on a single area by multiple processes of this command.

Example

```
awplus# configure terminal
awplus(config)# router ipv6 ospf P2
awplus(config-router)# area 1 range 2000::/3
```

area stub (IPv6 OSPF)

This command defines an OSPF area as a stub area. By default, no stub area is defined.

Use this command when routers in the area do not require learning about external LSAs. You can define the area as a totally stubby area by configuring the Area Border Router of that area using the area stub no-summary command.

The no variant of this command removes this definition.

Syntax

```
area <area-id> stub [no-summary]
no area <area-id> stub [no-summary]
```

Parameter	Description	
<area-id>	The OSPF area that you are configuring as a stub area. Use one of the following formats: This can be entered in either dotted decimal format or normal decimal format. For example the values dotted decimal 0.0.1.2 and decimal 258 would both define the same area-ID.	
	<A.B.C.D>	OSPF area-ID, expressed in the IPv4 address format *<A.B.C.D>*.
	<0-4294967295>	OSPF area-ID expressed as a decimal number within the range shown.
	For example the values dotted decimal 0.0.1.2 and decimal 258 would both define the same area-ID.	
no-summary	Stops an ABR from sending summary link advertisements into the stub area.	

Mode Router Configuration

Usage There are two stub area router configuration commands: the area stub and area default-cost commands. In all routers attached to the stub area, configure the area by using the area stub command. For an area border router (ABR) attached to the stub area, also use the area default-cost command.

Example

```
awplus# configure terminal
awplus(config)# router ipv6 ospf 100
awplus(config-router)# area 100 stub
```

Related Commands area default-cost (OSPFv3 for IPv6)

area virtual-link (IPv6 OSPF)

This command configures a link between a non-backbone area and the backbone, through other non-backbone areas.

In OSPF, all non-backbone areas must be connected to a backbone area. If the connection to the backbone is lost, the virtual link repairs the connection.

The no variant of this command removes the virtual link.

Syntax

```
area <area-id> virtual-link <router-id>

no area <area-id>  virtual-link <router-id>

area <area-id>  virtual-link <router-id>

no area <area-id>  virtual-link <router-id>

area <area-id>  virtual-link <router-id> [hello-interval <1-65535>]
   [retransmit-interval <1-65535>] [transmit-delay <1-65535>]

no area <area-id>  virtual-link <router-id> [hello-interval]
   [retransmit-interval] [transmit-delay]
```

Parameter	Description	
<area-id>	The area-ID of the transit area that the virtual link passes through. This can be entered in either dotted decimal format or normal decimal format as shown below.	
	<A.B.C.D>	OSPF area-ID, expressed in the IPv4 address format *<A.B.C.D>*.
	<0-4294967295>	OSPF area-ID expressed as a decimal number within the range shown.
	For example the values dotted decimal 0.0.1.2 and decimal 258 would both define the same area-ID.	
<router-id>	The OSPF router ID of the virtual link neighbor.	
dead-interval	If no packets are received from a particular neighbor for dead-interval seconds, the router considers the neighbor router to be off-line. Default: 40 seconds	
	<1-65535>	The number of seconds in the interval.
hello-interval	The interval the router waits before it sends a hello packet. Default: 10 seconds	
	<1-65535>	The number of seconds in the interval.
retransmit-interval	The interval the router waits before it retransmits a packet. Default: 5 seconds	
	<1-65535>	The number of seconds in the interval.
transmit-delay	The interval the router waits before it transmits a packet. Default: 1 seconds	
	<1-65535>	The number of seconds in the interval.

Mode Router Configuration

Usage You can configure virtual links between any two backbone routers that have an interface to a common non-backbone area. The protocol treats these two routers, joined by a virtual link, as if they were connected by an unnumbered point-to-point network. To configure a virtual link, you require:

- The transit area-ID, i.e. the area-ID of the non-backbone area that the two backbone routers are both connected to.
- The corresponding virtual link neighbor's router ID. To see the router ID use the show ipv6 ospf command.

Configure the hello-interval to be the same for all routers attached to a common network. A short hello-interval results in the router detecting topological changes faster but also an increase in the routing traffic.

The retransmit-interval is the expected round-trip delay between any two routers in a network. Set the value to be greater than the expected round-trip delay to avoid needless retransmissions.

The transmit-delay is the time taken to transmit a link state update packet on the interface. Before transmission, the link state advertisements in the update packet, are incremented by this amount. Set the transmit-delay to be greater than zero. Also, take into account the transmission and propagation delays for the interface.

Example To configure a virtual link through area 1to the router with router-ID 10.10.11.50, use the following commands:

```
awplus# configure terminal
awplus(config)# router ipv6 ospf 100
awplus(config-router)# area 1 virtual-link 10.10.11.50 hello 5
dead 10
```

Related Commands show ipv6 ospf

auto-cost reference bandwidth (IPv6 OSPF)

This command controls how OSPF calculates default metrics for the interface.

By default, OSPF calculates the OSPF metric for an interface by dividing the reference bandwidth by the interface bandwidth. The default for the reference bandwidth is 100 Mbps. As a result, if this default is used, there is very little difference between the metrics applied to interfaces of increasing bandwidth beyond 100 Mbps. The auto-cost command is used to alter this reference bandwidth in order to give a real difference between the metrics of high bandwidth links of differing bandwidths. In a network that has multiple links with high bandwidths, specify a larger reference bandwidth value to differentiate the costs on those links.

Use the no variant of this command to assign cost based only on the interface bandwidth.

Syntax

```
auto-cost reference-bandwidth <1-4294967>
no auto-cost reference-bandwidth
```

Parameter	Description
<1-4294967>	The reference bandwidth, measured in Mbits per second (Mbps).

Default 100 Mbps

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router ipv6 ospf 20
awplus(config-router)# auto-cost reference-bandwidth 1000
```

Related Commands ipv6 ospf cost

bandwidth (duplicate)

This command is a copy of the bandwidth command on page 38.15. It specifies the maximum bandwidth to be used for each VLAN interface.

Use the no variant of this command to remove the maximum bandwidth.

Syntax

```
bandwidth  <bandwidth-setting>
no bandwidth
```

Parameter	Description
<bandwidth-setting>	Sets to bandwidth for the interface. Enter a value in the range 1 to 10000000000. The bandwidth value is in bits.

Default 100000000 (for OSPF configuration this is often considered as 100 Mbps)

Mode Interface Configuration for a VLAN interface.

Usage This value is used when calculating the metrics for the VLAN interface.

Example To set the bandwidth command for VLAN2 to be 1 Mbps, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# bandwidth 1000000
```

Related Commands

show running-config
show running-config as-path access-list
show interface

clear ipv6 ospf process

This command clears and restarts the IPv6 OSPF routing process. Specify the Process ID to clear one particular OSPF process. When no Process ID is specified, this command clears all running OSPF processes.

Syntax `clear ipv6 ospf [<0-65535>] process`

Parameter	Description
`<0-65535>`	The routing process ID.

Mode Privileged Exec

Example

```
awplus# clear ipv6 ospf process
```

debug ipv6 ospf events

This command enables IPv6 OSPF debugging for event troubleshooting.

To enable all debugging options, specify debug ipv6 ospf event with no additional parameters.

The no and undebug variants of this command disable OSPF debugging. Using this command with no parameters entered, will disable debugging for all parameter options.

Syntax

```
debug ipv6 ospf events [abr] [asbr] [os][router] [vlink]
no debug ipv6 ospf events [abr] [asbr] [os] [router] [vlink]
```

Parameter	Description
abr	Shows ABR events.
asbr	Shows ASBR events.
router	Shows other router events.
os	Shows OS events.
vlink	Shows virtual link events.

Mode Privileged Exec and Global Configuration

Example To enable IPv6 event debugging and show ABR events, use the following command:

```
awplus# debug ipv6 ospf events asbr
```

debug ipv6 ospf ifsm

This command specifies debugging options for IPv6 OSPF Interface Finite State Machine (IFSM) troubleshooting.

To enable all debugging options, specify debug ipv6 ospf ifsm with no additional parameters.

The no and undebug variants of this command disable IPv6 OSPF IFSM debugging. Use these commands without parameters to disable all the options.

Syntax

```
debug ipv6 ospf ifsm [events] [status] [timers]
no debug ipv6 ospf ifsm [events] [status] [timers]
```

Parameter	Description
events	Displays IFSM event information.
status	Displays IFSM status information.
timers	Displays IFSM timer information.

Mode Privileged Exec and Global Configuration

Example To specify IPv6 OSPF debugging options to display IPv6 OSPF IFSM events information, use the following commands:

```
awplus# debug ipv6 ospf ifsm events
```

Related Commands

terminal monitor
undebug ipv6 ospf ifsm

debug ipv6 ospf lsa

This command enables debugging options for IPv6 OSPF Link State Advertisements (LSA) troubleshooting. This displays information related to internal operations of LSAs.

To enable all debugging options, specify debug ipv6 ospf lsa with no additional parameters.

The no and undebug variants of this command disable IPv6 OSPF LSA debugging. Use this command without parameters to disable all the options.

Syntax

```
debug ipv6 ospf lsa [flooding] [generate] [install] [maxage]
    [refresh]

no debug ipv6 ospf lsa [flooding] [generate] [install] [maxage]
    [refresh]
```

Parameter	Description
`flooding`	Displays LSA flooding.
`generate`	Displays LSA generation.
`install`	Show LSA installation.
`maxage`	Shows maximum age of the LSA in seconds.
`refresh`	Displays LSA refresh.

Mode Privileged Exec and Global Configuration

Examples To enable debugging for IPv6 OSPF refresh LSA, use the following commands:

```
awplus# debug ipv6 ospf lsa refresh
```

Related Commands

terminal monitor
undebug ipv6 ospf lsa

debug ipv6 ospf nfsm

This command enables debugging options for IPv6 OSPF Neighbor Finite State Machines (NFSMs).

To enable all debugging options, specify debug ipv6 ospf nfsm with no additional parameters.

The no and undebug variants of this command disable IPv6 OSPF NFSM debugging. Use this command without parameters to disable all the options.

Syntax

```
debug ipv6 ospf nfsm [events] [status] [timers]
no debug ipv6 ospf nfsm [events] [status] [timers]
```

Parameter	Description
`events`	Displays NFSM event information.
`status`	Displays NSFM status information.
`timers`	Displays NFSM timer information.

Mode Privileged Exec and Global Configuration

Examples To enable IPv6 debugging option to display timer information, use the following command:

```
awplus# debug ipv6 ospf nfsm timers
```

Related Commands

terminal monitor
undebug ipv6 ospf nfsm

debug ipv6 ospf packet

This command enables debugging options for IPv6 OSPF packets.

To enable all debugging options, specify debug ipv6 ospf packet with no additional parameters.

The no and undebug variants of this command disable IPv6 OSPF packet debugging. Use this command without parameters to disable all options.

Syntax

```
debug ipv6 ospf packet [dd] [detail] [hello] [ls-ack] [ls-request]
    [ls-update] [recv] [send]

no debug ipv6 ospf packet [dd] [detail] [hello] [ls-ack] [ls-request]
    [ls-update] [recv] [send]
```

Parameter	Description
dd	Specifies debugging for IPv6 OSPF database descriptions.
detail	Sets the debug option to detailed information.
hello	Specifies debugging for IPv6 OSPF hello packets.
ls-ack	Specifies debugging for IPv6 OSPF link state acknowledgments.
ls-request	Specifies debugging for IPv6 OSPF link state requests.
ls-update	Specifies debugging for IPv6 OSPF link state updates.
recv	Specifies the debug option set for received packets.
send	Specifies the debug option set for sent packets.

Mode Privileged Exec and Global Configuration

Examples To enable debugging for hello packets, use the following command:

```
awplus# debug ipv6 ospf packet hello
```

Related Commands

terminal monitor
undebug ipv6 ospf packet

debug ipv6 ospf route

This command enables debugging of route calculation. Use this command without parameters to turn on all the options.

The no and undebug variants of this command disable IPv6 OSPF route debugging. Use this command without parameters to disable all options.

Syntax

```
debug ipv6 ospf route [ase] [ia] [install] [spf]
no debug ipv6 ospf route [ase] [ia] [install] [spf]
```

Parameter	Description
ase	Specifies the debugging of external route calculation.
ia	Specifies the debugging of inter-area route calculation.
install	Specifies the debugging of route installation.
spf	Specifies the debugging of SPF calculation.

Mode Privileged Exec and Global Configuration

Examples To enable IPv6 route debugging of inter-area route calculations, use the following command:

```
awplus# debug ipv6 ospf route ia
```

Related Commands

terminal monitor
undebug ipv6 ospf route

default-metric (IPv6 OSPF)

This command sets default metric value for routes redistributed into the IPv6 OSPF routing protocol.

The no variant of this command returns IPv6 OSPF to using built-in, automatic metric translations, as appropriate for each routing protocol.

Syntax

```
default-metric <0-16777214>
no default-metric [<0-16777214>]
```

Parameter	Description
<1-16777214>	Default metric value appropriate for the specified routing protocol.

Mode Router Configuration

Usage A default metric facilitates redistributing routes even with incompatible metrics. If the metrics do not convert, the default metric provides an alternative and enables the redistribution to continue. The effect of this command is that IPv6 OSPF will use the same metric value for all redistributed routes. Use this command in conjunction with the redistribute (IPv6 OSPF) command.

Examples

```
awplus# configure terminal
awplus(config)# router ipv6 ospf 100
awplus(config-router)# default-metric 100

awplus# configure terminal
awplus(config)# router ipv6 ospf 100
awplus(config-router)# no default-metric
```

Related commands redistribute (IPv6 OSPF)

ipv6 ospf cost

This command explicitly specifies the cost of the link-state metric in a router-LSA.

The interface cost indicates the overhead required to send packets across a certain VLAN interface.

To set the VLAN interface cost manually, use this command.

The no variant of this command resets the VLAN interface cost to the default.

Syntax

```
ipv6 ospf [<ipv6-address>] cost <1-65535>
no ipv6 ospf [<ipv6-address>] cost
```

Parameter	Description
<ipv6-address>	The IPv6 address uses the format X:X::X:X/Prefix-Length. The prefix-length is usually set between 0 and 64, or has the value 128.
<1-65535>	The link-state metric.

Default By default the reference bandwidth is 100 Mbps (10^8), but can be set to a different value by the command, auto-cost reference bandwidth (IPv6 OSPF) command on page 40.8.

Mode Interface Configuration, for a VLAN interface.

Usage The link-state metric cost is stated in the Router-LSA's link. Typically, the cost is inversely proportional to the bandwidth of an interface. By default, the cost of a VLAN interface is calculated according to the following formula:

reference bandwidth / interface bandwidth

The reference bandwidth is set by default at 100000000 (or 100 Mbps), but can be changed by the auto-cost reference bandwidth (IPv6 OSPF) command on page 40.8.

The interface bandwidth is set by default to 100000000 (or 100 Mbps), but can be changed by the bandwidth (duplicate) command on page 40.9.

Example To set the IPv6 OSPF cost to 10 on interface `vlan25` for IPv6 address 2001:0db8:21e:10d::5/32 use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan25
awplus(config-if)# ipv6 ospf 2001:0db8:21e:10d::5/64 cost 10
```

Note The IPv6 addresses shown use the address space 2001:0db8::/32, defined in RFC 3849 for documentation purposes. These addresses should not be used for practical networks (other than for testing purposes) nor should they appear on any public network.

Related Commands
show ipv6 ospf interface
auto-cost reference bandwidth (IPv6 OSPF)
bandwidth (duplicate)

ipv6 ospf dead-interval

This command sets the interval during which no hello packets are received and after which a neighbor is declared dead.

The dead-interval is the amount of time that OSPF waits to receive an OSPF hello packet from the neighbor before declaring the neighbor is down. This value is advertised in the router's hello packets. It must be a multiple of the hello-interval and be the same for all routers on a specific network.

The no variant of this command returns the interval to the default of 40 seconds.

Syntax

```
ipv6 ospf dead-interval <1-65535> [<inst-id>]
no ipv6 ospf  dead-interval
```

Parameter	Description
<1-65535>	The interval in seconds. Default: 40
<inst-id>	The instance ID Default: 0

Mode Interface Configuration

Example The following example shows configuring the dead-interval to 10 seconds on interface `vlan1`.

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ipv6 ospf dead-interval 10
```

Related Commands

ipv6 ospf hello-interval
show ipv6 ospf interface

ipv6 ospf display route single-line

Use this command to change the result of the show ipv6 route command to display each route entry on a single line.

Syntax

```
ipv6 ospf display route single-line
no ipv6 ospf display route single-line
```

Mode Global Configuration

Example To display each route entry on a single line.

```
awplus# configure terminal
awplus(config)# ipv6 ospf display route single-line
```

Related Commands show ipv6 ospf route

ipv6 ospf hello-interval

This command specifies the interval between hello packets.

The hello-interval is advertised in the hello packets. Configure the same hello-interval for all routers on a specific network. A shorter interval ensures faster detection of topological changes, but results in more routing traffic.

The no variant of this command returns the interval to the default of 10 seconds.

Syntax

```
ipv6 ospf hello-interval <1-65535>
no ipv6 ospf hello-interval
```

Parameter	Description
<1-65535>	The hello-interval in seconds. Default: 10

Default The default interval is 10 seconds.

Mode Interface Configuration for a VLAN interface.

Example The following example shows setting the hello-interval to 3 seconds on interface `vlan2`.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 ospf hello-interval 3
```

Related Commands

ipv6 ospf dead-interval
show ipv6 ospf interface

ipv6 ospf priority

This command sets the router priority, which is a parameter used in the election of the designated router for the link.

The no variant of this command returns the router priority to the default of 1.

Syntax

```
ipv6 ospf priority <priority>
no ipv6 ospf priority
```

Parameter	Description
<priority>	*<0-255>* Specifies the router priority of the interface. The larger the value, the greater the priority level. The value 0 defines that the switch cannot become either the DR, or backup DR for the link.

Default The default priority is 1.

Mode Interface Configuration for a VLAN interface.

Usage Set the priority to help determine the OSPF Designated Router (DR) for a link. If two routers attempt to become the DR, the router with the higher router priority becomes the DR. If the router priority is the same for two routers, the router with the higher router ID takes precedence.

Routers with zero router priority values cannot become the designated or backup designated router.

Example The following example shows setting the OSPFv3 priority value to 3 on the `vlan2` interface.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 ospf priority 3
```

ipv6 ospf retransmit-interval

Use this command to specify the time between link-state advertisement (LSA) retransmissions for adjacencies belonging to the interface.

Use the no variant of this command to return to the default of 5 seconds.

Syntax

```
ipv6 ospf retransmit-interval <1-65535>
no ipv6 ospf retransmit-interval
```

Parameter	Description
<1-65535>	Specifies the interval in seconds.

Default The default interval is 5 seconds.

Mode Interface mode for a VLAN interface.

Usage After sending an LSA to a neighbor, the router keeps the LSA until it receives an acknowledgement. In case the router does not receive an acknowledgement during the set time (the retransmit interval value) it retransmits the LSA. Set the retransmission interval value conservatively to avoid needless retransmission. The interval should be greater than the expected round-trip delay between two routers.

Example The following example shows setting the ospf retransmit interval to 6 seconds on the `vlan2` interface.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 ospf retransmit-interval 6
```

ipv6 ospf transmit-delay

Use this command to set the estimated time it takes to transmit a link-state-update packet on the VLAN interface.

Use the no variant of this command to return to the default of 1 second.

Syntax

```
ipv6 ospf transmit-delay <1-65535>
no ipv6 ospf transmit-delay
```

Parameter	Description
<1-65535>	Specifies the time, in seconds, to transmit a link-state update.

Default The default interval is 1 second.

Mode Interface Configuration for a VLAN interface.

Usage The transmit delay value adds a specified time to the age field of an update. If the delay is not added, the time in which the LSA transmits over the link is not considered. This command is especially useful for low speed links. Add transmission and propagation delays when setting the transmit delay value.

Example To set the IPv6 OSPF transmit delay time to 3 seconds on the `vlan2` interface, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 ospf transmit-delay 3
```

ipv6 router ospf

Use this command to enable IPv6 OSPF routing on an interface.

Use the no variant of this command to disable IPv6 OSPF routing.

Syntax

```
ipv6 router ospf area <area-id> [tag <process-id>]
   [instance <inst-id>]

no ipv6 router ospf area <area-id>
```

Parameter	Description
<area-id>	The ID of the IPv6 OSPF routing area. Can be entered as either an IPv4 A.B.C.D address format, or as an unsigned integer in the range, 0 to 4294967295. Use either of the following forms when entering an area-ID: ■ area-id <*A.B.C.D*> Where A.B.C.D is a number entered in IPv4 address format. ■ area-id <0 to 4294967295>.
<process-id>	The process tag denotes a separate router process. It can comprise any string of alphanumeric characters. Note that this tag is local to the router on which it is set and does not appear in any OSPF packets or LSA.
<instance-id>	The OSPF instance ID, entered as an integer between 0 and 255. This is the value that will appear in the instance field of the IPv6 OSPF hello packet, see Figure 39-2 on page 39.5.

Defaults

IPv6 OSPF routing is disabled by default.

When enabling IPv6 OSPF routing:

- the process-tag will default to a null value if not set.
- the Instance ID defaults to 0 if not set.

Mode

Interface mode for a VLAN interface.

Usage

When enabling IPv6 OSPF routing on an interface, specifying the area-ID is mandatory, but the Process tag and Instance are optional.

For more information see "Configuring Instances and Processes" on page 39.26.

Example

The following commands enable IPv6 OSPF on VLAN2, area 1, tag PT2, and instance 2.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 router ospf area 1 tag PT2 instance-id 2
```

max-concurrent-dd (IPv6 OSPF)

Use this command to limit the number of neighbors that can be concurrently processed in the database exchange. The specified value limits the number of neighbors from all interfaces, not per interface.

Use the no variant of this command to have no limit on the maximum number of LSAs.

Syntax

```
max-concurrent-dd <max-neighbors>
no max-concurrent-dd
```

Parameter	Description
<max-neighbors>	<1-65535> The maximum number of neighbors.

Mode Router Configuration

Usage This command is useful where bringing up several adjacencies on a router is affecting performance. In this situation, you can often enhance the system performance by limiting the number of neighbors that can be processed concurrently.

Example The following example sets the max-concurrent-dd value to allow only 4 neighbors to be processed at a time.

```
awplus# configure terminal
awplus(config)# router ipv6 ospf
awplus(config-router)# max-concurrent-dd 4
```

Related Commands router ipv6 ospf

passive-interface (IPv6 OSPF)

Use this command to suppress the sending of Hello packets on a specified interface. If you use the passive-interface command without the optional parameters then all interfaces are put into passive mode.

Use the no variant of this command to allow the sending of Hello packets on all interfaces, or on the specified interface. If you use the no variant of this command without the optional parameters then all interfaces are removed from passive mode.

Syntax

```
passive-interface [<interface>]
no passive-interface [<interface>]
```

Parameter	Description
<interface>	The name or the VID of the VLAN interface.

Mode Router Configuration

Usage Configure an interface to be passive if you wish its connected route to be treated as an OSPF route (rather than an AS-external route), but do not wish to actually exchange any OSPF packets via this interface.

Examples To configure passive interface mode on interface vlan2, enter the following commands:

```
awplus(config)# router ipv6 ospf
awplus(config-router)# passive-interface vlan2
```

To configure passive interface mode on all interfaces, enter the following commands:

```
awplus(config)# router ipv6 ospf
awplus(config-router)# passive-interface
```

To remove passive interface mode on interface vlan2, enter the following commands:

```
awplus(config)# router ipv6 ospf
awplus(config-router)# no passive-interface vlan2
```

To remove passive interface mode on all interfaces, enter the following commands:

```
awplus(config)# router ipv6 ospf
awplus(config-router)# no passive-interface
```

redistribute (IPv6 OSPF)

Use this command to redistribute routes from other routing protocols, static routes and connected routes into an IPv6 OSPF routing table.

Use the no variant of this command to disable this function.

Syntax

```
redistribute <protocol>} [metric <0-16777214>] [metric-type {1|2}]
   [route-map <route-map-entry>]

no redistribute <protocol>
```

Parameter	Description	
<protocol>	The routing protocol to be redistributed, can be one of:	
	`connected`	Connected routes
	`rip`	Routing Internet Protocol
	`static`	Static Routes
`metric`	*<0-16777214>* Specifies the external metric.	
`metric-type`	Specifies the external metric-type, either type 1 or type 2. ■ For Metric Type 1 The best route is based on the external redistributed path cost plus the internal path cost presented by the native routing protocol. ■ For Metric Type 2 The best route is based only on the external redistributed path cost. The internal path cost is only used to break a “tie” situation between two identical external path costs.	
`route-map`	*<route-map-entry>* Where the route-map-entry specifies the pointer to the specific route-map.	

Mode Router Configuration

Usage IPv6 OSPF advertises routes learnt from the RIP routing protocol including static or connected routes. Each injected prefix is put into the AS-external-LSA with a specified metric and metric type.

Example The following example shows the redistribution of RIP routes into the IPv6 OSPF routing table, with a metric of 10 and a metric type of 1.

```
awplus# configure terminal
awplus(config)# router ipv6 ospf
awplus(config-router)# redistribute rip metric 10 metric-type 1
```

restart ipv6 ospf graceful

Use this command to force the OSPFv3 process to restart. You may optionally specify a grace-period value. If a grace-period is not specified then a default value of 120 seconds is applied.

You should specify a grace-period value of 120 seconds or more. Low grace-period values may cause the graceful restart process on neighboring routers to terminate with routes missing.

Syntax `restart ipv6 ospf graceful [grace-period <1-1800>]`

Parameter	Description
`grace-period`	Specify the grace period.
<1-1800>	The grace period in seconds.

Default The default OSPF grace-period is 120 seconds.

Mode Privileged Exec

Usage After this command is executed, the OSPFv3 process immediately shuts down. It notifies the system that OSPF has performed a graceful shutdown. Routes installed by OSPF are preserved until the grace-period expires.

When a restart ospf graceful command is issued, the OSPF configuration is reloaded from the last saved configuration. Ensure you first enter the copy running-config startup-config command.

Example To restart OSPFv3, use the following commands:

```
awplus# copy running-config startup-config
awplus# restart ipv6 ospf graceful grace-period 200
```

To apply the default grace-period (120 seconds), use the following commands:

```
awplus# copy running-config startup-config
awplus# restart ipv6 ospf graceful
```

router ipv6 ospf

Use this command to create or remove an IPv6 OSPF routing process, or to enter the Router Configuration mode to configure a specific IPv6 OSPF routing process. Use the no variant of this command to terminate an IPv6 OSPF routing process.

Use the no parameter with the process-id parameter, to terminate and delete a specific IPv6 OSPF routing process.

Syntax

```
router ipv6 ospf [<process-id>]
no router ipv6 ospf [<process-id>]
```

Parameter	Description
<process-id>	A character string that identifies a routing process. If you do not specify the process-id a "null" process ID will be applied. Note that this will appear in show output as *null* However you cannot select the null process by using the character string *null* as command entry characters.

Default No routing process is defined by default.

Mode Global Configuration

Usage The process ID enables you to run more than one OSPF session within the same router, then configure each session to a different router port. Note that this function is internal to the router, other routers (neighbors etc.) have no knowledge of these different processes. The hello and LSAs issued from each process will appear as if coming from a separate physical router.

To a large extent the requirement for multiple processes has been replaced by the ability within IPv6 OSPF of running simultaneous router instances.

The process ID of IPv6 OSPF is an optional parameter for the no variant of this command only. When removing all IPv6 OSPF processes on the switch, you do not need to specify each Process ID, but when removing particular IPv6 OSPF processes, you must specify each Process ID to be removed.

For a description of processes and instances and their configuration relationships, see "Configuring Instances and Processes" on page 39.26.

Example This example shows the use of this command to enter Router Configuration mode.

```
awplus# configure terminal
awplus(config)# router ipv6 ospf P100
awplus(config-router)#
```

router-id (IPv6 OSPF)

Use this command to specify a router ID for the IPv6 OSPF process.

Use the no variant of this command to disable this function.

Syntax

```
router-id <router-id>
no router-id
```

Parameter	Description
<router-id>	Specifies the router ID in IPv4 address format.

Mode Router Configuration

Usage Configure each router with a unique router-id. In an IPv6 OSPF router process that has active neighbors, a new router-id takes effect at the next reload or when you restart OSPF manually.

Example The following example shows a specified router ID 0.0.4.5.

```
awplus# configure terminal
awplus(config)# router ipv6 ospf
awplus(config-router)# router-id 0.0.4.5
```

Related Commands show ipv6 ospf

show debugging ipv6 ospf

Use this command to display which OSPFv3 debugging options are currently enabled.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show debugging ipv6 ospf`

Mode User Exec and Privileged Exec

Example

```
awplus# show debugging ipv6 ospf
```

Output Figure 40-1: Example output from the **show debugging ipv6 ospf** command

```
OSPFv3 debugging status:
  OSPFv3 all packet detail debugging is on
  OSPFv3 all IFSM debugging is on
  OSPFv3 all NFSM debugging is on
  OSPFv3 all LSA debugging is on
  OSPFv3 all NSM debugging is on
  OSPFv3 all route calculation debugging is on
  OSPFv3 all event debugging is on
```

show ipv6 ospf

Use this command to display general information about all IPv6 OSPF routing processes. Include the process ID parameter with this command to display information about specified processes.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ipv6 ospf
show ipv6 ospf <process-id>
```

Parameter	Description
<process-id>	*<0-65535>* The ID of the router process for which information will be displayed. If this parameter is included, only the information for the specified routing process is displayed.

Mode User Exec and Privileged Exec

Examples To display general information about all IPv6 OSPF routing processes, use the command:

```
awplus# show ipv6 ospf
```

To display general information about IPv6 OSPF (OSPFv3) routing process `P10`, use the command:

```
awplus# show ipv6 ospf P10
```

Output Figure 40-2: Example output from the **show ipv6 ospf** command for process P10

```
Routing Process "OSPFv3 (P10)" with ID 0.0.1.1
Route Licence: Route : Limit=Unlimited, Allocated=4
Route Licence: Breach: Current=0, Watermark=0
Process uptime is 4 days 1 hour 1 minute
SPF schedule delay min 0.50 secs, SPF schedule delay max 50.0 secs
Minimum LSA interval 5 secs, Minimum LSA arrival 1 secs
Number of incomming current DD exchange neighbors 0/5
Number of outgoing current DD exchange neighbors 0/5
Number of external LSA 6. Checksum Sum 0x4DD7E
Number of AS-Scoped Unknown LSA 0
Number of LSA originated 26
Number of LSA received 1984
Number of areas in this router is 1
   Area BACKBONE(0)
        Number of interfaces in this area is 2(2)
        SPF algorithm executed 6 times
        Number of LSA 9.  Checksum Sum 0x5801B
        Number of Unknown LSA 0
```

Related Commands router ipv6 ospf

show ipv6 ospf database

Use this command to display a database summary for IPv6 OSPF information. Include the process ID parameter with this command to display information about specified processes.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 ospf [<process-id>] database`

Parameter	Description
<process-id>	*<0-65535>* The ID of the router process for which information will be displayed.

Mode User Exec and Privileged Exec

Examples To display the database summary for IPv6 OSPF information on process `P10`, use the command:

```
awplus# show ipv6 ospf P10 database
```

Figure 40-3: Example output from the **show ipv6 ospf P10 database** command

```
OSPFv3 Router with ID (0.0.1.1) (Process P10)

                Link-LSA (Interface vlan2)

Link State ID   ADV Router      Age  Seq#       CkSum  Prefix
0.0.0.202       0.0.1.1          46 0x800000c3 0x5f50      1
0.0.0.202       0.0.1.2           8 0x800000c3 0x4ca0      1

                Link-LSA (Interface vlan3)

Link State ID   ADV Router      Age  Seq#       CkSum  Prefix
0.0.0.203       0.0.1.1         1071 0x8000000e 0xe082      1
0.0.0.203       0.0.1.3         1057 0x8000000e 0xb8aa      1

                Router-LSA (Area 0.0.0.0)

Link State ID   ADV Router      Age  Seq#       CkSum    Link
0.0.0.0         0.0.1.1         1016 0x800000cd 0xa426      2
0.0.0.0         0.0.1.2          979 0x800000d8 0xad2b      1
0.0.0.0         0.0.1.3         1005 0x800000cf 0xefed      1

                Network-LSA (Area 0.0.0.0)

Link State ID   ADV Router      Age  Seq#       CkSum
0.0.0.202       0.0.1.2         1764 0x800000c2 0x94c3
0.0.0.203       0.0.1.3         1010 0x800000c4 0x8ac8

                Intra-Area-Prefix-LSA (Area 0.0.0.0)

Link State ID   ADV Router      Age  Seq#       CkSum  Prefix  Reference
0.0.0.2         0.0.1.2          978 0x800000a1 0x699a      1  Router-LSA
0.0.0.4         0.0.1.2         1764 0x800000c2 0xca4d      1  Network-LSA
0.0.0.1         0.0.1.3         1004 0x80000012 0xaee2      1  Router-LSA
0.0.0.7         0.0.1.3         1005 0x8000000e 0x3c89      1  Network-LSA

                AS-external-LSA

Link State ID   ADV Router      Age  Seq#       CkSum
0.0.0.13        0.0.1.1         1071 0x8000000e 0xca9f E2
0.0.0.14        0.0.1.1         1071 0x8000000e 0xcc9b E2
0.0.0.15        0.0.1.1         1071 0x8000000e 0xce97 E2
0.0.0.16        0.0.1.1         1071 0x8000000e 0xd093 E2
0.0.0.17        0.0.1.1         1071 0x8000000e 0xd28f E2
0.0.0.18        0.0.1.1         1071 0x8000000e 0xd48b E2
```

show ipv6 ospf database external

Use this command to display information about the external LSAs.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 ospf database external [adv-router <adv-router-id>]`

Parameter	Description
`adv-router`	Displays all the LSAs of the specified router.
`<adv-router-id>`	The Advertising Router ID (usually entered in IPv4 address format A.B.C.D). Note that this ID component no longer represents an address; it is simply a character string that has an IPv4 address format.

Mode User Exec and Privileged Exec

Examples To display information about the external LSAs, use the following command:

```
awplus# show ipv6 ospf database external adv-router 10.10.10.1
```

Figure 40-4: Example output from the **show ipv6 ospf database external** command

```
LS age: 1087
  LS Type: AS-External-LSA
  Link State ID: 0.0.0.13
  Advertising Router: 0.0.1.1
  LS Seq Number: 0x8000000C
  Checksum: 0xCE9D
  Length: 52
    Metric Type: 2 (Larger than any link state path)
    Metric: 20
    Prefix: 2010:2222::/64
    Prefix Options: 0 (-|-|-|-)
    Forwarding Address: 2003:1111::1

LS age: 1087
  LS Type: AS-External-LSA
  Link State ID: 0.0.0.14
  Advertising Router: 0.0.1.1
  LS Seq Number: 0x8000000C
  Checksum: 0xD099
  Length: 52
    Metric Type: 2 (Larger than any link state path)
    Metric: 20
    Prefix: 2011:2222::/64
    Prefix Options: 0 (-|-|-|-)
    Forwarding Address: 2003:1111::1
```

Figure 40-4: Example output from the **show ipv6 ospf database external**

```
LS age: 1087
  LS Type: AS-External-LSA
  Link State ID: 0.0.0.15
  Advertising Router: 0.0.1.1
  LS Seq Number: 0x8000000C
  Checksum: 0xD295
  Length: 52
    Metric Type: 2 (Larger than any link state path)
    Metric: 20
    Prefix: 2012:2222::/64
    Prefix Options: 0 (-|-|-|-)
    Forwarding Address: 2003:1111::1


  LS age: 1087
  LS Type: AS-External-LSA
  Link State ID: 0.0.0.16
  Advertising Router: 0.0.1.1
  LS Seq Number: 0x8000000C
  Checksum: 0xD491
  Length: 52
    Metric Type: 2 (Larger than any link state path)
    Metric: 20
    Prefix: 2013:2222::/64
    Prefix Options: 0 (-|-|-|-)
    Forwarding Address: 2003:1111::1


LS age: 1087
  LS Type: AS-External-LSA
  Link State ID: 0.0.0.17
  Advertising Router: 0.0.1.1
  LS Seq Number: 0x8000000C
  Checksum: 0xD68D
  Length: 52
    Metric Type: 2 (Larger than any link state path)
    Metric: 20
    Prefix: 2014:2222::/64
    Prefix Options: 0 (-|-|-|-)
    Forwarding Address: 2003:1111::1


  LS age: 1087
  LS Type: AS-External-LSA
  Link State ID: 0.0.0.18
  Advertising Router: 0.0.1.1
  LS Seq Number: 0x8000000C
  Checksum: 0xD889
  Length: 52
    Metric Type: 2 (Larger than any link state path)
    Metric: 20
    Prefix: 2015:2222::/64
    Prefix Options: 0 (-|-|-|-)
    Forwarding Address: 2003:1111::1
```

show ipv6 ospf database network

Use this command to display information about the network LSAs.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 ospf database network [adv-router <adv-router-id>]`

Parameter	Description
`adv-router`	The advertising router selected.
`<adv-router-id>`	The router ID of the advertising router, in IPv4 address format. Note however, that this no longer represents a real address.

Mode User Exec and Privileged Exec

Examples To display information about the OSPFv3 network LSAs, use the following command:

```
awplus# show ipv6 ospf database network
```

Output Figure 40-5: Example output from the **show ipv6 ospf database network** command

```
OSPFv3 Router with ID (0.0.1.1) (Process P10)

                Network-LSA (Area 0.0.0.0)

  LS age: 97
  LS Type: Network-LSA
  Link State ID: 0.0.0.202
  Advertising Router: 0.0.1.2
  LS Seq Number: 0x800000C3
  Checksum: 0x92C4
  Length: 32
  Options: 0x000013 (-|R|-|-|E|V6)
    Attached Router: 0.0.1.2
    Attached Router: 0.0.1.1

  LS age: 1144
  LS Type: Network-LSA
  Link State ID: 0.0.0.203
  Advertising Router: 0.0.1.3
  LS Seq Number: 0x800000C4
  Checksum: 0x8AC8
  Length: 32
  Options: 0x000013 (-|R|-|-|E|V6)
    Attached Router: 0.0.1.3
    Attached Router: 0.0.1.1
```

show ipv6 ospf database router

Use this command to display information only about the router LSAs.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 ospf database router [adv-router <adv-router>]`

Parameter	Description
`adv-router`	The advertising router selected.
`<adv-router-id>`	The router ID of the advertising router, in IPv4 address format. Note however, that this no longer represents a real address.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ipv6 ospf database router
```

Figure 40-6: Example output from the **show ipv6 ospf database router** command

```
           OSPFv3 Router with ID (0.0.1.3) (Process P10)

                Router-LSA (Area 0.0.0.0)

LS age: 556
  LS Type: Router-LSA
  Link State ID: 0.0.0.0
  Advertising Router: 0.0.1.1
  LS Seq Number: 0x800000CA
  Checksum: 0xAA23
  Length: 56
  Flags: 0x02 (-|-|E|-)
  Options: 0x000013 (-|R|-|-|E|V6)

    Link connected to: a Transit Network
      Metric: 1
      Interface ID: 203
      Neighbor Interface ID: 203
      Neighbor Router ID: 0.0.1.3

    Link connected to: a Transit Network
      Metric: 1
      Interface ID: 202
      Neighbor Interface ID: 202
      Neighbor Router ID: 0.0.1.2


  LS age: 520
  LS Type: Router-LSA
  Link State ID: 0.0.0.0
  Advertising Router: 0.0.1.2
  LS Seq Number: 0x800000D5
  Checksum: 0xB328
  Length: 40
  Flags: 0x00 (-|-|-|-)
  Options: 0x000013 (-|R|-|-|E|V6)

    Link connected to: a Transit Network
      Metric: 1
      Interface ID: 202
      Neighbor Interface ID: 202
      Neighbor Router ID: 0.0.1.2


LS age: 543
  LS Type: Router-LSA
  Link State ID: 0.0.0.0
  Advertising Router: 0.0.1.3
  LS Seq Number: 0x800000CC
  Checksum: 0xF5EA
  Length: 40
  Flags: 0x00 (-|-|-|-)
  Options: 0x000013 (-|R|-|-|E|V6)

    Link connected to: a Transit Network
      Metric: 1
      Interface ID: 203
      Neighbor Interface ID: 203
      Neighbor Router ID: 0.0.1.3
            OSPFv3 Router with ID (0.0.1.3) (Process P10)

                AS-external-LSA
```

Figure 40-6: Example output from the **show ipv6 ospf database router** command(cont.)

```
  LS age: 1384
  LS Type: AS-External-LSA
  Link State ID: 0.0.0.13
  Advertising Router: 0.0.1.1
  LS Seq Number: 0x80000009
  Checksum: 0xD49A
  Length: 52
    Metric Type: 2 (Larger than any link state path)
    Metric: 20
    Prefix: 2010:2222::/64
    Prefix Options: 0 (-|-|-|-)
    Forwarding Address: 2003:1111::1


LS age: 1384
  LS Type: AS-External-LSA
  Link State ID: 0.0.0.14
  Advertising Router: 0.0.1.1
  LS Seq Number: 0x80000009
  Checksum: 0xD696
  Length: 52
    Metric Type: 2 (Larger than any link state path)
    Metric: 20
    Prefix: 2011:2222::/64
    Prefix Options: 0 (-|-|-|-)
    Forwarding Address: 2003:1111::1


LS age: 1384
  LS Type: AS-External-LSA
  Link State ID: 0.0.0.15
  Advertising Router: 0.0.1.1
  LS Seq Number: 0x80000009
  Checksum: 0xD892
  Length: 52
    Metric Type: 2 (Larger than any link state path)
    Metric: 20
    Prefix: 2012:2222::/64
    Prefix Options: 0 (-|-|-|-)
    Forwarding Address: 2003:1111::1
```

show ipv6 ospf interface

Use this command to display interface information for OSPF.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 ospf interface [<interface-name>]`

Parameter	Description
<interface-name>	An alphanumeric string that is the interface name.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ipv6 ospf interface vlan2
```

Output Figure 40-7: Example output from the **show ipv6 ospf interface** command

```
vlan3 is up, line protocol is up
  Interface ID 203
  IPv6 Prefixes
    fe80::200:cdff:fe27:c4bf/64 (Link-Local Address)
    2003:1111::1/64
  OSPFv3 Process (P1), Area 0.0.0.0, Instance ID 0
    Router ID 0.0.1.3, Network Type BROADCAST, Cost: 1
    Transmit Delay is 1 sec, State DR, Priority 1
    Designated Router (ID) 0.0.1.3
      Interface Address fe80::200:cdff:fe27:c4bf
    Backup Designated Router (ID) 0.0.1.1
      Interface Address fe80::200:cdff:fe24:daae
    Timer interval configured, Hello 10, Dead 40, Wait 40,
Retransmit 5
      Hello due in 00:00:06
    Neighbor Count is 1, Adjacent neighbor count is 1
vlan5 is up, line protocol is up
  Interface ID 205
  IPv6 Prefixes
    fe80::200:cdff:fe27:c4bf/64 (Link-Local Address)
    2005:1111::1/64
  OSPFv3 Process (P1), Area 0.0.0.0, Instance ID 0
    Router ID 0.0.1.3, Network Type BROADCAST, Cost: 1
    Transmit Delay is 1 sec, State DR, Priority 1
    Designated Router (ID) 0.0.1.3
      Interface Address fe80::200:cdff:fe27:c4bf
    No backup designated router on this link
    Timer interval configured, Hello 10, Dead 40, Wait 40,
Retransmit 5
      Hello due in 00:00:05
    Neighbor Count is 0, Adjacent neighbor count is 0
```

Figure 40-8: Example output from the **show ipv6 ospf interface** vlan3 command

```
vlan3 is up, line protocol is up
  Interface ID 203
  IPv6 Prefixes
    fe80::200:cdff:fe24:daae/64 (Link-Local Address)
    2003:1111::2/64
  OSPFv3 Process (P1), Area 0.0.0.0, Instance ID 0
    Router ID 0.0.1.1, Network Type BROADCAST, Cost: 1
    Transmit Delay is 1 sec, State DR, Priority 1
    Designated Router (ID) 0.0.1.1
      Interface Address fe80::200:cdff:fe24:daae
    No backup designated router on this link
    Timer interval configured, Hello 10, Dead 40, Wait 40,
Retransmit 5
      Hello due in 00:00:02
    Neighbor Count is 0, Adjacent neighbor count is 0
```

show ipv6 ospf neighbor

Use this command to display information on OSPF neighbors. Include the process ID parameter with this command to display information about specified processes.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ipv6 ospf [<process-id>] neighbor <neighbor-id>
show ipv6 ospf [<process-id>] neighbor detail
show ipv6 ospf [<process-id>] neighbor <interface> [detail]
```

Parameter	Description
<process-id>	<character string> The ID of the OSPF process for which information will be displayed.
<neighbor-id>	The Neighbor ID, entered in IP address (A.B.C.D) format.
detail	Detail of all neighbors.
<interface>	IP address of the interface.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ipv6 ospf neighbor
```

Output Figure 40-9: Example output from the **show ipv6 ospf neighbor** command

```
OSPFv3 Process (P1)
Neighbor ID    Pri   State           Dead Time   Interface   Instance
ID
0.0.1.1          1   Full/Backup   00:00:33    vlan3       0
```

Figure 40-10: Example output from the **show ipv6 ospf neighbor detail** command

```
 Neighbor 0.0.1.2,     interface address
fe80::215:77ff:fec9:7472
   In the area 0.0.0.0 via interface vlan2
   Neighbor priority is 1, State is Full, 6 state changes
   DR is 0.0.1.2     BDR is 0.0.1.1
   Options is 0x000013 (-|R|-|-|E|V6)
   Dead timer due in 00:00:33
   Database Summary List 0
   Link State Request List 0
   Link State Retransmission List 0
```

show ipv6 ospf route

Use this command to display the OSPF routing table. Include the process ID parameter with this command to display the OSPF routing table for specified processes.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 ospf [<process-id>] route`

Parameter	Description
<process-id>	A character string that specifies the router process. If this parameter is included, only the information for this specified routing process is displayed.

Mode User Exec and Privileged Exec

Examples To display the OSPF routing table, use the command:

```
awplus# show ipv6 ospf route
```

Output Figure 40-11: Example output from the **show ipv6 ospf P10 route** command for a specific process

```
OSPFv3 Process (P1)
Codes: C - connected, D - Discard, O - OSPF, IA - OSPF inter
area
       E1 - OSPF external type 1, E2 - OSPF external type 2

   Destination                                        Metric
     Next-hop
O  2002:1111::/64                                        2
     via fe80::200:cdff:fe24:daae, vlan3, Area 0.0.0.0
C  2003:1111::/64                                        1
     directly connected, vlan3, Area 0.0.0.0
O  2004:1111::/64                                        3
     via fe80::200:cdff:fe24:daae, vlan3, Area 0.0.0.0
C  2005:1111::/64                                        1
     directly connected, vlan5, Area 0.0.0.0
E2 2010:2222::/64                                    1/20
     via 2003:1111::1, vlan3
E2 2011:2222::/64                                    1/20
     via 2003:1111::1, vlan3
E2 2012:2222::/64                                    1/20
     via 2003:1111::1, vlan3
E2 2013:2222::/64                                    1/20
     via 2003:1111::1, vlan3
E2 2014:2222::/64                                    1/20
     via 2003:1111::1, vlan3
E2 2015:2222::/64                                    1/20
     via 2003:1111::1, vlan3
```

undebug ipv6 ospf events

This command applies the functionality of the no debug ipv6 ospf events command on page 40.11.

undebug ipv6 ospf ifsm

This command applies the functionality of the no debug ipv6 ospf ifsm command on page 40.12.

undebug ipv6 ospf lsa

This command applies the functionality of the no debug ipv6 ospf lsa command on page 40.13.

undebug ipv6 ospf nfsm

This command applies the functionality of the no debug ipv6 ospf nfsm command on page 40.14.

undebug ipv6 ospf nsm

This command applies the functionality of the no debug ipv6 ospf nfsm command on page 40.14.

undebug ipv6 ospf packet

This command applies the functionality of the no debug ipv6 ospf packet command on page 40.15.

undebug ipv6 ospf route

This command applies the functionality of the no debug ipv6 ospf route command on page 40.16.

Chapter 41: BGP Configuration

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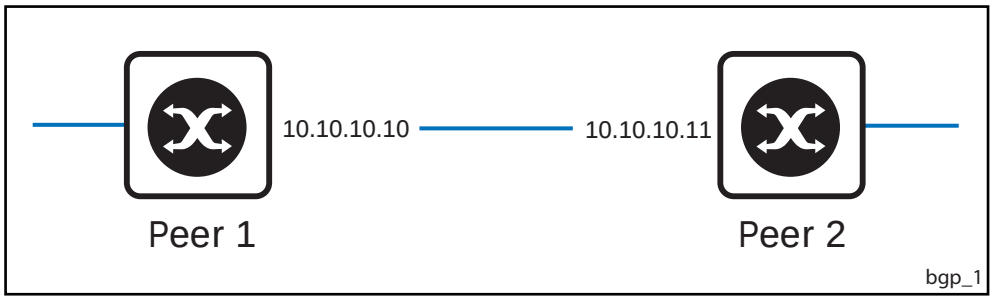
Introduction

This chapter contains basic BGP configuration examples. For details about the commands used in these examples, or the outputs from validation commands, see Chapter 42, BGP Commands.

Enabling BGP Peers In The Same Autonomous System

This example shows the minimum configuration required for enabling BGP on an interface. Peer 1 and Peer 2 are two BGP Peers belonging to the same Autonomous System (AS), AS200, connecting to network 10.10.10.0/24. First, define the routing process and the AS number to which the peers belong. Then, define BGP neighbors to start exchanging routing updates.



Peer 1

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router bgp 200`	Define the routing process. The number 200 specifies the AS number of Peer 1.
`awplus(config-router)#`	
`neighbor 10.10.10.11 remote-as 200`	Define BGP neighbors. 10.10.10.11 is the IP address of the neighbor (Peer 2) and 200 is the neighbor's AS number.

Peer 2

`awplus#`	
`configure terminal`	Enter the Global Configuration mode
`awplus(config)#`	
`router bgp 200`	Define the routing process. The number 200 specifies the AS number of Peer 2.
`awplus(config-router)#`	
`neighbor 10.10.10.10 remote-as 200`	Define BGP neighbors. 10.10.10.10 is the IP address of the neighbor (Peer 1) and 200 is the neighbor's AS number.

Names of Commands Used

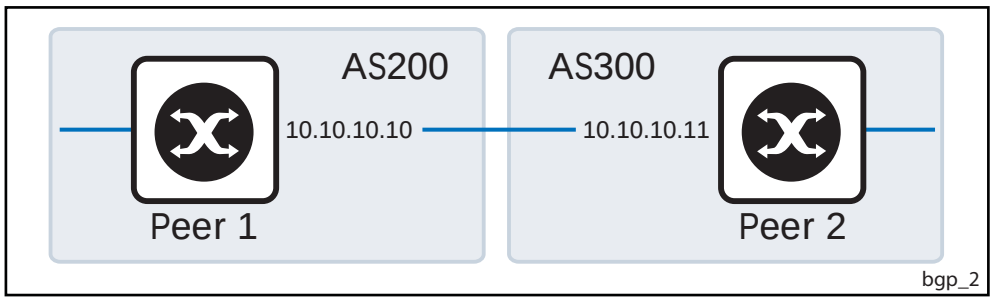
router bgp
neighbor remote-as

Validation Commands

show ip bgp summary
show ip bgp neighbors

Enabling BGP Between Different Autonomous Systems

This example shows the minimum configuration required for enabling BGP on an interface when the BGP peers belong to different Autonomous Systems (ASs). Peer 1 and Peer 2 are two BGP peers in different ASs, AS200 and AS300 connecting to network 10.10.10.0/24.



Peer 1

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router bgp 200`	Define the routing process. The number 200 specifies the AS number of Peer 1.
`awplus(config-router)#`	
`neighbor 10.10.10.11 remote-as 300`	Define BGP neighbors. 10.10.10.11 is the IP address of the neighbor (Peer 2) and 300 is the neighbor's AS number.

Peer 2

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router bgp 300`	Define the routing process. The number 300 specifies the AS number of Peer 2.
`awplus(config-router)#`	
`neighbor 10.10.10.10 remote-as 200`	Define BGP neighbors. 10.10.10.10 is the IP address of the neighbor (Peer 1) and 200 is the neighbor's AS number.

Names of Commands Used

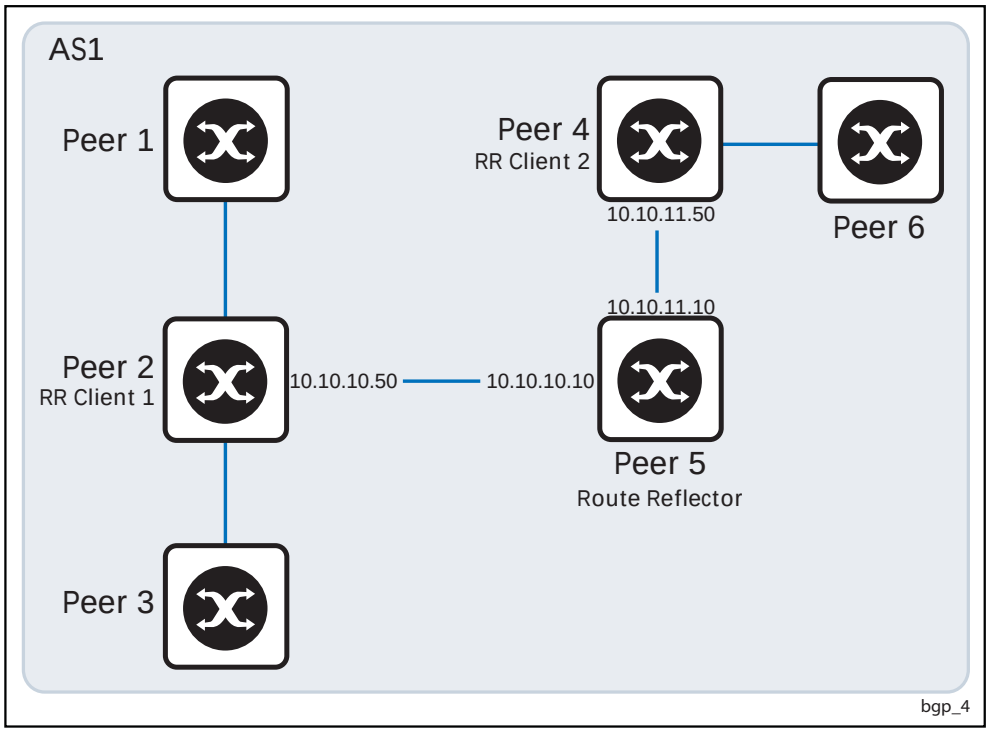
router bgp
neighbor remote-as

Validation Commands

show ip bgp summary
show ip bgp neighbors

Route Reflector

Use Route Reflector to reduce the iBGP mesh inside an AS. In this example, Peer 2, Peer 5 and Peer 4 would have to maintain a full mesh among themselves but by making Peer 5 the Route Reflector, Peer 2 (Client1) has an iBGP session with the Route Reflector only and not with Peer 4 (Client 2). The routes learned from Peer 2 are advertised to the other clients and to iBGP peers outside the cluster; the iBGP routes learned from iBGP peers outside the cluster are advertised to Peer 2. This reduces the iBGP peer connections in AS1.



Route Reflector (Peer 5)

`awplus#` `configure terminal`	Enter the Global Configuration mode.
`awplus(config)#` `router bgp 1`	Define the routing process. The number `1` specifies the AS number of Peer 5.
`awplus(config-router)#` `neighbor 10.10.10.50 remote-as 1`	Define BGP neighbors. `10.10.10.50` is the IP address of one of the neighbors (Peer 2) and `1` is the neighbor's AS number.
`awplus(config-router)#` `neighbor 10.10.10.50 route-reflector client`	Configure Peer 5 as the Route-Reflector (RR) and neighbor Peer 2 as its client.
`awplus(config-router)#` `neighbor 10.10.11.50 remote-as 1`	Define BGP neighbor. `10.10.11.50` is the IP address of one of the neighbors (Peer 4) and 1 is the neighbor's AS number.
`awplus(config-router)#` `neighbor 10.10.11.50 route-reflector client`	Configure Peer 5 as the Route-Reflector (RR) and neighbor Peer 4 as its client.

Route Reflector Client 1 (Peer 2)

`awplus(config)#`	
`router bgp 1`	Define the routing process. The number `1` specifies the AS number of Peer 2.
`awplus(config-router)#`	
`neighbor 10.10.10.10 remote-as 1`	Define BGP neighbors. `10.10.10.10` is the IP address of the neighbor (Peer 5) and `1` is the neighbor's AS number.

Route Reflector Client 2 (Peer 4)

`awplus(config)#`	
`router bgp 1`	Define the routing process. The number `1` specifies the AS number of Peer 4.
`awplus(config-router)#`	
`neighbor 10.10.11.10 remote-as 1`	Define BGP neighbors. `10.10.11.10` is the IP address of the neighbor (Peer 5) and `1` is the neighbor's AS number.

Names of Commands Used

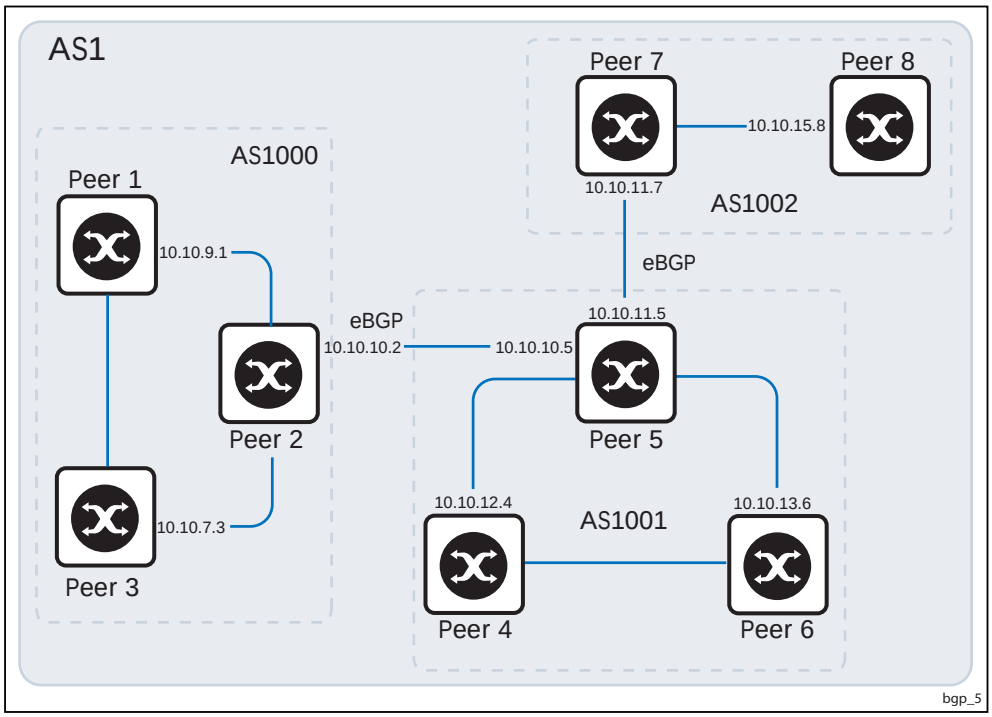
neighbor remote-as
neighbor route-reflector-client

Validation Commands

show ip bgp
show ip bgp neighbors

Confederations

In this example, AS1 contains three Confederation Autonomous Systems - AS 1000, AS 1001 and AS 1002. To any outside AS, the Confederation is a single AS. AS1 Confederation eBGP is run between Peer 2 and Peer 5, and between Peer 5 and Peer 7. Peer 2 is configured so that its local AS is 1000. Its peer connection to Peer 5 is set up like any other eBGP session. The bgp confederation identifier command on page 42.16 tells the peer that it is a member of a Confederation and the Confederation ID. The bgp confederation peers command on page 42.17 lists the member AS to which Peer 2 is connected. The command tells the BGP process that the eBGP connection is a Confederation eBGP rather than a normal eBGP.



Peer 2

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router bgp 1000`	Define the routing process. The number `1000` specifies the AS number of Peer 2.
`awplus(config-router)#`	
`bgp confederation identifier 1`	Specify BGP Confederation Identifier. To routers outside the confederation, the whole confederation will appear as a single AS, and the identifier will appear as its AS number.
`awplus(config-router)#`	
`bgp confederation peers 1001 1002`	Specify `1001` (AS1001) and `1002` (AS1002) to become members of the Confederation.

Peer 2(cont.)

```
awplus(config-router)#
neighbor 10.10.10.5 remote-as 1001
awplus(config-router)#
neighbor 10.10.9.1 remote-as 1000
awplus(config-router)#
neighbor 10.10.7.3 remote-as 1000
```

Define BGP neighbors for Peer 2 by specifying the IP addresses and the AS numbers of neighbors.

Peer 5

```
awplus(config)#
router bgp 1001
```

Define the routing process. The number `1001` specifies the AS number of Peer 5.

```
awplus(config-router)#
bgp confederation identifier 1
```

Specify BGP Confederation Identifier. To routers outside the confederation, the whole confederation will appear as a single AS, and the identifier will appear as its AS number.

```
awplus(config-router)#
bgp confederation peers 1000 1002
```

Specify `1000` (AS1000) and `1002` (AS1002) to become members of the Confederation.

```
awplus(config-router)#
neighbor 10.10.10.2 remote-as 1000
awplus(config-router)#
neighbor 10.10.11.7 remote-as 1002
awplus(config-router)#
neighbor 10.10.13.6 remote-as 1001
awplus(config-router)#
neighbor 10.10.12.4 remote-as 1001
```

Define BGP neighbors for Peer 5 by specifying the IP addresses and the AS numbers of neighbors.

Peer 7

```
awplus(config)#
router bgp 1002
```

Define the routing process. The number `1001` specifies the AS number of Peer 5.

```
awplus(config-router)#
bgp confederation identifier 1
```

Specify BGP Confederation Identifier. To routers outside the confederation, the whole confederation will appear as a single AS, and the identifier will appear as its AS number.

```
awplus(config-router)#
bgp confederation peers 1000 1001
```

Specify `1000` (AS1000) and `1001` (AS1001) to become members of the Confederation.

```
awplus(config-router)#
neighbor 10.10.11.5 remote-as 1001
awplus(config-router)#
neighbor 10.10.15.8 remote-as 1002
```

Define BGP neighbors for Peer 7 by specifying the IP addresses and the AS numbers of neighbors.

Names of Commands Used

neighbor remote-as
bgp confederation peers
bgp confederation identifier

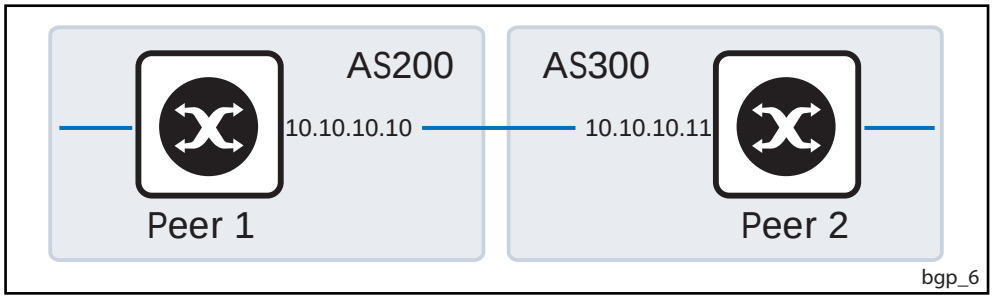
Validation Commands

show ip bgp
show ip bgp neighbors

BGP Authentication

BGP authentication allows users to receive selected routing information, enhancing security of their network traffic. When BGP authentication is enabled on a peer, the peer verifies routing packet it receives by exchanging a password that is configured on both the sending and the receiving peers.

In this example, both Peer 1 and Peer 2 have `manager` as the password.
Configure the same password on all routers that are to communicate using BGP in a network.



Peer 1

`awplus(config)#` `configure terminal`	Enter the Global Configuration mode.
`awplus(config-router)#` `router bgp 200`	Define the routing process. The number `200` specifies the AS number of Peer 1.
`awplus(config-router)#` `neighbor 10.10.10.11 remote-as 200`	Define BGP neighbors and establish a TCP session. `10.10.10.11` is the IP address of the neighbor (Peer 2) and `200` is the neighbor's AS number.
`awplus(config-router)#` `neighbor 10.10.10.11 password 1 manager`	Specify the encryption type and the password.

Peer 2

`awplus(config)#` `configure terminal`	Enter the Global Configuration mode.
`awplus(config-router)#` `router bgp 200`	Define the routing process. The number `200` specifies the AS number of Peer 2.
`awplus(config-router)#` `neighbor 10.10.10.10 remote-as 200`	Define BGP neighbors and establish a TCP session. `10.10.10.10` is the IP address of the neighbor (Peer 1) and `200` is the neighbor's AS number.
`awplus(config-router)#` `neighbor 10.10.10.10 password 1 manager`	Specify the encryption type and the password.

Names of Commands Used

neighbor remote-as
neighbor password

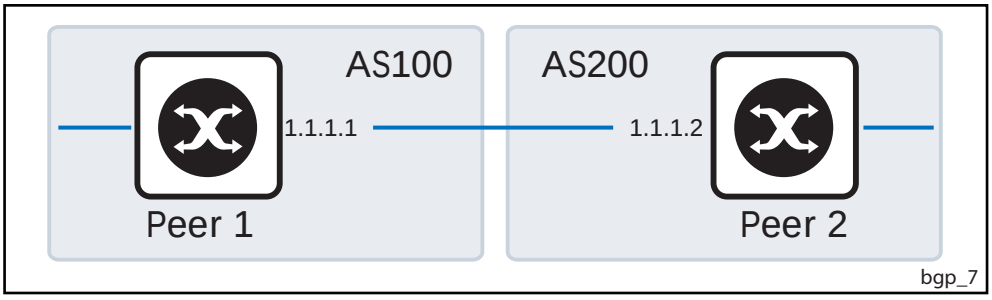
Validation Commands

show ip bgp
show ip bgp neighbors

Configuring BGP Graceful Reset

The graceful restart feature for BGP session reset is used so that any changes in network configuration do not affect packet forwarding. The bgp graceful-restart graceful-reset command on page 42.27 invokes graceful restart only when a configuration change forces a peer reset.

This example shows configuring BGP graceful reset.



Peer 1

`awplus(config)#` `configure terminal`	Enter the Global Configuration mode.
`awplus(config-router)#` `router bgp 100`	Define the routing process. The number `100` specifies the AS number of Peer 1.
`awplus(config-router)#` `bgp graceful-restart`	Enable BGP graceful restart support.
`awplus(config-router)#` `bgp graceful-restart graceful-reset`	Configure to invoke graceful restart when a configuration change forces a peer reset.
`awplus(config-router)#` `neighbor 1.1.1.2 remote-as 200`	Specify the neighbor's IP address (1.1.1.2) and the AS number of the neighbor (200).
`awplus(config-router)#` `neighbor 1.1.1.2 capability graceful-restart`	Specify the neighbor's IP address (1.1.1.2) for which the graceful restart capability is supported.

Peer 2

`awplus(config)#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config-router)#`	
`router bgp 200`	Define the routing process. The number `200` specifies the AS number of Peer 2.
`awplus(config-router)#`	
`bgp graceful-restart`	Enable BGP graceful restart support.
`awplus(config-router)#`	
`bgp graceful-restart graceful-reset`	Configure to invoke graceful restart when a configuration change forces a peer reset.
`awplus(config-router)#`	
`neighbor 1.1.1.1 remote-as 100`	Specify the neighbor's IP address (1.1.1.1) and the AS number of the neighbor (100).
`awplus(config-router)#`	
`neighbor 1.1.1.1 capability graceful-restart`	Specify the neighbor's IP address (1.1.1.1) for which the graceful restart capability is supported

Names of Commands Used

bgp graceful-restart
bgp graceful-restart graceful-reset
neighbor capability graceful-restart
neighbor remote-as
neighbor restart-time
router bgp

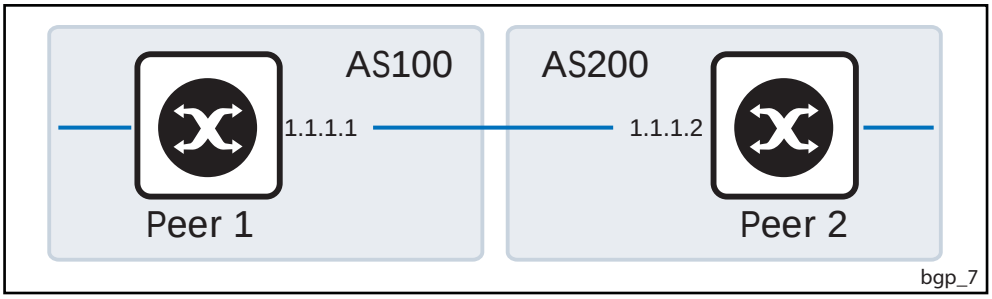
Validation Commands

show ip bgp
show ip bgp neighbors
show ip bgp summary
show ip route
show ip route database

Configuring BGP Graceful Restart

Using BGP graceful restart, the data forwarding plane of the device can continue to process and forward packets even if the control plane, which is responsible for determining best paths, fails. The bgp graceful-restart command on page 42.26 sets the maximum time that a graceful-restart neighbor waits to come back up after a restart. This value is applied to all neighbors unless you explicitly override it by configuring the corresponding value on the neighbor.

This example shows configuring BGP graceful restart.



Peer 1

`awplus(config)#` `configure terminal`	Enter the Global Configuration mode.
`awplus(config-router)#` `router bgp 100`	Define the routing process. The number `100` specifies the AS number of Peer 1.
`awplus(config-router)#` `bgp graceful-restart restart-time 180`	Configure the maximum time in seconds (180) required for neighbor(s) to restart.
`awplus(config-router)#` `bgp graceful-restart stalepath-time 150`	Configure the maximum time in seconds (150) to retain stale paths from the restarting neighbor(s).
`awplus(config-router)#` `bgp update-delay 120`	Configure the maximum time in seconds (120) to defer initial route selection.
`awplus(config-router)#` `neighbor 1.1.1.2 remote-as 200`	Specify the neighbor's IP address (1.1.1.2) and the AS number of the neighbor (200).
`awplus(config-router)#` `neighbor 1.1.1.2 capability graceful-restart`	Specify the neighbor's IP address (1.1.1.2) for which the graceful restart capability is supported.

Peer 2

`awplus(config)#` `configure terminal`	Enter the Global Configuration mode.
`awplus(config-router)#` `router bgp 200`	Define the routing process. The number `200` specifies the AS number of Peer 2.
`awplus(config-router)#` `bgp graceful-restart`	Enable BGP graceful restart support. If the restart and stale-path timers are not configured, the defaults are 90 seconds and 360 seconds, respectively.
`awplus(config-router)#` `neighbor 1.1.1.1 remote-as 100`	Specify the neighbor's IP address (1.1.1.1) and the AS number of the neighbor (100).
`awplus(config-router)#` `neighbor 1.1.1.1 capability graceful-restart`	Specify the neighbor's IP address (1.1.1.1) for which the graceful restart capability is supported
`awplus(config-router)#` `neighbor 1.1.1.1 restart-time 160`	Configure the maximum time in seconds (160) required for the neighbor to restart. This overwrites the configured restart time for that neighbor. For example: the above configured restart-time for all neighbors is 90 seconds (the default). With this command, the neighbor, 1.1.1.1, will have a 160 second restart-time.

Names of Commands Used

bgp graceful-restart
bgp graceful-restart graceful-reset
bgp update-delay
neighbor capability graceful-restart
neighbor remote-as
neighbor restart-time
router bgp

Validation Commands

show ip bgp
show ip bgp neighbors
show ip bgp summary
show ip route
show ip route database

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Introduction

This chapter provides an alphabetical reference of commands used to configure the Border Gateway Protocol (BGP). For more information about BGP on the switch, see Chapter 41, BGP Configuration.

For some features in this chapter, the syntax or operation may differ between products:

x900 indicates that the following text applies to x900-24XS, x900-24XT, x900-12XS switches.

SBx908 indicates that the following text applies to SwitchBlade x908 switches.

Command List

address-family ipv4 (BGP)

This command enters the IPv4 Address-Family Configuration command mode. In this mode you can configure address-family specific parameters. When using VRF-Lite, you can enter Address Family Configuration mode for a specified VRF instance before configuring that instance.

Syntax

```
address-family ipv4 [unicast|vrf <vrf-name>]
no address-family ipv4 [unicast|vrf <vrf-name>]
```

Parameter	Description
`ipv4`	Configure parameters relating to the BGP exchange of IPv4 prefixes.
`unicast`	Configure parameters relating to the BGP exchange of routes to unicast destinations.
`vrf`	Applies the command to the specified VRF instance.
`<vrf-name>`	The name of the VRF instance to enter IPv4 Address-Family mode for.

Mode Router Configuration or Address Family Configuration mode for a VRF instance

Usage To leave the Address Family Configuration mode and return to Router Configuration mode, use the exit-address-family (BGP) command.

Example

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# neighbor 192.168.0.1 interface
port1.0.2
awplus(config-router)# address-family ipv4 vrf green
awplus(config-router-af)# neighbor 192.168.0.1 activate
awplus(config-router-af)# exit-address-family
awplus(config-router)#
```

Related Commands exit-address-family (BGP)

aggregate-address (BGP)

This command adds an aggregate route that can be advertised to BGP neighbors. This command creates an aggregate entry in the BGP routing table if the switch learns, by any means, any routes that are within the range configured by the aggregate address/mask.

The no variant of this command removes the aggregate configured by the aggregate-address command.

Syntax

```
aggregate-address <ipaddr/m> {summary-only|as-set}
no aggregate-address <ipaddr/m> {summary-only|as-set}
```

Parameter	Description
`<ipaddr/m>`	Specifies the aggregate IPv4 address and mask.
`summary-only`	Filters more specific routes from updates. Only the aggregate address/mask will be advertised, and none of the component addresses that fall within the range of the aggregate address/mask.
`as-set`	Generates AS set path information. The AS-path advertised with the aggregate is an unordered list of all the AS-numbers that appear in any of the AS-paths of the component routes, with each AS-number appearing just once in the list.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage If the `summary-only` parameter is specified, then only the aggregate address/mask will be advertised, and none of the component addresses that fall within the range of the aggregate address/mask. For example, if you configure:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# aggregate-address 172.0.0.0/8 summary-only
```

then the switch will advertise the prefix `172.0.0.0/8`, but no component routes like `172.10.0.0/16`

The `as-set` parameter controls the AS-path attribute that is advertised with the aggregate route. If the switch has learnt multiple routes that are within the range of the aggregate address/mask, and the AS-paths associated with those routes contain different sets of AS-numbers, then it is not possible to create a single AS-path that accurately represents the AS-paths of all those component routes. In this case, the switch will, by default, advertise a NULL AS-path with the aggregate.

Example

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# aggregate-address 192.0.0.0/8 as-set
summary-only
```

Related Commands match as-path

auto-summary

Use this command to enable sending summarized routes by a BGP speaker to its peers in the Router Configuration mode or in the Address-Family Configuration mode. BGP uses auto-summary to advertise summarized routes.

Use the no variant of this command to disable BGP auto-summary.

Syntax

```
auto-summary
no auto-summary
```

Default The auto-summary function is disabled by default.

Mode Router Configuration and Address Family IPv4 mode

Usage If certain routes have already been advertised, enabling auto-summary results in non-summarized routes being withdrawn and only summarized routes are advertised. Summarized routes are advertised before non-summarized routes are withdrawn from all connected peers.

If certain routes have already been advertised, disabling auto-summary results in summarized routes being withdrawn and only non-summarized routes are advertised. Non-summarized routes are advertised before summarized routes are withdrawn from all connected peers.

Examples The following example enables auto-summary in Router Configuration mode:

```
awplus# configure
awplus(config)# router bgp 100
awplus(config-router)# auto-summary
```

The following example disables auto-summary in Router Configuration mode:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# no auto-summary
```

The following example enables auto-summary in Address Family IPv4 mode:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# address-family ipv4
awplus(config-router-af)# auto-summary
```

The following example disables auto-summary in Address Family IPv4 mode:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# address-family ipv4
awplus(config-router-af)# no auto-summary
```

bgp aggregate-nexthop-check

This command affects the operation of the summary-only option on the aggregate-address command.

This command enables a mode whereby the summary-only option will only suppress the component routes if those component routes all have the same nexthop. If the routes have different nexthops, then they will continue to be advertised to peers even if the summary-only option is configured. By default this is disabled.

The no variant of this command disables this function.

Syntax

```
bgp aggregate-nexthop-check
no bgp aggregate-nexthop-check
```

Default Disabled by default.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# bgp aggregate-nexthop-check
```

bgp always-compare-med

This command enables BGP to compare the Multi Exit Discriminator (MED) for paths from neighbors in different autonomous systems.

Multi Exit Discriminator (MED) is used in best path selection by BGP. MED is compared after BGP attributes weight, local preference, AS-path and origin have been compared and are equal.

By default, MED comparison is done only among routes from the same autonomous system (AS). Use the bgp always-compare-mode command to allow comparison of MEDs from different ASs.

A path with a lower MED value is preferred. For example, if the bgp table contains the following entries, and the bgp always-compare-med command has been issued to enable this feature:

```
Route1: as-path 400, med 300
Route2: as-path 200, med 200
Route3: as-path 400, med 250
```

Route1 is compared to Route2. Route2 is best of the two (lower MED). Next, Route2 is compared to Route3 and Route2 is chosen best path again (lower MED). If always-compare-med was disabled, MED is not taken into account when Route1 and Route2 are compared, because of different ASs and MED is compared for only Route1 and Route3. In this case, Route3 would be the best path. The selected route is also affected by the bgp deterministic-med command. See the bgp deterministic-med command on page 42.23 for details.

If this command is used to compare MEDs for all paths, it should be configured on every BGP router in the AS.

The no variant of this command disallows the comparison.

Syntax

```
bgp always-compare-med
no bgp always-compare-med
```

Default By default this feature is disabled.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp always-compare-med
```

Related Commands

bgp bestpath med
bgp bestpath as-path ignore
bgp bestpath compare-routerid
bgp deterministic-med

bgp bestpath as-path ignore

This command prevents the router from considering as-path as a factor in the algorithm for choosing a route.

The no variant of this command allows the router to consider as-path in choosing a route.

Syntax

```
bgp bestpath as-path ignore
no bgp bestpath as-path ignore
```

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp bestpath as-path ignore
```

Related Commands bgp always-compare-med
bgp bestpath med
bgp bestpath compare-routerid

bgp bestpath compare-confed-aspath

This command specifies that the AS confederation path length must be used, when available, in the BGP best path decision process. It is effective only when bgp bestpath as-path ignore command has not been specified.

By default, if BGP receives routes with identical eBGP paths from eBGP peers, BGP does not continue to consider any AS confederation path length attributes that may be associated with the routes.

The no variant of this command returns the switch to the default state, where the switch ignores AS confederation path length in the BGP best path selection process.

Syntax

```
bgp bestpath compare-confed-aspath
no bgp bestpath compare-confed-aspath
```

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp bestpath compare-confed-aspath
```

Related Commands bgp bestpath as-path ignore

bgp bestpath compare-routerid

By default, when comparing similar routes from peers, BGP does not consider the router ID of neighbors advertising the routes - BGP simply selects the first received route. Use the bgp bestpath compare-routerid command to include router ID in the selection process; similar routes are compared and the route with the lowest router ID is selected.

The no variant of this command disables this feature, and returns the switch to the default state, where the switch ignores the router ID in the BGP best path selection process.

Syntax

```
bgp bestpath compare-routerid

no bgp bestpath compare-routerid
```

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp bestpath compare-routerid
```

Related Commands show ip bgp
show ip bgp neighbors

bgp bestpath med

This command controls how the Multi Exit Discriminator (MED) attribute comparison is performed.

Use the no variant of this command to prevent BGP from considering the MED attribute when comparing paths.

Syntax

```
bgp bestpath med {[confed] [missing-as-worst]}
```

Parameter	Description
confed	Compares MED among confederation paths.
missing-as-worst	Treats missing MED as the least preferred one.

Mode Router Configuration

Usage The confed parameter enables MED comparison among paths learned from confederation peers. The MED attributes are compared only if there is no external AS (Autonomous System), where an external AS is one that is not within the confederation. If there is an external AS in the path, then the MED comparison is not made.

For example, in the following paths the MED value is not compared with `Path3` since it is not in the confederation. MED is compared for `Path1` and `Path2` only.

```
Path1 = 32000 32004, med=4
Path2 = 32001 32004, med=2
Path3 = 32003 1, med=1
```

The effect of the missing-as-worst parameter is to treat a missing MED attribute in a path as having a value of infinity, making the path without a MED value the least desirable path. If the missing-as-worst parameter is not configured, the missing MED attribute is assigned the value of 0, making the path with the missing MED attribute the best path.

Examples

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp bestpath med missing-as-worst
```

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp bestpath med confed
```

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp bestpath med confed missing-as-worst
```

Related Commands

bgp always-compare-med
bgp bestpath as-path ignore
bgp deterministic-med

bgp bestpath med remove-recv-med

This command removes the Multi Exit Discriminator (MED) attribute from the update messages received by the BGP speaker from its peers. However, the local BGP speaker will send MED attributes in the update messages to its peers, unless specified not to by the bgp bestpath med remove-send-med command.

Use the no variant of this command to disable this feature.

Syntax

```
bgp bestpath med remove-recv-med
no bgp bestpath med remove-recv-med
```

Mode Router Configuration

Example To enable the remove-recv-med feature on the BGP speaker belonging to the Autonomous System (AS) 100, enter the command:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp bestpath med remove-recv-med
```

Related Commands bgp bestpath med remove-send-med

bgp bestpath med remove-send-med

This command removes the Multi Exit Discriminator (MED) attribute from the update messages sent by the BGP speaker to its peers. However, the local BGP speaker will consider the MED attribute received from other peers during the decision and route selection process, unless specified not to by the bgp bestpath med remove-recv-med command.

Use the no variant of this command to disable this feature.

Syntax

```
bgp bestpath med remove-send-med
no bgp bestpath med remove-send-med
```

Mode Router Configuration

Example To enable the remove-send-med feature on the BGP speaker belonging to the Autonomous System (AS) 100, enter the command:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp bestpath med remove-send-med
```

Related Commands bgp bestpath med remove-recv-med

bgp client-to-client reflection

This command restores route reflection from a BGP route reflector to clients.

The bgp client-to-client reflection command is used to configure routers as route reflectors. Route reflectors are used when all Interior Border Gateway Protocol (iBGP) speakers are not fully meshed. If the clients are fully meshed the route reflector is not required, use the no variant of this command to disable the client-to-client route reflection.

When a router is configured as a route reflector, client-to-client reflection is enabled by default.

The no variant of this command turns off client-to-client reflection.

Syntax

```
bgp client-to-client reflection
no bgp client-to-client reflection
```

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# no bgp client-to-client reflection
```

Related Commands

bgp cluster-id
neighbor route-reflector-client
show ip bgp

bgp cluster-id

This command configures the cluster-id if the BGP cluster has more than one route reflector. A cluster includes one or more route reflectors and their clients. Usually, each cluster is identified by the router-id of its single route reflector. However, to increase redundancy, a cluster may sometimes have more than one route reflector. All router reflectors in such a cluster are then identified by a cluster-id.

The bgp cluster-id command is used to configure the 4 byte cluster ID for clusters with more than one route reflector.

The no variant of this command removes the cluster ID.

Syntax

```
bgp cluster-id {<ip-address>|<cluster-id>}
no bgp cluster-id
```

Parameter	Description	
<cluster-id>	<1-4294967295>	Route Reflector cluster-id as a 32 bit quantity.
<ip-address>	*A.B.C.D*	Route Reflector Cluster-id in IP address format.

Mode Router Configuration

Usage The following configuration creates `cluster-id 5` including two route-reflector-clients.

```
awplus(config)# router bgp 200
awplus(config-router)# neighbor 2.2.2.2 remote-as 200
awplus(config-router)# neighbor 3.3.3.3 remote-as 200
awplus(config-router)# neighbor 3.3.3.3 route-reflector-client
awplus(config-router)# neighbor 5.5.5.5 remote-as 200
awplus(config-router)# neighbor 5.5.5.5 route-reflector-client
awplus(config-router)# neighbor 6.6.6.6 remote-as 200
awplus(config-router)# bgp cluster-id 5
```

Examples To add a bgp cluster-id, apply the example commands as shown below:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp cluster-id 10.10.1.1
```

To remove a bgp cluster-id apply the example commands as shown below:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# no bgp cluster-id 10.10.1.1
```

Related Commands

bgp client-to-client reflection
neighbor route-reflector-client
show ip bgp

bgp confederation identifier

This command specifies a BGP confederation identifier.

The no variant of this command removes all BGP confederation identifiers.

Syntax

```
bgp confederation identifier <1-4294967295>
no bgp confederation identifier
```

Parameter	Description
<1-4294967295>	Set routing domain confederation AS number.

Mode

Router Configuration

Examples

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp confederation identifier 1
```

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# no bgp confederation identifier
```

Related Commands

bgp confederation peers

bgp confederation peers

This command configures the Autonomous Systems (AS) that belong to the same confederation as the current switch.

A confederation allows an AS to be divided into several sub-ASs. The overall AS is given a confederation identifier. External routers view only the whole confederation as one AS, whose AS number is the confederation identifier. Each sub-AS is fully meshed within itself and is visible internally to the confederation.

Use the bgp confederation peer command to define the list of AS numbers of the sub-ASs in the confederation containing the current switch.

The no variant of this command removes an autonomous system from the confederation.

Syntax

```
bgp confederation peers <1-4294967295>
no bgp confederation peers <1-4294967295>
```

Parameter	Description
<1-4294967295>	AS numbers of eBGP peers that are under same confederation but in a different sub-AS.

Mode Router Configuration

Usage In the following configuration of Router 1 the neighbor `172.210.30.2` and `172.210.20.1` have iBGP connection within AS `100`. The neighbor `173.213.30.1` has an BGP connection, but it is within AS `200`, which is part of the same confederation. The neighbor `6.6.6.6` has an eBGP connection to external AS `500`.

In the configuration of Router 2, neighbor `5.5.5.4` has an eBGP connection to confederation `300`. `Router2` does not know about the ASs `100` and `200`, it only knows about confederation `300`.

Router 1

```
awplus(config)# router bgp 100
awplus(config-router)# bgp confederation identifier 300
awplus(config-router)# bgp confederation peers 200
awplus(config-router)# neighbor 172.210.30.2 remote-as 100
awplus(config-router)# neighbor 172.210.20.1 remote-as 100
awplus(config-router)# neighbor 173.213.30.1 remote-as 200
awplus(config-router)# neighbor 6.6.6.6 remote-as 300
```

Router 2

```
awplus(config)# router bgp 500
awplus(config-router)# neighbor 5.5.5.4 remote-as 300
```

Example

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp confederation peers 1234
```

Related Commands bgp confederation identifier

bgp config-type

Use this command to set the BGP configuration type to either standard or enhanced types.

Use the no variant of this command to restore the default BGP configuration type (enhanced).

Syntax

```
bgp config-type {standard|enhanced}
no bgp config-type
```

Parameter	Description
`standard`	Specifies the industry standard style configuration. After setting the configuration to standard, make sure to use the neighbor send-community command to send out BGP community attributes. The no synchronization command is always shown in the configuration.
`enhanced`	Specifies the enhanced style configuration. The enhanced configuration type requires no specific configuration for sending out BGP standard community and extended community attributes. The no synchronization command is enabled by default in Global Configuration mode and not shown in configuration output.

Default By default, the BGP configuration type is enhanced.

Mode Global Configuration

Example To specify the `standard` BGP configuration type, enter the following commands:

```
awplus# configure terminal
awplus(config)# bgp config-type standard
```

To specify the `enhanced` BGP configuration type, enter the following commands::

```
awplus# configure terminal
awplus(config)# bgp config-type enhanced
```

To restore the default BGP configuration type (`enhanced`), enter the following commands:

```
awplus# configure terminal
awplus(config)# no bgp config-type
```

Related Commands neighbor send-community

bgp dampening

This command enables BGP dampening and sets BGP dampening parameters.

Route dampening minimizes the instability caused by route flapping. A penalty is added for every flap in a flapping route. As soon as the total penalty reaches the suppress limit the advertisement of the route is suppressed. This penalty is decayed according to the configured half time value. Once the penalty is lower than the reuse limit, the route advertisement is un-suppressed.

The dampening information is purged from the router once the penalty becomes less than half of the reuse limit.

The no variant of this command disables BGP dampening or unsets the BGP dampening parameters.

Syntax

```
bgp dampening

no bgp dampening

bgp dampening <reachtime>

no bgp dampening <reachtime>

bgp dampening <reachtime> <reuse> <suppress> <maxsuppress>
    <unreachtime>

no bgp dampening <reachtime> <reuse> <suppress> <maxsuppress>
    <unreachtime>

bgp dampening route-map <routemap-name>

no bgp dampening route-map <routemap-name>
```

Parameter	Description
<reachtime>	<1-45> Specifies the reachability half-life time in minutes. The time for the penalty to decrease to one-half of its current value. The default is 15 minutes.
<reuse>	<1-20000> Specifies the reuse limit value. When the penalty for a suppressed route decays below the reuse value, the routes become unsuppressed. The default reuse limit is 750
<suppress>	<1-20000> Specifies the suppress limit value. When the penalty for a route exceeds the suppress value, the route is suppressed. The default suppress limit is 2000.
<maxsuppress>	<1-255> Specifies the max-suppress-time. Maximum time that a dampened route is suppressed. The default max-suppress value is 4 times the half-life time (60 minutes).
<unreachtime>	<1-45> Specifies the un-reachability half-life time for penalty, in minutes.
route-map	Route-map to specify criteria for dampening.
<routemap-name>	Specify the name of the route-map.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router bgp 11
awplus(config-router)# bgp dampening 20 800 2500 80 25
```

bgp default ipv4-unicast

This command configures BGP defaults and activates IPv4-unicast for a peer by default. This affects the BGP global configuration.

The no variant of this command disables this function. The BGP routing process will no longer exchange IPv4 addressing information with BGP neighbor routers.

Syntax

```
bgp default ipv4-unicast
no bgp default ipv4-unicast
```

Default This is enabled by default.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp default ipv4-unicast
```

bgp default local-preference

This command changes the default local preference value.

The local preference indicates the preferred path when there are multiple paths to the same destination. The path with the higher preference is preferred.

Use this command to define the default local preference value that the switch will advertise for the routes it sends. The preference is sent to all routers and access servers in the local autonomous system.

The no variant of this command reverts to the default local preference value of 100.

Syntax

```
bgp default local-preference <pref-value>
no bgp default local-preference [<pref-value>]
```

Parameter	Description
<pref-value>	<0-4294967295> Configure default local preference value. The default local preference value is 100.

Default By default the local-preference value is 100.

Mode Router Configuration

Examples

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp default local-preference 2345555

awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# no bgp default local-preference
```

bgp deterministic-med

Use this command to allow or disallow the switch to compare the Multi Exit Discriminator (MED) variable when choosing among routes advertised by different peers in the same autonomous system (AS).

Use the bgp deterministic-med command to enable this feature to allow the comparison of MED variables when choosing among routes advertised by different peers in the same AS.

Use the no variant of this command to disable this feature to disallow the comparison of the MED variable when choosing among routes advertised by different peers in the same AS.

Syntax

```
bgp deterministic-med
no bgp deterministic-med
```

Default Disabled by default

Mode Router Configuration

Usage When the bgp deterministic-med command is enabled, routes from the same AS are grouped together and ordered according to their MED values, and the best routes of each group are compared.

The main benefit of this is that the choice of best route then does not depend on the order in which the routes happened to be received, which is rather random and arbitrary.

To see how this works, consider the following set of bgp table entries, all for the same route:

```
1: ASPATH 234, MED 120, internal, IGP metric to NEXT_HOP 40
2: ASPATH 389, MED 190, internal, IGP metric to NEXT_HOP 35
3: ASPATH 234, MED 245, external
```

If bgp deterministic-med is not enabled, then entry `3:` will be chosen, because it is an external route.

But if BGP deterministic-MED is enabled, the entries will be grouped as follows:

```
Group 1:  1: ASPATH 234, MED 120, internal, IGP metric to NEXT_HOP 40
          3: ASPATH 234, MED 245, external
Group 2:  2: ASPATH 389, MED 190, internal, IGP metric to NEXT_HOP 35
```

Note Routes from the same AS are grouped together and ordered by MED.

Entry `1:` is chosen as the best route from `Group 1`, since this route has the lowest MED value. Entry 2 has to be the best route in `Group 2`, since this is the only route in that group. These two group winners are compared against each other, and Entry `2:` is chosen as the best route because Entry `2:` has the lower metric to next-hop.

All routers in an AS should have the same setting for BGP deterministic-MED. All routers in an AS should have BGP deterministic-MED enabled with bgp deterministic-med, or all routers in an AS should have BGP deterministic-MED disabled with no bgp-deterministic-med.

In the example above, the MED values were not considered when comparing the winners of the two groups (the best routes from the different ASs). To use MED in the comparison of routes from different ASs, use the bgp always-compare-med command on page 42.9.

Examples

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp deterministic-med
```

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# no bgp deterministic-med
```

Related Commands

show ip bgp
show ip bgp neighbors

bgp enforce-first-as

Use this command to enforce the denying of eBGP updates in which the neighbor's AS number is not the first AS in the AS-path attribute.

Use the no variant of this command to disable this feature.

Syntax

```
bgp enforce-first-as
no bgp enforce-first-as
```

Mode

Router Configuration

Usage

This command specifies that any updates received from an external neighbor that do not have the neighbor's configured Autonomous System (AS) at the beginning of the AS_PATH in the received update must be denied. Enabling this feature adds to the security of the BGP network by not allowing traffic from unauthorized systems.

Example

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router# bgp enforce-first-as
```

bgp fast-external-failover

Use this command to reset a BGP session immediately if the interface used for BGP connection goes down.

Use the no variant of this command to disable this feature.

Syntax

```
bgp fast-external-failover
no bgp fast-external-failover
```

Default Enabled

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp fast-external-failover
```

bgp graceful-restart

Use this command to enable BGP graceful-restart capabilities for restart and stalepath times.

Use the no variant of this command to restore restart timers to their default settings.

Syntax

```
bgp graceful-restart
   [restart-time <delay-value>|stalepath-time <delay-value>]

no bgp graceful-restart [restart-time|stalepath-time]
```

Parameter	Description
`restart-time`	The maximum time needed for neighbors to restart, in seconds. The default restart-time is 120 seconds.
`stalepath-time`	The maximum time to retain stale paths from restarting neighbors, in seconds. The default stalepath-time is 120 seconds.
`<delay-value>`	`<1-3600>` Maximum time in seconds. Default is 120 seconds.

Default The default BGP graceful restart time is 120 seconds without restart-time or stalepath-time parameters specified. The default restart-time and stalepath-times are also 120 seconds.

Mode Router Configuration

Usage This command is used to set the maximum time that a graceful-restart neighbor waits to come back up after a restart. This value is applied to all neighbors unless you explicitly override it by configuring the corresponding value on the neighbor.

The restart-time parameter is used for setting the maximum time that a graceful-restart neighbor waits to come back up after a restart. This restart-time value is applied to neighbors unless you explicitly override it by configuring the corresponding value on the neighbor.

The stalepath-time parameter is used to set the maximum time to preserve stale paths from a gracefully restarted neighbor. All stalepaths, unless reinstated by the neighbor after a re-establishment, will be deleted when time, as specified by the stalepath-time parameter, expires.

Examples

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# bgp graceful-restart 150
```

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# no bgp graceful-restart
```

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# bgp graceful-restart restart-time 150
```

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# no bgp graceful-restart restart-time 150
```

Related Commands bgp graceful-restart graceful-reset
neighbor capability graceful-restart
restart bgp graceful

bgp graceful-restart graceful-reset

This command enables BGP graceful-restart when a configuration change forces a peer restart.

Use the no variant of this command to restore the device to its default state.

Syntax

```
bgp graceful-restart graceful-reset
no bgp graceful-restart graceful-reset
```

Default By default this feature is disabled.

Mode Router Configuration

Usage The bgp graceful-restart command on page 42.26 must be enabled before this command is enabled. All events that cause BGP peer reset, including all session reset commands, can trigger graceful-restart.

Example To enable the graceful-restart graceful-reset feature on the BGP peer belonging to Autonomous System (AS) 10, use the commands:

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# bgp graceful-restart graceful-reset
```

To disable the graceful-restart graceful-reset feature on the BGP peer belonging to Autonomous System (AS) 10, use the commands:

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# no bgp graceful-restart graceful-reset
```

Related Commands bgp graceful-restart

bgp log-neighbor-changes

Use this command to enable logging of status change messages without turning on debug bgp commands.

Use the no variant of this command to disable this feature.

Syntax

```
bgp log-neighbor-changes
no bgp log-neighbor-changes
```

Default Disabled

Mode Router Configuration

Usage AlliedWare Plus™ provides other kinds of logging services for neighbor status, for example, debug bgp fsm, debug bgp events, etc. However, these commands create a significant hit in the logging performance. If you need to log neighbor status changes only, we recommend turning off all the debug commands, and then use this command.

To see BGP neighbor changes in the log you must also set the log level to informational using the log buffered (filter) command on page 10.9.

A sample output of this log is:

```
%Protocol-Severity-Events: Message-text
```

A sample output of the log for an `interface down` event is:

```
%BGP-5-ADJCHANGE: neighbor 10.10.0.24 Down Interface flap
```

The bgp log-neighbor-changes command logs the following events:

- BGP Notification Received
- Erroneous BGP Update Received
- User reset request
- Peer time-out
- Peer Closing down the session
- Interface flap
- Router ID changed
- Neighbor deleted
- Member added to peer group
- Administrative shutdown
- Remote AS changed
- RR client configuration modification
- Soft reconfiguration modification

Example To enable the logging of BGP status changes without using the debug bgp command:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp log-neighbor-changes
```

bgp memory maxallocation

This command allocates a maximum percentage of the RAM (Random Access Memory) available on the switch for BGP processes.

When this percentage is exceeded, BGP peering terminates and an out of resources error displays. The default setting for bgp memory maxallocation is 100% memory allocation.

Use the no variant of this command to reset memory allocation to the default.

Syntax

```
bgp memory maxallocation <1-100>
no bgp memory maxallocation
```

Parameter	Description
<1-100>	Percentage of switch memory allocated to BGP processes. Note this is RAM (Random Access Memory), not switch flash memory.

Default BGP processes are allocated the maximum percentage of 100% of the switch's available RAM memory by default. Note only non-default BGP memory allocation values are shown in the running or startup configuration files:

```
awplus#show running-config
!
bgp memory maxallocation 50
!
```

Mode Global Configuration

Examples To limit the maximum amount of memory used by BGP processes to 65% of the total RAM memory available on the switch, use the commands:

```
awplus# configure terminal
awplus(config)# bgp memory maxallocation 65
```

To return to the default 100% maximum RAM memory allocation available on the switch for BGP processes, use the commands:

```
awplus# configure terminal
awplus(config)# no bgp memory maxallocation
```

bgp multiple-instance

Use this command to enable or disable the BGP multiple-instance support.

Use the no variant of this command to disable this function.

Syntax

```
bgp multiple-instance [allow-same-peer]
no bgp multiple-instance [allow-same-peer]
```

Parameter	Description
allow-same-peer	Activate the same peer in multiple BGP views.

Default No multiple-instance support is enabled by default.

Mode Global Configuration

Example To enable BGP multiple-instance support, enter the following commands:

```
awplus# configure terminal
awplus(config)# bgp multiple-instance
```

To disable BGP multiple-instance support, enter the following commands:

```
awplus# configure terminal
awplus(config)# no bgp multiple-instance
```

To enable BGP multiple-instance support, and activate the same peer in multiple BGP views, enter the following commands:

```
awplus# configure terminal
awplus(config)# bgp multiple-instance allow-same-peer
```

bgp nexthop-trigger-count

Use this command to configure the display of BGP nexthop-tracking status.

Use the no variant of this command to disable this function.

Syntax

```
bgp nexthop-trigger-count <0-127>
no bgp nexthop-trigger-count
```

Parameter	Description
<0-127>	BGP nexthop-tracking status.

Mode Router Configuration

Example To enable nexthop-tracking status on the BGP peer belonging to the Autonomous System (AS) 100, enter the following commands:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp nexthop-trigger-count 10
```

To disable nexthop-tracking status, enter the following commands:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# no bgp nexthop-trigger-count
```

Related Commands

bgp nexthop-trigger delay
bgp nexthop-trigger enable
show bgp nexthop-tracking

bgp nexthop-trigger delay

Use this command to set the delay interval for nexthop address tracking.

Use the no variant of this command to reset the timer value to the default.

Syntax

```
bgp nexthop-trigger delay <1-100>

no bgp nexthop-trigger delay
```

Parameter	Description
<1-100>	Nexthop trigger delay interval in seconds.

Default The default nexthop delay interval is 5 seconds.

Mode Global Configuration

Usage This command configures the delay interval between routing table walks for nexthop delay tracking. The delay interval determines how long BGP waits after it receives the trigger from the system about one or more nexthop changes before it walks the full BGP table to determine which prefixes are affected by the nexthop changes.

Example To set the nexthop delay interval to 6 seconds, enter the command:

```
awplus# configure terminal
awplus(config)# bgp nexthop-trigger delay 6
```

Related Commands

bgp nexthop-trigger-count
bgp nexthop-trigger enable

bgp nexthop-trigger enable

Use this command to enable nexthop address tracking. If nexthop address tracking is enabled and a nexthop trigger delay interval has not been explicitly set with the bgp nexthop-trigger delay command on page 42.32, the default delay interval of 5 seconds is used.

Use the no variant of this command to disable this feature.

Syntax

```
bgp nexthop-trigger enable

no bgp nexthop-trigger enable
```

Default By default this feature is disabled.

Mode Global Configuration

Usage Nexthop address tracking is an event driven notification system that monitors the status of routes installed in the Routing Information Base (RIB) and reports nexthop changes that affect internal BGP (iBGP) or external BGP (eBGP) prefixes directly to the BGP process. This improves the overall BGP convergence time, by allowing BGP to respond rapidly to nexthop changes for routes installed in the RIB.

If nexthop tracking is enabled after certain routes are learnt, the registration of all the nexthops of selected BGP routes are done immediately after the nexthop tracking feature is enabled.

If nexthop tracking is disabled, and if there are still some selected BGP routes, BGP deregisters the nexthops of all of the selected BGP routes from the system.

If nexthop tracking is disabled when nexthop tracking is in the process of execution, an error appears, and nexthop tracking is not disabled. However, if the nexthop tracking timer is running at the time of negation, the nexthop tracking timer is stopped, and nexthop tracking is disabled.

Example To enable nexthop address tracking, enter the command:

```
awplus# configure terminal
awplus(config)# bgp nexthop-trigger enable
```

Related Commands

bgp nexthop-trigger-count
bgp nexthop-trigger delay
show bgp nexthop-tracking

bgp rfc1771-path-select

Use this command to set the RFC1771 compatible path selection mechanism.

Use the no variant of this command to revert this setting.

Syntax

```
bgp rfc1771-path-select
no bgp rfc1771-path-select
```

Default Industry standard compatible path selection mechanism.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# bgp rfc1771-path-select
```

bgp rfc1771-strict

Use this command to set the Strict RFC1771 setting.

Use the no variant of this command to revert this setting.

Syntax

```
bgp rfc1771-strict
no bgp rfc1771-strict
```

Default Disabled

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# bgp rfc1771-strict
```

bgp router-id

Use this command to configure the router identifier. The IP address specified in this command does not have to be an IP address that is configured on any of the interfaces on the switch.

Use the no variant of this command to return the router-id to its default value (as described in **Default** below).

Syntax

```
bgp router-id <routerid>
no bgp router-id [<routerid>]
```

Parameter	Description
<routerid>	A.B.C.D Specifies the IP address without mask for a manually configured router ID.

Default If the local loopback interface (lo) is configured the router-id is set to the IP address of this interface. If not, the highest IP address is the router-id.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Use the bgp router-id command to manually configure a fixed router ID as a BGP router identifier. The router-id configured using this command takes precedence over all other router-id sources

Examples To configure a router ID with an IP address for a BGP router identifier, enter the commands listed below:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp router-id 1.1.2.3
```

To disable the router ID for a BGP router identifier enter the commands listed below:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# no bgp router-id
```

bgp scan-time

Use this command to set the interval for BGP route next-hop scanning.

Use the no variant of this command to disable this function.

Syntax

```
bgp scan-time <time>
no bgp scan-time [<time>]
```

Parameter	Description
<time>	<0-60> Scanning interval in seconds.

Default The default scanning interval is 60 seconds.

Mode Router Configuration

Usage Use this command to configure scanning intervals of BGP routers. This interval is the period after which router checks the validity of the routes in its database.

To disable BGP scanning, set the scan time interval to 0 seconds.

Example

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# bgp scan-time 10
```

bgp update-delay

Use this command to specify the update-delay value for a graceful-restart capable router.

Use the no variant of this command to revert to the default update-delay value.

Syntax

```
bgp update-delay <1-3600>
no bgp update-delay [<1-3600>]
```

Parameter	Description
<1-3600>	Delay value in seconds.

Default The default update-delay value is 120 seconds.

Mode Router Configuration

Usage The update-delay value is the maximum time a graceful-restart capable router which is restarting will defer route-selection and advertisements to all its graceful-restart capable neighbors. This maximum time starts from the instance the first neighbor attains established state after restart. The restarting router prematurely terminates this timer when end-of-rib markers are received from all its graceful-restart capable neighbors.

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# bgp update-delay 345
```

clear bgp *

Use this command to reset the BGP connection for all peers.

Syntax

```
clear bgp *
clear bgp * in [prefix-filter]
clear bgp * out
clear bgp * soft [in|out]
```

Parameter	Description
*	Clears all BGP peers.
in	Indicates that incoming advertised routes will be cleared.
prefix-filter	Specifies that a prefix-list will be sent, by the ORF mechanism, to those neighbors with which the ORF capability has been negotiated. The neighbors will be triggered to resend updates, which match the prefix-list filter, to the local router. The local router will then perform a soft reconfiguration.
out	Indicates that outgoing advertised routes will be cleared.
soft in	Soft inbound reset causes the neighbors to resend all their updates to the local switch, without resetting the connection or clearing the entries in the local switch. So, the local switch stores new updates, and uses them to systematically replace existing table entries. This process can use a considerable amount of memory.
soft out	Soft outbound reset causes the switch to simply resend all its updates to the specified neighbor(s), without resetting the connection, or clearing table entries.

Mode Privileged Exec

Examples

```
awplus# clear bgp * soft in
awplus# clear bgp * in prefix-filter
```

clear bgp (ip address)

Use this command to reset the BGP connection for specified peers.

Syntax

```
clear bgp <ip-address>
clear bgp <ip-address> in [prefix-filter]
clear bgp <ip-address> out
clear bgp <ip-address> soft [in|out]
```

Parameter	Description
<ip-address>	Specifies the IPv4 address of the neighbor whose connection is to be reset, entered in the form A.B.C.D.
`in`	Indicates that incoming advertised routes will be cleared.
`prefix-filter`	Specifies that a prefix-list will be sent, by the ORF mechanism, to those neighbors with which the ORF capability has been negotiated. The neighbors will be triggered to resend updates, which match the prefix-list filter, to the local router. The local router will then perform a soft reconfiguration.
`out`	Indicates that outgoing advertised routes will be cleared.
`soft in`	Soft inbound reset causes the neighbors to resend all their updates to the local switch, without resetting the connection or clearing the entries in the local switch. So, the local switch stores new updates, and uses them to systematically replace existing table entries. This process can use a considerable amount of memory.
`soft out`	Soft outbound reset causes the switch to simply resend all its updates to the specified neighbor(s), without resetting the connection, or clearing table entries.

Mode Privileged Exec

Examples

```
awplus# clear bgp 3.3.3.3 soft in prefix-filter
awplus# clear bgp 2.2.2.2 out
```

clear bgp (ASN)

Use this command to reset the BGP connection for peers in the specified Autonomous System Number (ASN).

Syntax `clear bgp <asn> [in [prefix-filter]|out|soft [in|out]]`

Parameter	Description
<asn>	<1-4294967295> The AS Number for which all routes will be cleared.
`in`	Indicates that incoming advertised routes will be cleared.
`prefix-filter`	Specifies that a prefix-list will be sent, by the ORF mechanism, to those neighbors with which the ORF capability has been negotiated. The neighbors will be triggered to resend updates, which match the prefix-list filter, to the local router. The local router will then perform a soft reconfiguration.
`out`	Indicates that outgoing advertised routes will be cleared.
`soft in`	Soft inbound reset causes the neighbors to resend all their updates to the local switch, without resetting the connection or clearing the entries in the local switch. So, the local switch stores new updates, and uses them to systematically replace existing table entries. This process can use a considerable amount of memory.
`soft out`	Soft outbound reset causes the switch to simply resend all its updates to the specified neighbor(s), without resetting the connection, or clearing table entries.

Mode Privileged Exec

Examples

```
awplus# clear bgp 300 soft in prefix-filter
awplus# clear bgp 500 soft out
awplus# clear bgp 300 soft in
awplus# clear bgp 1 in prefix-filter
```

clear bgp external

Use this command to reset the BGP connection for all external peers.

Syntax `clear bgp external [in [prefix-filter]|out|soft [in|out]]`

Parameter	Description
`external`	Clears all external peers.
`in`	Indicates that incoming advertised routes will be cleared.
`prefix-filter`	Specifies that a prefix-list will be sent, by the ORF mechanism, to those neighbors with which the ORF capability has been negotiated. The neighbors will be triggered to resend updates, which match the prefix-list filter, to the local router. The local router will then perform a soft reconfiguration.
`out`	Indicates that outgoing advertised routes will be cleared.
`soft in`	Soft inbound reset causes the neighbors to resend all their updates to the local switch, without resetting the connection or clearing the entries in the local switch. So, the local switch stores new updates, and uses them to systematically replace existing table entries. This process can use a considerable amount of memory.
`soft out`	Soft outbound reset causes the switch to simply resend all its updates to the specified neighbor(s), without resetting the connection, or clearing table entries.

Mode Privileged Exec

Examples

```
awplus# clear bgp external soft in
awplus# clear bgp external in prefix-filter
```

clear bgp peer-group

Use this command to reset the BGP connection for all members of a peer group.

Syntax

```
clear bgp peer-group <peer-group>
   [in [prefix-filter]|out|soft [in|out]]
```

Parameter	Description
`peer-group`	Clears all members of a peer group.
<peer-group>	Name of the BGP peer group
`in`	Indicates that incoming advertised routes will be cleared.
`prefix-filter`	Specifies that a prefix-list will be sent, by the ORF mechanism, to those neighbors with which the ORF capability has been negotiated. The neighbors will be triggered to resend updates, which match the prefix-list filter, to the local router. The local router will then perform a soft reconfiguration.
`out`	Indicates that outgoing advertised routes will be cleared.
`soft in`	Soft inbound reset causes the neighbors to resend all their updates to the local switch, without resetting the connection or clearing the entries in the local switch. So, the local switch stores new updates, and uses them to systematically replace existing table entries. This process can use a considerable amount of memory.
`soft out`	Soft outbound reset causes the switch to simply resend all its updates to the specified neighbor(s), without resetting the connection, or clearing table entries.

Mode Privileged Exec

Examples

```
awplus# clear bgp peer-group P1 soft in
awplus# clear bgp peer-group P2 in
```

clear bgp view

Use this command to reset all BGP connections.

Syntax

```
clear bgp view <bgp-view> *
clear bgp view <bgp-view> * soft [in|out]
```

Parameter	Description
*	Clears all bgp peers.
<*bgp-view*>	Name of the BGP view.
soft in	Soft inbound reset causes the neighbors to resend all their updates to the local switch, without resetting the connection or clearing the entries in the local switch. So, the local switch stores new updates, and uses them to systematically replace existing table entries. This process can use a considerable amount of memory.
soft out	Soft outbound reset causes the switch to simply resend all its updates to the specified neighbor(s), without resetting the connection, or clearing table entries.

Mode Privileged Exec

Example

```
awplus# clear bgp view instance1 * soft in
```

clear ip bgp *

Use this command to reset all BGP connections, either by fully resetting sessions or by performing soft resets. If VRF-Lite is configured, you can reset BGP connections for all VRF instances or for a specified VRF instance.

Syntax

```
clear ip bgp * [vrf <vrf-name>]
clear ip bgp * [vrf <vrf-name>] in
clear ip bgp * [vrf <vrf-name>] out
clear ip bgp * [vrf <vrf-name>] soft [in|out]
clear ip bgp * in [prefix-filter]
```

Parameter	Description
*	Clears all bgp peers.
in	Indicates that incoming advertised routes will be cleared.
prefix-filter	Specifies that a prefix-list will be sent, by the ORF mechanism, to those neighbors with which the ORF capability has been negotiated. The neighbors will be triggered to resend updates, which match the prefix-list filter, to the local router. The local router will then perform a soft reconfiguration.
out	Indicates that outgoing advertised routes will be cleared.
soft in	Soft inbound reset causes the neighbors to resend all their updates to the local switch, without resetting the connection or clearing the entries in the local switch. So, the local switch stores new updates, and uses them to systematically replace existing table entries. This process can use a considerable amount of memory.
soft out	Soft outbound reset causes the switch to simply resend all its updates to the specified neighbor(s), without resetting the connection, or clearing table entries.
vrf	Applies the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.

Mode Privileged Exec

Examples To clear all BGP peers, use the command:

```
awplus# clear ip bgp *
```

To clear all BGP peers in VRF instance red, use the command:

```
awplus# clear ip bgp * vrf red
```

To clear all outbound BGP peers in VRF instance red, use the command:

```
awplus# clear ip bgp * out vrf red
```

clear ip bgp (ip address)

Use this command to reset the IPv4 BGP connection to the peer specified by the IP address. When VRF-Lite is configured, you can apply this command to a specific VRF instance.

Syntax

```
clear ip bgp <ip-address> [in [prefix-filter]|out|soft [in|out]]

clear ip bgp <ip-address> [vrf <vrf-name>] [in|out|soft [in|out]]

clear ip bgp <ip-address> [vrf <vrf-name>] ipv4 {unicast|multicast}
   [in [prefix-filter]|out|soft [in|out]]
```

Parameter	Description
<ip-address>	Specifies the IPv4 address of the neighbor whose connection is to be reset, entered in the form A.B.C.D.
ipv4	Clears all IPv4 address family peers. Configure parameters relating to the BGP exchange of IPv4 prefixes.
in	Indicates that incoming advertised routes will be cleared.
prefix-filter	Specifies that a prefix-list will be sent, by the ORF mechanism, to those neighbors with which the ORF capability has been negotiated. The neighbors will be triggered to resend updates, which match the prefix-list filter, to the local router. The local router will then perform a soft reconfiguration.
out	Indicates that outgoing advertised routes will be cleared.
soft in	Soft inbound reset causes the neighbors to resend all their updates to the local switch, without resetting the connection or clearing the entries in the local switch. So, the local switch stores new updates, and uses them to systematically replace existing table entries. This process can use a considerable amount of memory.
soft out	Soft outbound reset causes the switch to simply resend all its updates to the specified neighbor(s), without resetting the connection, or clearing table entries.
unicast	The unicast address family modifier. Configure parameters relating to the BGP exchange of routes to unicast destinations.
multicast	The multicast address family modifier. Configure parameters relating to the BGP exchange of routes to multicast sources.
vrf	Applies the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.

Mode

Privileged Exec

Examples

Use the following command to clear the BGP connection to peer at IP address 192.0.2.11, and clearing all incoming routes.

```
awplus# clear ip bgp 192.0.2.11 in
```

To apply the above example to clear the BGP connection to peer at IP address 192.0.2.11for the VRF instance blue, use the following commands:

```
awplus# clear ip bgp 192.0.2.11 vrf blue in
```

clear ip bgp dampening

Use this command to clear route dampening information and unsuppress routes that have been suppressed routes.

Syntax

```
clear ip bgp dampening [<ip-address>|<ip-address/m>]
clear ip bgp ipv4 [unicast] dampening [<ip-address>|<ip-address/m>]
```

Parameter	Description
<ip-address>	Specifies the IPv4 address for which BGP dampening is to be cleared, in dotted decimal format.
<ip-address/m>	Specifies the IPv4 address with mask for which BGP dampening is to be cleared, entered in the form A.B.C.D/M. Where M is the subnet mask
ipv4	Clears all IPv4 address family peers. Configure parameters relating to the BGP exchange of IPv4 prefixes.
unicast	Unicast address family modifier. Configure parameters relating to the BGP exchange of routes to unicast destinations.

Mode Privileged Exec

Examples

```
awplus# clear ip bgp dampening 10.10.0.121
awplus# clear ip bgp ipv4 unicast dampening
```

clear ip bgp flap-statistics

Use this command to clear the flap count and history duration for the specified prefixes.

Syntax

```
clear ip bgp flap-statistics [<ip-address>|<ip-address/m>]
clear ip bgp ipv4 [unicast] flap-statistics [<ip-address>|<ip-
    address/m>]
```

Parameter	Description
<ip-address>	Specifies the IPv4 address for which BGP flap count and history duration are to be cleared.
<ip-address/m>	Specifies the IPv4 address with mask for which BGP flap count and history duration are to be cleared.
ipv4	Clears all IPv4 address family peers. Configure parameters relating to the BGP exchange of IPv4 prefixes.
unicast	Unicast address family modifier. Configure parameters relating to the BGP exchange of routes to unicast destinations.

Mode Privileged Exec

Examples

```
awplus# clear ip bgp flap-statistics 10.10.0.121
awplus# clear ip bgp ipv4 unicast flap-statistics
```

clear ip bgp (ASN)

Use this command to reset the BGP connections to all peers in a specified Autonomous System Number (ASN).

Syntax

```
clear ip bgp <asn> [in [prefix-filter]|out|soft [in|out]]
clear ip bgp <asn> ipv4 [unicast|multicast]
clear ip bgp <asn> ipv4 [unicast|multicast] in [prefix-filter]
clear ip bgp <asn> ipv4 [unicast|multicast] out
clear ip bgp <asn> ipv4 [unicast|multicast] soft [in|out]
```

Parameter	Description
<asn>	<1-4294967295> Specifies the ASN for which all routes will be cleared.
ipv4	Clears all IPv4 address family peers. Configure parameters relating to the BGP exchange of IPv4 prefixes.
in	Indicates that incoming advertised routes will be cleared.
prefix-filter	Specifies that a prefix-list will be sent, by the ORF mechanism, to those neighbors with which the ORF capability has been negotiated. The neighbors will be triggered to resend updates, which match the prefix-list filter, to the local router. The local router will then perform a soft reconfiguration.
out	Indicates that outgoing advertised routes will be cleared.
soft in	Soft inbound reset causes the neighbors to resend all their updates to the local switch, without resetting the connection or clearing the entries in the local switch. So, the local switch stores new updates, and uses them to systematically replace existing table entries. This process can use a considerable amount of memory.
soft out	Soft outbound reset causes the switch to simply resend all its updates to the specified neighbor(s), without resetting the connection, or clearing table entries.
unicast	Unicast address family modifier. Configure parameters relating to the BGP exchange of routes to unicast destinations.
multicast	Multicast address family modifier. Configure parameters relating to the BGP exchange of routes to multicast sources.

Mode Privileged Exec

Examples

```
awplus# clear ip bgp 100
awplus# clear ip bgp 200 ipv4 unicast in prefix-filter
```

clear ip bgp external

Use this command to reset the BGP connections to all external peers.

Syntax

```
clear ip bgp external [in [prefix-filter]|out|soft [in|out]]
clear ip bgp external ipv4 [unicast|multicast]
clear ip bgp external ipv4 [unicast|multicast] in [prefix-filter]
clear ip bgp external ipv4 [unicast|multicast] out
clear ip bgp external ipv4 [unicast|multicast] soft [in|out]
```

Parameter	Description
`external`	Clears all external peers.
`ipv4`	Clears all IPv4 address family peers. Configure parameters relating to the BGP exchange of IPv4 prefixes.
`in`	Indicates that incoming advertised routes will be cleared.
`prefix-filter`	Specifies that a prefix-list will be sent, by the ORF mechanism, to those neighbors with which the ORF capability has been negotiated. The neighbors will be triggered to resend updates, which match the prefix-list filter, to the local router. The local router will then perform a soft reconfiguration.
`out`	Indicates that outgoing advertised routes will be cleared.
`soft in`	Soft inbound reset causes the neighbors to resend all their updates to the local switch, without resetting the connection or clearing the entries in the local switch. So, the local switch stores new updates, and uses them to systematically replace existing table entries. This process can use a considerable amount of memory.
`soft out`	Soft outbound reset causes the switch to simply resend all its updates to the specified neighbor(s), without resetting the connection, or clearing table entries.
`unicast`	Unicast address family modifier. Configure parameters relating to the BGP exchange of routes to unicast destinations.

Mode Privileged Exec

Examples

```
awplus# clear ip bgp external out
awplus# clear ip bgp external ipv4 unicast in prefix-filter
```

clear ip bgp peer-group

Use this command to reset the BGP connections to all members of a peer group.

Syntax

```
clear ip bgp peer-group <peer-name>
clear ip bgp peer-group <peer-name> in [prefix-filter]
clear ip bgp peer-group <peer-name> out
clear ip bgp peer-group <peer-name> soft [in|out]
clear ip bgp peer-group <peer-name> ipv4 [unicast]
clear ip bgp peer-group <peer-name> ipv4 [unicast] in [prefix-filter]
clear ip bgp peer-group <peer-name> ipv4 [unicast] out
clear ip bgp peer-group <peer-name> ipv4 [unicast] soft [in|out]
```

Parameter	Description
`peer-group`	Clears all members of a peer group.
`<peer-name>`	Specifies the name of the peer group for which all members will be cleared.
`ipv4`	Clears all IPv4 address family peers. Configure parameters relating to the BGP exchange of IPv4 prefixes.
`in`	Indicates that incoming advertised routes will be cleared.
`prefix-filter`	Specifies that a prefix-list will be sent, by the ORF mechanism, to those neighbors with which the ORF capability has been negotiated. The neighbors will be triggered to resend updates, which match the prefix-list filter, to the local router. The local router will then perform a soft reconfiguration.
`out`	Indicates that outgoing advertised routes will be cleared.
`soft in`	Soft inbound reset causes the neighbors to resend all their updates to the local switch, without resetting the connection or clearing the entries in the local switch. So, the local switch stores new updates, and uses them to systematically replace existing table entries. This process can use a considerable amount of memory.
`soft out`	Soft outbound reset causes the switch to simply resend all its updates to the specified neighbor(s), without resetting the connection, or clearing table entries.
`unicast`	Unicast address family modifier. Configure parameters relating to the BGP exchange of routes to unicast destinations.

Mode Privileged Exec

Examples

```
awplus# clear ip bgp peer-group Peer1 out

awplus# clear ip bgp peer-group mypeer ipv4 unicast in
        prefix-filter
```

clear ip bgp view

Use this command to reset connections with all the neighbors within the specified view.

The specified bgp view for this command is created using the router bgp view command.

Syntax

```
clear ip bgp view <bgp-view> *
clear ip bgp view <bgp-view> * in [prefix-filter]
clear ip bgp view <bgp-view> * out
clear ip bgp view <bgp-view> * soft [in|out]
clear ip bgp view <bgp-view> * ipv4 [unicast]
clear ip bgp view <bgp-view> * ipv4 [unicast] in [prefix-filter]
clear ip bgp view <bgp-view> * ipv4 [unicast] out
clear ip bgp view <bgp-view> * ipv4 [unicast] soft [in|out]
```

Parameter	Description
`view`	Specifies BGP view.
<bgp-view>	Specifies the name of the view for which all routes will be cleared.
`*`	Clears all peers.
`ipv4`	Clears all IPv4 address family peers. Configure parameters relating to the BGP exchange of IPv4 prefixes.
`in`	Indicates that incoming advertised routes will be cleared.
`prefix-filter`	Specifies that a prefix-list will be sent, by the ORF mechanism, to those neighbors with which the ORF capability has been negotiated. The neighbors will be triggered to resend updates, which match the prefix-list filter, to the local router. The local router will then perform a soft reconfiguration.
`out`	Indicates that outgoing advertised routes will be cleared.
`soft in`	Soft inbound reset causes the neighbors to resend all their updates to the local switch, without resetting the connection or clearing the entries in the local switch. So, the local switch stores new updates, and uses them to systematically replace existing table entries. This process can use a considerable amount of memory.
`soft out`	Soft outbound reset causes the switch to simply resend all its updates to the specified neighbor(s), without resetting the connection, or clearing table entries.
`unicast`	Unicast address family modifier. Configure parameters relating to the BGP exchange of routes to unicast destinations.

Mode Privileged Exec

Examples

```
awplus# clear ip bgp view I4 * in prefix-filter
awplus# clear ip bgp view I2 ipv4 unicast soft in
```

Related Commands router bgp view

debug bgp

Use this command to turn on one or more BGP debug options.

Use the no variant of this command to disable one or more BGP debug options.

Syntax

```
debug bgp [all|dampening|events|filters|fsm|keepalives|nht|nsm|
   updates [in|out]]

no debug all bgp

no debug bgp [all|dampening|events|filters|fsm|keepalives|nht|nsm|
   updates [in|out]]
```

Parameter	Description
`all`	Turns on all debugging for BGP.
`dampening`	Specifies debugging for BGP dampening.
`events`	Specifies debugging for BGP events.
`filters`	Specifies debugging for BGP filters.
`fsm`	Specifies debugging for BGP Finite State Machine (FSM).
`keepalives`	Specifies debugging for BGP keepalives.
`nht`	Specifies debugging for BGP NHT (Next Hop Tracking) messages.
`nsm`	Specifies debugging for NSM messages.
`updates`	`[in|out]` Specifies debugging for BGP updates.
`in`	Inbound updates.
`out`	Outbound updates.

Mode Privileged Exec and Global Configuration

Usage If the command is entered with no parameters, then all debug options are enabled.

Examples

```
awplus# debug bgp

awplus# debug bgp events

awplus# debug bgp nht

awplus# debug bgp updates in
```

Related Commands show debugging bgp
undebug bgp

distance (BGP)

This command sets the administrative distance for BGP routes. The switch uses this value to select between two or more routes to the same destination from two different routing protocols. The route with the smallest administrative distance value is added to the Forwarding Information Base (FIB). For more information, see "Administrative Distance" on page 31.5.

The no variant of this command sets the administrative distance for the route to the default for the route type.

Syntax

```
distance <1-255> <ip-address/m> [<listname>]
distance bgp <ebgp> <ibgp> <local>
no distance <1-255> <ip-address/m> [<listname>]
no distance bgp <ebgp> <ibgp> <local>
```

Parameter	Description
<1-255>	The administrative distance value you are setting for the route.
<ip-address/m>	The IP source prefix that you are changing the administrative distance for, entered in the form A.B.C.D/M. This is an IPv4 address in dotted decimal notation followed by a forward slash, and then the prefix length.
<listname>	The name of the access list to be applied to the administrative distance to selected routes.
<ebgp>	Specifies the administrative distance of external BGP (eBGP) routes. These are routes learnt from a neighbor out of the AS. Specify the distance as a number between 1 and 255. Default: 20
<ibgp>	Specifies the administrative distance of internal BGP (iBGP) routes. These are routes learnt from a neighbor within the same AS. Specify the distance as a number between 1 and 255. Default: 200
<local>	Specifies the administrative distance of local BGP routes. These are routes redistributed from another protocol within your device. Specify the distance as a number between 1 and 255. Default: 200

Mode Router Configuration

Usage You can use this command to set the administrative distance:

- for each BGP route types by specifying:
  distance (BGP) <ebgp> <igbp> <local>
- for a specific route by specifying:
  distance (BGP) <1-255> <ip-address/m> [<listname>]

If the administrative distance is changed, it could create inconsistency in the routing table and obstruct routing.

Examples To set the administrative distance to 34 for the route 10.10.0.0/24 in BGP 100, and use the access list “mylist” to filter the routes, use the commands:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# distance 34 10.10.0.0/24 mylist
```

To set BGP 100’s administrative distances for eBGP routes to 34, iBGP routes to 23, and local BGP routes to 15, use the commands:

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# distance bgp 34 23 15
```

exit-address-family (BGP)

Use this command to exit the Address Family mode.

Syntax `exit-address-family`

Mode Address Family mode

Example To enter and then exit Address Family Configuration mode for VRF instance red, use the commands:.

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# address-family ipv4 vrf red
awplus(config-router-af)# exit-address-family
awplus(config-router)#
```

Related Commands address-family ipv4 (BGP)

ip as-path access-list

This command defines a BGP Autonomous System (AS) path access list.

The named AS path list is a filter based on regular expressions. If the regular expression matches the AS path in a BGP update message, then the permit or deny condition applies to that update. Use this command to define the BGP access list globally, then use neighbor configuration commands to apply the list to a particular neighbor.

The no variant of this command disables the use of the access list

Syntax

```
ip as-path access-list <listname> {deny|permit} <reg-exp>
no ip as-path access-list <listname> {deny|permit} <reg-exp>
```

Parameter	Description
<listname>	Specifies the name of the access list.
deny	Denies access to matching conditions.
permit	Permits access to matching conditions.
<reg-exp>	Specifies a regular expression to match the BGP AS paths.

Regular expressions listed below can be used with the ip as-path-access-list command:

Symbol	Character	Meaning
^	Caret	Used to match the beginning of the input string. When used at the beginning of a string of characters, it negates a pattern match.
$	Dollar sign	Used to match the end of the input string.
.	Period	Used to match a single character (white spaces included).
*	Asterisk	Used to match none or more sequences of a pattern.
+	Plus sign	Used to match one or more sequences of a pattern.
?	Question mark	Used to match none or one occurrence of a pattern.
_	Underscore	Used to match spaces, commas, braces, parenthesis, or the beginning and end of an input string.
[ ]	Brackets	Specifies a range of single-characters.
-	Hyphen	Separates the end points of a range.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# ip as-path access-list mylist deny ^65535$
```

ip community-list

Use this command to add an entry to a standard BGP community-list filter.

Use the no variant of this command to delete the community list entry.

Syntax

```
ip community-list <listname> {deny|permit} .<community>
no ip community-list <listname> {deny|permit} .<community>
```

Parameter	Description
<listname>	Specifies the community listname.
deny	Specifies the community to reject.
permit	Specifies the community to accept.
.*<community>*	{*<AS:VAL>* | local-AS | no-advertise | no-export}
<AS:VAL>	Specifies the valid value for the community number. This format represents the 32 bit communities value, where AS is the high order 16 bits and VAL is the low order 16 bits in digit format.
local-AS	Specifies routes not to be advertised to external BGP peers.
no-advertise	Specifies routes not to be advertised to other BGP peers.
no-export	Specifies routes not to be advertised outside of Autonomous System boundary.

Mode Global Configuration

Usage A community-list can be used as a filter to BGP updates. Use this command to define the community access list globally, then use neighbor configuration commands to apply the list to a particular neighbor.

There are two kinds of community-lists: expanded and standard. A standard community-list defines the community attributes explicitly and not via a regular expression. An expanded community-list defines the communities attributes with regular expressions.

The standard community-list is compiled into binary format and is directly compared with the BGP communities attribute in the BGP updates. The comparison is faster than the expanded community-list. Any community value that does not match the standard community value is automatically treated as expanded.

Example

```
awplus# configure terminal
awplus(config)# ip community-list mylist permit 7675:80 7675:90
```

Related Commands ip community-list standard
ip community-list expanded

ip community-list expanded

Use this command to add an entry to an expanded BGP community-list filter.

Use the no variant of this command to delete the community list entry.

Syntax

```
ip community-list <100-199> {deny|permit} .<line>

no ip community-list <100-199> {deny|permit} .<line>

ip community-list expanded <expanded-listname> {deny|permit} .<line>

no ip community-list expanded <expanded-listname> {deny|permit}
    .<line>
```

Parameter	Description
<100-199>	Expanded community list number.
expanded	Specifies an expanded community list.
<expanded-listname>	Expanded community list entry.
deny	Specifies community to reject.
permit	Specifies community to accept.
.<line>	Specifies community attributes with regular expressions.

Regular expressions listed below can be used with the ip community-list expanded command:

Symbol	Character	Meaning
^	Caret	Used to match the beginning of the input string. When used at the beginning of a string of characters, it negates a pattern match.
$	Dollar sign	Used to match the end of the input string.
.	Period	Used to match a single character (white spaces included).
*	Asterisk	Used to match none or more sequences of a pattern.
+	Plus sign	Used to match one or more sequences of a pattern.
?	Question mark	Used to match none or one occurrence of a pattern.
_	Underscore	Used to match spaces, commas, braces, parenthesis, or the beginning and end of an input string.
[ ]	Brackets	Specifies a range of single-characters.
-	Hyphen	Separates the end points of a range.

Mode Global Configuration

Usage A community-list can be used as a filter to BGP updates. Use this command to define the community access list globally, then use neighbor configuration commands to apply the list to a particular neighbor.

There are two kinds of community-lists: expanded and standard. A standard community-list defines the community attributes explicitly and not via a regular expression. An expanded community-list defines the communities attributes with regular expressions.

The standard community-list is compiled into binary format and is directly compared with the BGP communities attribute in the BGP updates. The comparison is faster than the expanded community-list. Any community value that does not match the standard community value is automatically treated as expanded.

Examples

```
awplus# configure terminal
awplus(config)# ip community-list 125 permit 6789906
awplus(config)# ip community-list expanded CLIST permit .*
```

Related Commands

ip community-list
ip community-list standard

ip community-list standard

Use this command to add an entry to a standard BGP community-list filter.

Use the no variant of this command to delete the standard community-list entry.

Syntax

```
ip community-list <1-99> {deny|permit} [.<community>]

no ip community-list <1-99> {deny|permit} [.<community>]

ip community-list standard <standard-listname> {deny|permit}
   [.<community>]

no ip community-list standard <standard-listname> {deny|permit}
   [.<community>]
```

Parameter	Description
<1-99>	Standard community list number.
`standard`	Specifies a standard community list.
<standard-listname>	Standard community list entry.
`deny`	Specifies community to reject.
`permit`	Specifies community to accept.
<community>	{*<AS:VAL>* | local-AS | no-advertise | no-export}
<AS:VAL>	Specifies the valid value for the community number. This format represents the 32 bit communities value, where `AS` is the high order 16 bits and `VAL` is the low order 16 bits in digit format.
`local-AS`	Specifies routes not to be advertised to external BGP peers.
`no-advertise`	Specifies routes not to be advertised to other BGP peers.
`no-export`	Specifies routes not to be advertised outside of the Autonomous System boundary.

Mode Global Configuration

Usage A community-list can be used as a filter to BGP updates. Use this command to define the community access list globally, then use neighbor configuration commands to apply the list to a particular neighbor.

There are two kinds of community-lists: expanded and standard. The standard community-list defines the community attributes as explicit values, without regular expressions. The expanded community-list defines the communities attributes with regular expressions.

The standard community-list is compiled into binary format and is directly compared with the BGP communities attribute in the BGP updates. The comparison is faster than the expanded community-list. Any community value that does not match the standard community value is automatically treated as expanded.

Examples

```
awplus# configure terminal

awplus(config)# ip community-list standard CLIST permit 7675:80
7675:90 no-export

awplus(config)# ip community-list 34 permit 5675:50 no-
advertise
```

Related Commands ip community-list
ip community-list expanded

ip extcommunity-list expanded

Use this command to create or delete an expanded extended community list.

Use the no variant of this command to delete the expanded extended community-list entry.

Syntax

```
ip extcommunity-list <100-199> {deny|permit}
    {.<line>|.<AS:NN>|.<ip-address>}

no ip extcommunity-list <100-199> {deny|permit}
    {.<line>|.<AS:NN>|.<ip-address>}

ip extcommunity-list expanded <expanded-listname> {deny|permit}
    {.<line>|.<AS:NN>|.<ip-address>}

no ip extcommunity-list expanded <expanded-listname> {deny|permit}
    {.<line>|.<AS:NN>|.<ip-address>}

no ip extcommunity-list <100-199>

no ip extcommunity-list expanded <expanded-listname>
```

Parameter	Description
<100-199>	Expanded extcommunity list number.
expanded	Specifies an expanded extcommunity list.
<expanded-listname>	Expanded extcommunity list entry.
deny	Specifies the extcommunity to reject.
permit	Specifies the extcommunity to accept.
.<line>	Specifies extcommunity attributes with regular expression.
<AS:NN>	Specifies the valid value for an extcommunity number. This format represents the 32 bit extcommunities value, where AA is the high order 16 bits and NN is the low order 16 bits in digit format.
<ip-address>	Specifies the IP address to deny or permit.

Regular expressions listed below are used with the ip extcommunity-list expanded command:

Symbol	Character	Meaning
^	Caret	Used to match the beginning of the input string. When used at the beginning of a string of characters, it negates a pattern match.
$	Dollar sign	Used to match the end of the input string.
.	Period	Used to match a single character (white spaces included).
*	Asterisk	Used to match none or more sequences of a pattern.
+	Plus sign	Used to match one or more sequences of a pattern.
?	Question mark	Used to match none or one occurrence of a pattern.
_	Underscore	Used to match spaces, commas, braces, parenthesis, or the beginning and end of an input string.

Symbol(cont.)	Character(cont.)	Meaning(cont.)
[ ]	Brackets	Specifies a range of single-characters.
-	Hyphen	Separates the end points of a range.

Mode Global Configuration

Examples

```
awplus# configure terminal
awplus(config)# ip extcommunity-list 125 permit 4567335
awplus(config)# ip extcommunity-list expanded CLIST permit .*
```

Related Commands ip extcommunity-list standard

ip extcommunity-list standard

Use this command to create and delete a standard extended community list.

Use the no variant of this command to delete a standard extended community-list entry.

Syntax

```
ip extcommunity-list <1-99> {deny|permit} {rt|soo} <community-number>

ip extcommunity-list standard <standard-listname> {deny|permit}
   {rt|soo} <community-number>

no ip extcommunity-list <1-99> [{deny|permit} {rt|soo}
   <community-number>]

no ip extcommunity-list standard <standard-listname> [{deny|permit}
   {rt|soo} <community-number>]
```

Parameter	Description
<1-99>	Standard extcommunity list number.
`standard`	Specifies a standard extended community list.
<standard-listname>	Standard extended community list entry.
`deny`	Specifies the extended community to reject.
`permit`	Specifies the extended community to accept.
`rt`	Specifies the route target of the extended community.
`soo`	Specifies the site of origin of the extended community.
<community-number>	Specifies the valid value for an extended community number. This can be one of two formats: ■ *<ASN:NN>* where *ASN* is an AS (Autonomous System) number and *NN* is a value chosen by the ASN administrator ■ *<A.B.C.D:NN>* where *A.B.C.D* is an IPv4 address, and *NN* is a value chosen by the ASN administrator. Note that *ASN* and *NN* are both integers from 1 to 4294967295. AS numbers are assigned to the regional registries by IANA (www.iana.org) and must be obtained in your region.

Mode Global Configuration

Examples

```
awplus# configure terminal
awplus(config)# ip extcommunity-list 36 permit rt 5675:50
awplus(config)# ip extcommunity-list standard CLIST permit soo
7645:70
```

```
awplus# configure terminal
awplus(config)# ip extcommunity-list 36 deny rt 192.168.1.1:70
awplus(config)# ip extcommunity-list standard CLIST deny soo
10.10.1.1:50
```

Related Commands ip extcommunity-list expanded
show ip extcommunity-list

neighbor activate

Use this command to enable the exchange of routes with a neighboring router, possibly within a specific address-family.

Use the no variant of this command to disable exchange of information with a neighbor.

Syntax

```
neighbor <neighborid> activate
no neighbor <neighborid> activate
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage This command triggers the switch to start a BGP peering relationship with the specified neighbor and start exchanging routes with that neighbor. The command is required for neighbors configured in Address-Family Configuration mode, but it is not required in Router Configuration mode (that it, it does not affect the device's behavior).

Examples To enable an exchange of routes with a neighboring router enter the commands shown below:

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 1.2.3.4 activate
```

Related Commands
address-family ipv4 (BGP)
neighbor remote-as

neighbor advertisement-interval

Use this command to set the minimum interval between sending the BGP routing updates.

Use the no variant of this command to set the interval time to the default.

Syntax

```
neighbor <neighborid> advertisement-interval <time>
no neighbor <neighborid> advertisement-interval [<time>]
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<time>	*<0-600>*	Advertise -interval value in seconds.

Default The default minimum interval between sending the BGP routing updates is 30 seconds.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Use this command to set the minimum interval between the sending of BGP routing updates. To reduce the flapping of routes to internet, a minimum advertisement interval is set, so that the BGP routing updates are sent only per interval seconds. BGP dampening can also be used to control the effects of flapping routes.

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.3 advertisement-
interval 45

awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# no neighbor 10.10.0.3 advertisement-
interval
```

neighbor allowas-in

Use this command to accept an AS-path with the specified Autonomous System (AS) number from inbound updates.

Use the no variant of this command to revert to default.

Syntax

```
neighbor <neighborid> allowas-in <occurrences>
no neighbor <neighborid> allowas-in
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<occurrences>	*<1-10>* Specifies the number of occurrences of the AS number.	

Default Disabled

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Use this command to configure PE routers to allow re-advertisement of all prefixes containing duplicate Autonomous System Numbers (ASNs). In a hub and spoke configuration, a PE router re-advertises all prefixes containing duplicate ASNs. Specify the remote-as or peer-group first using the related commands.

Examples

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.1 allowas-in 3
```

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# address-family ipv4
awplus(config-router-af)# neighbor 10.10.0.1 allowas-in 3
```

Related Commands

neighbor remote-as
neighbor peer-group (creating a peer-group)
neighbor peer-group (adding a neighbor)

neighbor as-origination-interval

Use this command to enable the sending of AS (Autonomous System) origination routing updates to the specified neighbor. This command can also be used to adjust the rate at which the updates are sent.

Use the no variant of this command to disable this feature.

Syntax

```
neighbor <neighbor_address> as-origination-interval <time>
no neighbor <neighbor_address> as-origination-interval [<time>]
```

Parameter	Description
<neighbor_address>	Neighbor IP address. Use A.B.C.D form.
<time>	<1-600> Time in seconds.

Default Disabled

Mode BGP Router Configuration

Usage This command is used to change the minimum interval between sending AS-origination routing updates. The interval can be from 1 to 600 seconds.

Examples

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# neighbor 10.10.0.1 as-origination-
interval 10
```

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-router)# no neighbor 10.10.0.1 as-origination-
interval
```

Related Commands address-family ipv4 (BGP)

neighbor attribute-unchanged

Use this command to advertise unchanged BGP attributes to the specified neighbor.

Use the no variant of this command to disable this function.

Syntax

```
neighbor <neighborid> attribute-unchanged {as-path|next-hop|med}
no neighbor <neighborid> attribute-unchanged {as-path|next-hop|med}
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
as-path	AS path attribute.	
next-hop	Next hop attribute.	
med	Multi Exit Discriminator.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Note the neighbor attribute-unchanged next-hop command has the same effect as invoking the neighbor transparent-nexthop command. Also note the neighbor attribute-unchanged as-path command has the same effect as invoking the neighbor transparent-as command.

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.75 attribute-unchanged
as-path med
```

Related Commands
neighbor transparent-as
neighbor transparent-nexthop

neighbor capability dynamic

Use this command to enable the dynamic capability for a specific peer.

Use the no variant of this command to disable the dynamic capability.

Syntax

```
neighbor <neighborid> capability dynamic
no neighbor <neighborid> capability dynamic
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Default Disabled

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage This command allows a BGP speaker to advertise or withdraw an address family capability to a peer in a non-disruptive manner.

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.10.1 capability dynamic
```

neighbor capability graceful-restart

Use this command to configure the device to advertise the Graceful Restart Capability to the neighbors.

Use the no variant of this command to configure the device so it does not advertise the Graceful Restart Capability to its neighbor.

Syntax

```
neighbor <neighborid> capability graceful-restart
no neighbor <neighborid> capability graceful-restart
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Default Disabled

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Use the neighbor capability graceful-restart command to advertise to the neighbor routers the capability of graceful restart. First specify neighbors remote-as identification number assigned by the neighbor router.

The graceful restart capability is advertised only when the graceful restart capability has been enabled using the bgp graceful-restart command on page 42.26.

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.10.50 capability
graceful-restart
```

Related Commands bgp graceful-restart
restart bgp graceful

neighbor capability orf prefix-list

Use this command to advertise ORF capability to neighbors.

Use the no variant of this command to disable this function.

Syntax

```
neighbor <neighborid> capability orf prefix-list {both|receive|send}

no neighbor <neighborid> capability orf prefix-list {both|receive|
    send}
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
`orf`	Advertises ORF capability to its neighbors.	
`both`	Indicates that the local router can send ORF entries to its peer as well as receive ORF entries from its peer.	
`receive`	Indicates that the local router is willing to receive ORF entries from its peer.	
`send`	Indicates that the local router is willing to send ORF entries to its peer.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Default Disabled by default.

Usage Outbound Route Filters (ORFs) send and receive capabilities to lessen the number of updates exchanged between neighbors. By filtering updates, this option minimizes generating and processing of updates. The local router advertises the ORF capability in `send` mode and the remote router receives the ORF capability in receive mode applying the filter as outbound policy. The two routers exchange updates to maintain the ORF for each router. Only an individual router or a peer-group can be configured to be in receive or `send mode`. A peer-group member cannot be configured to be in receive or send mode

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.5 capability orf
prefix-list both
```

neighbor capability route-refresh

Use this command to advertise route-refresh capability to the specified neighbors.

Use the no variant of this command to disable this function

Syntax

```
neighbor <neighborid> capability route-refresh
no neighbor <neighborid> capability route-refresh
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Default Enabled by default.

Usage Use this command to advertise to peer about route refresh capability support. If route refresh capability is supported, then router can dynamically request that the peer readvertises its Adj-RIB-Out.

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.10.1 capability route-refresh
```

neighbor collide-established

Use this command to specify including a neighbor, already in an 'established' state, for conflict resolution when a TCP connection collision is detected.

Use the no variant of this command to remove a neighbor, already in an 'established' state, for conflict resolution when a TCP connection collision is detected.

Syntax

```
neighbor <neighborid> collide-established
no neighbor <neighborid> collide-established
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode Router Configuration

Usage This command must be used only when specially required. It is not required in most network deployments.

The associated functionality of including an 'established' neighbor into TCP connection collision conflict resolution is automatically enabled when neighbor is configured for BGP graceful-restart.

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 3.3.3.3 collide-established
```

neighbor default-originate

Use this command to allow a BGP local router to send the default route 0.0.0.0 to a neighbor.

Use the no variant of this command to send no route as a default.

Syntax

```
neighbor {<neighborid>} default-originate [route-map <routemap-name>]

no neighbor {<neighborid>} default-originate [route-map <routemap-
    name>]
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
route-map	If a route-map is specified, then the route table must contain at least one route that matches the permit criteria of the route map before the default route will be advertised to the specified neighbor.	
<routemap-name>	Route-map name.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.10.1 default-originate
route-map myroute
```

neighbor description

Use this command to associate a description with a neighbor.

Use the no variant of this command to remove the description.

Syntax

```
neighbor <neighborid> description <description>
no neighbor <neighborid> description [<description>]
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<description>	Up to 80 characters of text describing the neighbor.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 1.2.3.4 description Backup
router for sales.
```

neighbor disallow-infinite-holdtime

Use this command to disallow the configuration of infinite holdtime.

Use the no variant of this command to allow the configuration of infinite holdtime.

Syntax

```
neighbor {<ip-address>} disallow-infinite-holdtime
no neighbor {<ip-address>} disallow-infinite-holdtime
```

Parameter	Description
<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.

Mode Router Configuration

Usage This command enables the local BGP speaker to reject holdtime “0” seconds from the peer during exchange of open messages or the user during configuration.

The no variant of this command allows the BGP speaker to accept “0” holdtime from the peer or during configuration.

Example To enable the disallow-infinite-holdtime feature on the BGP speaker with the IP address of `10.10.10.10`, enter the command:

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.11.4.26 disallow-infinite-
holdtime
```

Related Commands neighbor timers
timers (BGP)

neighbor distribute-list

This command filters route update from a particular BGP neighbor using an access control list.

You can add one incoming and one outgoing distribute-list for each BGP neighbor.

The no variant of this command removes a previously configured distribute-list.

Syntax

```
neighbor <neighborid> distribute-list <access-list> {in|out}
no neighbor <neighborid> distribute-list <access-list> {in|out}
```

Parameter	Description	
<neighborid>	Identification method for the BGP peer. Use one of the following formats:	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation *A.B.C.D.*
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) and neighbor remote-as commands. When this parameter is used with a command, the command applies on all peers in the specified group.
<access-list>	The specific access-list used to filter routes. Specify one of the following types of access-lists:	
	<WORD>	The name of IP access-list.
	<1-199>	The ID number of a standard IP access-list.
	<1300-2699>	The ID number of an extended IP access-list.
in	Indicates that incoming advertised routes will be filtered.	
out	Indicates that outgoing advertised routes will be filtered.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 1.2.3.4 distribute-list
mylist out
```

neighbor dont-capability-negotiate

Use this command to disable capability negotiation.

The capability negotiation is performed by default. This command is used to allow compatibility with older BGP versions that have no capability parameters used in open messages between peers.

Use the no variant of this command to enable capability negotiation.

Syntax

```
neighbor <neighborid> dont-capability-negotiate
no neighbor <neighborid> dont-capability-negotiate
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	Specifies the address of the BGP neighbor in IPv4 format *A.B.C.D*.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.34 dont-capability-
negotiate
```

neighbor ebgp-multihop

Use this command to accept and attempt BGP connections to external peers on indirectly connected networks.

Effectively, this command sets the TTL value in the BGP packets that the router sends to the neighbor, so that the packets may traverse the network route to the neighbor.

The switch will not establish a connection to a multihop neighbor, if the only route to the multihop peer is a default route.

Use the no variant of this command to return to the default.

Syntax

```
neighbor <neighborid> ebgp-multihop [<count>]
no neighbor <neighborid> ebgp-multihop [<count>]
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<count>	*<1-255>* The Maximum hop count, that is set in the TTL field of the BGP packets. If this optional parameter is not specified with the command, then the Maximum hop count is set to 255.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.10.34 remote-as 20
awplus(config-router)# neighbor 10.10.10.34 ebgp-multihop 5
```

neighbor enforce-multihop

Use this command to enforce the requirement that BGP neighbors form multihop connections.

Use the no variant of this command to turn off this feature.

Syntax

```
neighbor <neighborid> enforce-multihop
no neighbor <neighborid> enforce-multihop
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.34 remote-as 20
awplus(config-router)# neighbor 10.10.0.34 enforce-multihop
```

neighbor filter-list

This command creates a BGP filter using an AS (Autonomous System) path list. This command specifies an AS path list, which it then applies to filter updates to and from a BGP neighbor

The no variant of this command removes the previously specified filter using access control lists.

Syntax

```
neighbor <neighborid> filter-list <listname> {in|out}
no neighbor <neighborid> filter-list <listname> {in|out}
```

Parameter	Description	
<neighborid>	Identification method for the BGP peer. Use one of the following formats:	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<listname>	The name of an AS (Autonomous System) path list.	
in	Indicates that incoming advertised routes will be filtered.	
out	Indicates that outgoing advertised routes will be filtered.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage This command specifies a filter for updates based on a BGP AS (Autonomous System) path list.

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.34 filter-list list1
out
```

neighbor interface

Use this command to configure the interface name of a BGP-speaking neighbor.

Use the no variant of this command to disable this function

Syntax

```
neighbor <ipaddr> interface <interface>
no neighbor <ipaddr> interface <interface>
```

Parameter	Description
<ipaddr>	Specifies the IPv4 address of the BGP neighbor - entered in dotted decimal notation.
<interface>	Specifies the interface name of BGP neighbor, e.g. `vlan2`.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Examples

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.72 interface vlan2

awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# no neighbor 10.10.0.72 interface vlan2
```

neighbor local-as

Use this command to configure a local AS number for the specified neighbor. This overrides the local AS number specified by the router bgp command on page 42.119.

Use the no variant of this command to remove the local AS number for the neighbor.

Syntax

```
neighbor <neighborid> local-as <as-number>
no neighbor <neighborid> local-as <as-number>
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<as-number>	*<1-4294967295>*	Neighbor's Autonomous System (AS) number.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage When VRF-Lite is configured, this command allows internal BGP loopback connections between named VRFs and the default global routing instance to be configured to act as eBGP connections, instead of only iBGP.

Related Commands router bgp

neighbor maximum-prefix

Use this command to control the number of prefixes that can be received from a neighbor.

Use the no variant of this command to disable this function. Do not specify threshold to apply the default threshold of 75% for the maximum number of prefixes before this is applied.

Syntax

```
neighbor <neighborid> maximum-prefix <maximum>
no neighbor <neighborid> maximum-prefix [<maximum>]
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<maximum>	*<maxprefix>* [*<threshold>*] [warning-only]	
<maxprefix>	*<1-4294967295>* Specifies the maximum number of prefixes permitted.	
<threshold>	*<1-100>* Specifies the threshold value, 1 to 100 percent. 75% by default.	
warning-only	Only gives a warning message when the limit is exceeded.	

Default The default threshold value is 75%. If the threshold value is not specified this default is applied.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage The neighbor maximum-prefix command allows the configuration of a specified number of prefixes that a BGP router is allowed to receive from a neighbor. When the warning-only option is not used, if any extra prefixes are received, the router ends the peering. A terminated peer, stays down until the clear ip bgp command is used.

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.72 maximum-prefix 1244
warning-only
```

neighbor next-hop-self

Use this command to configure the router as the next hop for a BGP-speaking neighbor or peer group.

Use the no variant of this command to disable this feature.

Syntax

```
neighbor <neighborid> next-hop-self
no neighbor <neighborid> next-hop-self
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage This command allows a BGP router to change the nexthop information that is sent to the iBGP peer. The nexthop information is set to the IP address of the interface used to communicate with the neighbor.

This command can be run for a specific VRF instance.

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.72 remote-as 100
awplus(config-router)# neighbor 10.10.0.72 next-hop-self
```

neighbor override-capability

Use this command to override a capability negotiation result.

Use the no variant of with this command to disable this function

Syntax

```
neighbor <neighborid> override-capability
no neighbor <neighborid> override-capability
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router bgp 12
awplus(config-router)# neighbor 10.10.10.10 override-capability
```

neighbor passive

Use this command to configure the local router to be passive with regard to the specified neighbor. This has the effect that the router will not attempt to initiate connections to this neighbor, but will accept incoming connection attempts from the neighbor.

Use the no variant of this command to disable this function

Syntax

```
neighbor <neighborid> passive
no neighbor <neighborid> passive
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Examples

```
awplus# configure terminal
awplus(config# router bgp 12
awplus(config-router)# neighbor 10.10.10.10 passive

awplus# configure terminal
awplus(config# router bgp 12
awplus(config-router)# no neighbor 10.10.10.10 passive
```

neighbor password

Use this command to enable MD5 authentication on a TCP connection between BGP neighbors.

Use the no variant of this command to disable this function.

Syntax

```
neighbor {<ip-address>|<peer-group-name>} password <password>

no neighbor {<ip-address>|<peer-group-name>}
    password [<password>]
```

Parameter	Description
<ip-address>	Specifies the IP address of the BGP neighbor, in A.B.C.D format.
<peer-group-name>	Name of an existing peer-group. When this parameter is used with a command, the command applies on all peers in the specified group.
<password>	An alphanumeric string of characters to be used as password.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage When using the *<peer-group-name>* parameter with this command (to apply this command to all peers in the group), see the related commands neighbor peer-group (adding a neighbor) and neighbor remote-as for information about how to create peer groups first.

Example This example specifies the encryption type and the password (`manager`) for the neighbor `10.10.10.10`:

```
awplus# configure terminal
awplus(config)# router bgp 1
awplus(config-router)# neighbor 10.10.10.10 password manager
```

This example removes the password set for the neighbor `10.10.10.10`:

```
awplus# configure terminal
awplus(config)# router bgp 1
awplus(config-router)# no neighbor 10.10.10.10 password
```

This example specifies the password (`manager`) for the neighbor `192.168.1.10` for an IPv4 address-family, VRF name `red`, and `router bgp 10`:

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# address-family ipv4 vrf red
awplus(config-router-af)# neighbor 192.168.1.1 password
manager
```

Related Commands neighbor peer-group (adding a neighbor)
neighbor remote-as

neighbor peer-group (adding a neighbor)

Use this command to add a neighbor to an existing peer-group.

Use the no variant of this command to disable this function.

Syntax

```
neighbor <ip-address> peer-group <tag>
no neighbor <ip-address> peer-group <tag>
```

Parameter	Description
<ip-address>	Specifies the IPv4 address of the BGP neighbor, entered in the format A.B.C.D.
<tag>	Name of the peer-group.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Use this command to add neighbors with the same update policies to a peer group. This facilitates the updates of various policies, such as, distribute and filter lists. The peer-group is then configured easily with many of the neighbor commands. Any changes made to the peer group affect all members.

To create a peer-group use the neighbor peer-group (creating a peer-group) command on page 42.93 and then use this command to add neighbors to the group.

Example This example shows a new peer-group `group1` and the adding of a neighbor `10.10.0.63` to the group.

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor group1 peer-group
awplus(config-router)# neighbor 10.10.0.63 peer-group group1
```

Related Commands neighbor peer-group (creating a peer-group)

neighbor peer-group (creating a peer-group)

Use this command to create a peer-group.

Use the no variant of this command to disable this function

Syntax

```
neighbor <tag> peer-group
no neighbor <tag> peer-group
```

Parameter	Description
<tag>	Name of the peer-group.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Neighbors with the same update policies are grouped into peer groups. This facilitates the updates of various policies, such as, distribute and filter lists. The peer-group is then configured easily with many of the neighbor commands. Any changes made to the peer group affect all members. Use this command to create a peer-group, then use the neighbor peer-group (adding a neighbor) command on page 42.92 to add neighbors to the group.

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor group1 peer-group
```

Related Commands neighbor peer-group (adding a neighbor)

neighbor port

Use this command to specify the TCP port to which packets are sent to on a neighbor.

Syntax

```
neighbor <neighborid> port <portnum>
no neighbor <neighborid> port [<portnum>]
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<portnum>	*<0-65535>* Specifies the TCP port number.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Example

```
awplus# configure terminal
awplus(config)# router bgp 12
awplus(config-router)# neighbor 10.10.10.10 port 643
```

neighbor prefix-list

Use this command to distribute BGP neighbor information as specified in a prefix list.

Use the no variant of this command to remove an entry.

Syntax

```
neighbor <neighborid> prefix-list <listname> {in|out}
no neighbor <neighborid> prefix-list <listname> {in|out}
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<listname>	The name of an IP prefix list.	
in	Specifies that the IP prefix list applies to incoming advertisements.	
out	Specifies that the IP prefix list applies to outgoing advertisements.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Use this command to specify a prefix list for filtering BGP advertisements. Filtering by prefix list matches the prefixes of routes with those listed in the prefix list. If there is a match, the route is used. An empty prefix list permits all prefixes. If a given prefix does not match any entries of a prefix list, the route is denied access.

The router begins the search at the top of the prefix list, with the sequence number 1. Once a match or deny occurs, the router does not need to go through the rest of the prefix list. For efficiency the most common matches or denies are listed at the top.

The neighbor distribute-list command is an alternative to the neighbor prefix-list command and only one of them can be used for filtering to the same neighbor in any direction.

Example

```
awplus# configure terminal
awplus(config)# ip prefix-list list1 deny 30.0.0.0/24
awplus(config)# router bgp 12
awplus(config-router)# neighbor 10.10.10.10 prefix-list list1
in
```

Related Commands ip prefix-list

neighbor remote-as

Use this command to configure an internal or external BGP (iBGP or eBGP) peering relationship with another router.

Use the no variant of this command to remove a previously configured BGP peering relationship.

Syntax

```
neighbor <neighborid> remote-as <as-number> [global|vrf <vrf-name>]
no neighbor <neighborid> remote-as <as-number>
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<as-number>	*<1-4294967295>* Neighbor's Autonomous System (AS) number.	
global	Specify that the remote neighbor exists locally within the device, in the global routing domain	
vrf	Specify that the remote neighbor exists locally within the device, in the specified VRF instance.	
<vrf-name>	The name of the VRF instance.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage This command is used to configure iBGP and eBGP peering relationships with other neighbors. A peer-group support of this command is configured only after creating a specific peer-group. Use the no variant of this command to remove a previously configured BGP peering relationship.

The vrf and global parameters are used to create internal 'loopback' BGP connections within the device between two VRF instances. This is used to leak BGP routes between a named VRF instance and the global routing instance. This requires BGP neighbors to be configured in both the global routing instance and in the named VRF instance.

Examples To configure a BGP peering relationship with another router:

```
awplus# configure terminal
awplus(config)# router bgp 11
awplus(config-router)# neighbor 10.10.0.73 remote-as 345
```

To remove a configured BGP peering relationship from another router:

```
awplus# configure terminal
awplus(config)# router bgp 11
awplus(config-router)# no neighbor 10.10.0.73 remote-as 345
```

neighbor remove-private-AS

Use this command to remove the private Autonomous System (AS) number from outbound updates.

Use the no variant of this command to revert to default.

Syntax

```
neighbor <neighborid> remove-private-AS
no neighbor <neighborid> remove-private-AS
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Default Disabled

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage The private AS numbers range from <64512-65535>. Private AS numbers are not advertised to the Internet. This command is used with external BGP peers only. The router removes the AS numbers only if the update includes private AS numbers. If the update includes both private and public AS numbers, the system treats it as an error.

Examples

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.63 remove-private-AS

awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# no neighbor 10.10.0.63 remove-private-AS
```

neighbor restart-time

Use this command to set a different restart-time other than the global restart-time configured using the bgp graceful-restart command.

Use the no variant of this command to restore the device to its default state.

Syntax

```
neighbor <neighborid> restart-time <delay-value>
no neighbor <neighborid> restart-time <delay-value>
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<delay-value>	*<1-3600>*	Delay value in seconds.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage This command takes precedence over the restart-time value specified using the bgp graceful-restart command.

The restart-time value is the maximum time that a graceful-restart neighbor waits to come back up after a restart. The default is 120 seconds.

Make sure that the restart time specified using this command does not exceed the stalepath-time specified in the Router Configuration mode.

Examples

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 3.3.3.3 restart-time 45

awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# no neighbor 3.3.3.3 restart-time 45
```

Related Commands bgp graceful-restart

neighbor route-map

Use this command to apply a route map to incoming or outgoing routes.

Use the no variant of this command to remove a route map.

Syntax

```
neighbor <neighborid> route-map <mapname> {in|out}
no neighbor <neighborid> route-map <mapname> {in|out}
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<mapname>	Specifies name of the route-map.	
in	Specifies that the access list applies to incoming advertisements.	
out	Specifies that the access list applies to outgoing advertisements.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Use neighbor route-map command to filter updates and modify attributes. A route map is applied to inbound or outbound updates. Only the routes that pass the route map are sent or accepted in updates.

Example The following example shows the configuration of the route-map name rmap2 and then the use of this map name in the neighbor route-map command.

```
awplus# configure terminal
awplus(config)# route-map rmap2 permit 6
awplus(config-route-map)# match origin incomplete
awplus(config-route-map)# set metric 100
awplus(config-route-map)# exit
awplus(config)# router bgp 12
awplus(config-router)# neighbor 10.10.10.10 route-map rmap2
in
```

Related Commands route-map

neighbor route-reflector-client

Use this command to configure the router as a BGP route reflector and configure the specified neighbor as its client.

Use the no variant of this command to indicate that the neighbor is not a client.

Syntax

```
neighbor <neighborid> route-reflector-client
no neighbor <neighborid> route-reflector-client
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Route reflectors are a solution for the explosion of iBGP peering within an autonomous system. By route reflection the number of iBGP peers within an AS is reduced. Use the neighbor route-reflector-client command to configure the local router as the route reflector and specify neighbors as its client.

An AS can have more than one route reflector. One route reflector treats the other route reflector as another iBGP speaker.

In the following configuration, Router1 is the route reflector for clients `3.3.3.3` and `2.2.2.2`; it also has a non-client peer `6.6.6.6`:

```
Router1#
router bgp 200
neighbor 3.3.3.3 remote-as 200
neighbor 3.3.3.3 route-reflector-client
neighbor 2.2.2.2 remote-as 200
neighbor 2.2.2.2 route-reflector-client
neighbor 6.6.6.6 remote-as 200
```

Examples

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.72 route-reflector-
client
```

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# no neighbor 10.10.0.72 route-reflector-
client
```

neighbor route-server-client

Use this command to specify the peer as route server client.

Use the no variant of this command to disable this function

Syntax

```
neighbor <neighborid> route-server-client
no neighbor <neighborid> route-server-client
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode Router Configuration

Examples

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.72 route-server-client
```

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# no neighbor 10.10.0.72 route-server-
client
```

neighbor send-community

Use this command to specify that a community attribute should be sent to a BGP neighbor.

Use the no variant of this command to remove the entry. Use the extended and no parameters to remove extended communities. Specifying no other parameter with no removes standard communities only.

Syntax

```
neighbor <neighborid> send-community {both|extended|standard}
no neighbor <neighborid> send-community {both|extended|standard}
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
`both`	Sends Standard and Extended Community attributes.	
`extended`	Sends Extended Community attributes.	
`standard`	Sends Standard Community attributes.	

Default Both standard and extended community attributes are sent to a neighbor.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage This command is used to specify a community attribute to be sent to a neighbor. The community attribute groups destinations in a certain community and applies routing decisions according to those communities. On receiving community attributes the router reannounces them to the neighbor. Only when the no parameter is used with this command the community attributes are not reannounced to the neighbor.

By default, both standard and extended community attributes are sent to a neighbor. To explicitly send only the `standard` or `extended` community attribute, run the bgp config-type command on page 42.19 with the `standard` parameter, before running this command.

Example

```
awplus# configure terminal
awplus(config)# bgp config-type standard
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.72 send-community
extended
```

Related Commands bgp config-type

neighbor shutdown

Use this command to disable a peering relationship with a neighbor.

Use the no variant of this command to re-enable the neighbor.

Syntax

```
neighbor <neighborid> shutdown
no neighbor <neighborid> shutdown
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage This command shuts down any active session for the specified neighbor and clears all related routing data.

Examples

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.72 shutdown
```

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# no neighbor 10.10.0.72 shutdown
```

neighbor soft-reconfiguration inbound

Use this command to configure the switch to start storing all updates from the neighbor, without any consideration of any inward route filtering policy that might be applied to the connection with this neighbor. This is so that the full set of the neighbor's updates are available locally to be used in a soft-reconfiguration event.

Use the no variant of this command to disable this function.

Syntax

```
neighbor <neighborid> soft-reconfiguration inbound
no neighbor <neighborid> soft-reconfiguration inbound
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Use this command to store updates for inbound soft reconfiguration. Soft-reconfiguration may be used in lieu of BGP route refresh capability. Using this command enables local storage of all the received routes and their attributes. This requires additional memory. When a soft reset (inbound) is done on this neighbor, the locally stored routes are re-processed according to the inbound policy. The BGP neighbor connection is not affected.

Examples

```
awplus# configure terminal
awplus(config)# router bgp 12
awplus(config-router)# neighbor 10.10.10.10 soft-reconfiguration
inbound
```

```
awplus# configure terminal
awplus(config)# router bgp 12
awplus(config-router)# no neighbor 10.10.10.10 soft-
reconfiguration inbound
```

neighbor strict-capability-match

Use this command to close the BGP connection if the capabilities being advertised by the switch do not exactly match the capabilities being advertised by the neighbor.

Use the no variant of this command to disable this function

Syntax

```
neighbor <neighborid> strict-capability-match
no neighbor <neighborid> strict-capability-match
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router bgp 12
awplus(config-router)# neighbor 10.10.10.10 strict-capability-match
```

neighbor timers

Use this command to set the timers for a specific BGP neighbor.

Use the no variant of this command to clear the timers for a specific BGP neighbor.

Syntax

```
neighbor <neighborid> timers
   {<keepalive> <holdtime>|connect <connect>}

no neighbor <neighborid> timers [connect]
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<keepalive>	*<0-65535>* Frequency (in seconds) at which a router sends keepalive messages to its neighbor. The default is 60 seconds.	
<holdtime>	*<0-65535>* Interval (in seconds) after which, on not receiving a keepalive message, the router declares a neighbor dead. The default is 180 seconds.	
<connect>	connect *<1-65535>* Specifies the connect timer in seconds.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Keepalive messages are sent by a router to inform another router that the BGP connection between the two is still active. The keepalive interval is the period of time between each keepalive message sent by the router. The holdtime interval is the time the router waits to receive a keepalive message and if it does not receive a message for this period it declares the neighbor dead.

Examples

```
awplus# configure terminal
awplus(config)# router bgp 12
awplus(config-router)# neighbor 10.10.10.10 timers 60 120
```

```
awplus# configure terminal
awplus(config)# router bgp 12
awplus(config-router)# no neighbor 10.10.10.10 timers
```

neighbor transparent-as

Use this command to specify not to append your AS path number even if the peer is an eBGP peer.

Note this command has the same effect as invoking neighbor attribute-unchanged as-path.

Syntax `neighbor <neighborid> transparent-as`

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router bgp 12
awplus(config-router)# neighbor 10.10.10.10 transparent-as
```

Related Commands neighbor attribute-unchanged

neighbor transparent-nexthop

Use this command to keep the nexthop value of the route even if the peer is an eBGP peer.

Note this command has the same effect as invoking neighbor attribute-unchanged next-hop.

Syntax `neighbor <neighborid> transparent-nexthop`

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router bgp 12
awplus(config-router)# neighbor 10.10.10.10 transparent-nexthop
```

Related Commands neighbor attribute-unchanged

neighbor unsuppress-map

Use this command to selectively leak more-specific routes to a particular neighbor.

Use the no variant of this command to remove selectively leaked specific routes to a particular neighbor as specified previously with the neighbor unsuppress-map command.

Syntax

```
neighbor <neighborid> unsuppress-map <route-map-name>
no neighbor <neighborid> unsuppress-map <route-map-name>
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<route-map-name>	The name of the route-map used to select routes to be unsuppressed.	

Mode BGP Router Configuration or Address-Family Configuration for ipv4 unicast or for a VRF instance

Usage When the aggregate-address command is used with the summary-only option, the more-specific routes of the aggregate are suppressed to all neighbors. Use the unsuppress-map command to selectively leak more-specific routes to a particular neighbor.

Examples

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.73 unsuppress-map
mymap
```

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# address-family ipv4 unicast
awplus(config-router-af)# neighbor 10.10.0.70 unsuppress-map
mymap
```

neighbor update-source

Use this command to specify that the source IP address of BGP packets sent to the neighbor to be the IP address that is configured on the specified interface.

Use the no variant of this command to remove the IP address from the interface as the source IP address of BGP packets sent to the neighbor.

Syntax

```
neighbor <neighborid> update-source <interface>
no neighbor <neighborid> update-source
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<interface>	Specifies the local loopback interface.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Use this command in conjunction with any specified interface on the router. The local loopback interface is the interface that is most commonly used with this command. The use of local loopback interface eliminates a dependency and BGP does not have to rely on the availability of a particular interface for making BGP peer relationships.

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# neighbor 10.10.0.72 update-source myif
```

neighbor version

Use this command to configure the switch to accept only a particular BGP version.

Use the no variant of this command to use the default BGP version (version 4).

Syntax

```
neighbor <neighborid> version <version>
no neighbor <neighborid> version
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<version>	{4} Specifies the BGP version number.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage By default, the system uses BGP version 4 and on request dynamically negotiates down to version 2. Using this command disables the router's version-negotiation capability and forces the router to use only a specified version with the neighbor.

Example

```
awplus# configure terminal
awplus(config)# router bgp 12
awplus(config-router)# neighbor 10.10.10.10 version 4
```

neighbor weight

Use this command to set default weights for routes from this neighbor.

Use the no variant of this command to remove a weight assignment.

Syntax

```
neighbor <neighborid> weight <weight>
no neighbor <neighborid> weight [<weight>]
```

Parameter	Description	
<neighborid>	{*<ip-address>*|*<tag>*}	
	<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.
	<tag>	Name of an existing peer-group. For information on how to create peer groups, refer to the neighbor peer-group (adding a neighbor) command on page 42.92, and neighbor remote-as command on page 42.96. When this parameter is used with a command, the command applies on all peers in the specified group.
<weight>	*<0-65535>* Specifies the weight this command assigns to the route.	

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Use this command to specify a weight value to all routes learned from a neighbor. The route with the highest weight gets preference when there are other routes on the network.

Unlike the local-preference attribute, the weight attribute is relevant only to the local router.

The weights assigned using the set weight command overrides the weights assigned using this command.

Example

```
awplus# configure terminal
awplus(config)# router bgp 12
awplus(config-router)# neighbor 10.10.10.10 weight 60
```

network (BGP)

Use this command to specify particular routes to be redistributed into the BGP routing process. A unicast network address without a mask is accepted if it falls into the natural boundary of its class. A class-boundary mask is derived if the address matches its natural class-boundary.

Note that you can specify a prefix length for the prefix being added, and you can also specify a classful network without a prefix length and an appropriate prefix length is added. Note that specifying a non-classful prefix without a prefix length results in a /32 prefix length on the route.

Use the no variant of this command to remove a network route entry.

Syntax

```
network {<ip-prefix/length>|<ip-network-addr>} [mask <network-mask>]
    [route-map <route-map-name>] [backdoor]

no network {<ip-prefix/length>|<ip-network-addr>}
    [mask <network-mask>][route-map <route-map-name>] [backdoor]
```

Parameter	Description
<ip-prefix/length>	IP network prefix and prefix length entered in dotted decimal format for the IP network prefix, then slash notation for the prefix length in the format A.B.C.D/M, e.g. 192.168.1.224/27
<ip-network-addr>	IP network prefix entered in dotted decimal format A.B.C.D, e.g. 192.168.1.224
<network-mask>	Specify a network mask in the format A.B.C.D, e.g. 255.255.255.224.
<route-map-name>	Specify the name of the route map.
`backdoor`	Specify a BGP backdoor route that is not advertised.

Mode Router Configuration and Address Family [`ipv4 unicast`] mode

Usage It does not matter how the route is arranged in the IP routing table. The route can arrive in the IP routing table by a static route, or the route can be learnt from OSPF or RIP routing.

If you configure a route-map, then that route-map will be used in filtering the network, or the route-map will be used to modify the attributes that are advertised with the route.

Example The following example illustrates a Class-A address configured as a network route. The natural Class-A network prefix mask length of 8 will be internally derived, that is, 2.0.0.0/8.

```
awplus(config)# router bgp 100
awplus(config-router)# network 2.0.0.0
```

Output Figure 42-1: Example output from the **show running-config** command after entering **network 2.0.0.0**

```
awplus#show running-config
!
router bgp 100
 network 2.0.0.0/8
!
```

Example The following example illustrates a network address which does not fall into its natural class boundary, and hence, is perceived as a host route, that is, 192.0.2.224/27.

```
awplus(config)# router bgp 100
awplus(config-router)# network 192.0.2.224 mask 255.255.255.224
```

Output Figure 42-2: Example output from the **show running-config** command after entering **network 192.0.2.224 mask 255.255.255.224**

```
awplus#show running-config
!
router bgp 100
 network 192.0.2.224/27
!
```

Example The following example is the same as the previous example for host route 192.0.2.224/7, but is entered in prefix/length format using slash notation (instead of prefix plus mask in dotted decimal format using the mask keyword before the network mask in dotted decimal format):

```
awplus(config)# router bgp 100
awplus(config-router)# network 192.0.2.224/27
```

Output Figure 42-3: Example output from the **show running-config** command after entering **network 192.0.2.224/27**

```
awplus#show running-config
!
router bgp 100
 network 192.0.2.224/27
!
```

network synchronization

Use this command to ensure the exact same static network prefix, specified through any of the network <prefix> commands, is local or has IGP reachability (in the NSM RIB) before being introduced into the BGP RIB.

Use the no variant of this command to disable this function.

Syntax

```
network synchronization
no network synchronization
```

Default Network synchronization is disabled by default.

Mode Router Configuration and Address Family [`ipv4 unicast`] mode

Examples The following example enables IGP synchronization of BGP static network routes in the Router Configuration mode.

```
awplus# configure terminal
awplus(config)# router bgp 11
awplus(config-router)# network synchronization
```

The following example enables IGP synchronization of BGP static network routes in the IPv4-Unicast address family.

```
awplus# configure terminal
awplus(config)# router bgp 11
awplus(config-router)# address-family ipv4 unicast
awplus(config-router-af)# network synchronization
```

redistribute (into BGP)

Use this command to inject routes from one routing process into a BGP routing table.

Use the no variant of this command to disable this function.

Syntax

```
redistribute {ospf|rip|connected|static} [route-map <route-map-entry-pointer>]
no redistribute {ospf|rip|connected|static} [route-map <route-map-entry-pointer>]
```

Parameter	Description
`connected`	Specifies the redistribution of connected routes.
`ospf`	Specifies the redistribution of OSFP information.
`rip`	Specifies the redistribution of RIP.
`static`	Specifies the redistribution of Static routes.
`route-map`	Route map reference.
<route-map-entry-pointer>	Pointer to route-map entries.

Mode BGP Router Configuration or BGP Router Address Family Configuration for a VRF instance

Usage Redistribution is used by routing protocols to advertise routes that are learned by some other means, such as by another routing protocol or by static routes. Since all internal routes are dumped into BGP, careful filtering is applied to make sure that only routes to be advertised reach the internet, not everything. This command allows redistribution by injecting prefixes from one routing protocol into another routing protocol.

Example The following example shows the configuration of a route-map named `rmap1`, which is then applied using the redistribute route-map command.

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 1
awplus(config-route-map)# match origin incomplete
awplus(config-route-map)# set metric 100
awplus(config-route-map)# exit
awplus(config)# router bgp 12
awplus(config-router)# redistribute ospf route-map rmap1
```

To apply the above example to a specific VRF instance named `blue`, use the following commands:

```
awplus(config)# router bgp 12
awplus(config-router)# address-family ipv4 vrf blue
awplus(config-router-af)# redistribute ospf route-map rmap1
```

restart bgp graceful

Use this command to force the switch to perform a graceful BGP restart.

Syntax

```
restart bgp graceful
```

Mode

Privileged Exec

Usage

Before using this command, BGP graceful-restart capabilities must be enabled within the router BGP (bgp graceful-restart command on page 42.26), and each neighbor configured on the device should be set to advertise its graceful-restart capability (neighbor capability graceful-restart command on page 42.73). The neighbor devices also need to have BGP graceful-restart capabilities enabled (bgp graceful-restart command on page 42.26).

This command stops the whole BGP process and makes the switch retain the BGP routes and mark them as stale. Receiving BGP speakers, retain and mark as stale all BGP routes received from the restarting speaker for all the address families received in the Graceful Restart Capability exchange.

When a restart bgp graceful command is issued, the BGP configuration is reloaded from the last saved configuration. Ensure you first issue a copy running-config startup-config.

Example

```
awplus# restart bgp graceful
```

Related Commands

bgp graceful-restart
neighbor capability graceful-restart
restart bgp graceful

router bgp

Use this command to configure a BGP routing process, specifying the 32-bit Autonomous System (AS) number.

Use the no variant of this command to disable a BGP routing process, specifying the 32-bit AS number.

Syntax

```
router bgp <asn>
no router bgp <asn>
```

Parameter	Description
<asn>	*<1-4294967295>* Specifies the 32-bit Autonomous System (AS) number.

Mode Global Configuration

Usage The router bgp command enables a BGP routing process, so you can set up a route server.

```
router bgp 1
    neighbor 10.0.0.1 remote-as 2
    neighbor 10.0.0.2 remote-as 3
     !
  router bgp 2
    neighbor 10.0.0.3 remote-as 4
    neighbor 10.0.0.4 remote-as 5
```

Examples

```
awplus# configure terminal
awplus(config)# router bgp 12
awplus(config-router)#
```

```
awplus# configure terminal
awplus(config)# no router bgp 12
awplus(config)#
```

Related Commands router bgp view

router bgp view

Use this command to create a named BGP view. BGP views can have the same or different 32-bit Autonomous System (AS) number. BGP view is only for exchanging BGP routing information.

Use the no variant of this command to disable a named BGP view.

Syntax

```
router bgp <asn> view <view-name>
no router bgp <asn> view <view-name>
```

Parameter	Description
<asn>	<1-4294967295> Specifies the 32-bit Autonomous System (AS) number.
<view-name>	Specifies BGP view name.

Mode Global Configuration

Usage Specify bgp multiple-instance before applying router bgp view so you can setup a route server:

```
router bgp 1 view 1
      neighbor 10.0.0.1 remote-as 2
      neighbor 10.0.0.2 remote-as 3
     !
     router bgp 2 view 2
      neighbor 10.0.0.3 remote-as 4
      neighbor 10.0.0.4 remote-as 5
```

If you have enabled bgp with the router bgp command you must disable bgp with the no router bgp command before you can specify bgp multiple-instance.

Example

```
awplus# configure terminal
awplus(config)# bgp multiple-instance
awplus(config)# router bgp 12 view bgp12
awplus(config-router)#

awplus# configure terminal
awplus(config)# bgp multiple-instance
awplus(config)# no router bgp 12 view bgp12
awplus(config)#
```

Related Commands

bgp multiple-instance
clear bgp view
clear ip bgp view
router bgp

show ip bgp view
show ip bgp view summary
show ip bgp view neighbors

show bgp nexthop-tracking

Use this command to display BGP nexthop-tracking status.

Syntax `show bgp nexthop-tracking`

Mode User Exec and Privileged Exec

Example To display BGP nexthop-tracking status, use the command:

```
awplus# show bgp nexthop-tracking
```

Related Commands bgp nexthop-trigger-count
show bgp nexthop-tree-details

show bgp nexthop-tree-details

Use this command to display BGP nexthop-tree-details.

Syntax `show bgp nexthop-tree-details`

Mode User Exec and Privileged Exec

Example To display BGP nexthop-tree-details, use the command:

```
awplus# show bgp nexthop-tree-details
```

Related Commands show bgp nexthop-tracking

show bgp memory maxallocation

This command displays the maximum percentage of total memory that is allocated to BGP processes.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show bgp memory maxallocation`

Mode Privileged Exec

Example To display the maximum amount of memory allocated for BGP processes, use the command:

```
awplus# show bgp memory maxallocation
```

Output Figure 42-4: Example output from the **show bgp memory maxallocation** command

```
BGP maximum RAM allocation is 100%
```

show debugging bgp

Use this command to display the BGP debugging option set.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show debugging bgp
```

Mode

User Exec and Privileged Exec

Example

```
awplus# show debugging bgp
```

Output

Figure 42-5: Example output from the **show debugging bgp** command

```
BGP debugging status:
  BGP debugging is on
  BGP events debugging is on
  BGP updates debugging is on
  BGP fsm debugging is on
```

Related Commands

debug bgp

show ip bgp

Use this command to display BGP network information.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp [global|vrf <vrf-name>] [<ipaddr>|<ipaddr/m>]`

Parameter	Description
<ipaddr> *<ipaddr/m>*	Specifies the IPv4 address and optional prefix mask length.
<prefix>	`unicast`
`unicast`	Specifies a IPv4 unicast address family. This is the default option. Configures parameters relating to the BGP exchange of routes to unicast destinations.
`global`	When VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.

Mode User Exec and Privileged Exec

Default Unicast is the default IPv4 address family.

Example

```
awplus# show ip bgp 10.10.1.34/24
```

Output Figure 42-6: Example output from the **show ip bgp** command

```
BGP table version is 7, local router ID is 80.80.80.80
Status codes: s suppressed, d damped, h history, * valid, >
best, i - internal, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight
Path
S>i10.70.0.0/24     192.10.23.67             0    100      0 ?
S>i30.30.30.30/32   192.10.23.67             0    100      0 ?
S>i63.63.63.1/32    192.10.23.67             0    100      0 ?
S>i67.67.67.67/32   192.10.23.67             0    100      0 ?
S>i172.22.10.0/24   192.10.23.67             0    100      0 ?
S>i192.10.21.0      192.10.23.67             0    100      0 ?
S>i192.10.23.0      192.10.23.67             0    100      0 ?

Total number of prefixes 7
```

show ip bgp attribute-info

Use this command to show internal attribute hash information.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp attribute-info`

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp attribute-info
```

Output Figure 42-7: Example output from the **show ip bgp attribute-info** command

```
attr[1] nexthop 0.0.0.0
attr[1] nexthop 10.10.10.10
attr[1] nexthop 10.10.10.50
```

show ip bgp cidr-only

Use this command to display routes with non-natural network masks.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip bgp [unicast] cidr-only
show ip bgp [global|vrf <vrf-name>] cidr-only
```

Parameter	Description
`global`	When VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
`<vrf-name>`	The name of the VRF instance.
`unicast`	Specifies a IPv4 unicast address family. This is the default option. Configures parameters relating to the BGP exchange of routes to unicast destinations.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp cidr-only
awplus# show ip bgp vrf red cidr-only
```

Output Figure 42-8: Example output from the **show ip bgp cidr-only** command

```
BGP table version is 0, local router ID is 10.10.10.50
Status codes: s suppressed, d damped, h history, p stale, *
valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network          Next Hop            Metric LocPrf Weight
Path
*> 3.3.3.0/24       10.10.10.10                              0 11
i
*> 6.6.6.0/24       0.0.0.0                              32768 i
Total number of prefixes 2
```

show ip bgp community

Use this command to display routes that match specified communities from a BGP instance.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

You may use any combination and repetition of parameters listed in the <*type*> placeholder.

Syntax `show ip bgp community [global|vrf <vrf-name>] [<type>] [exact-match]`

Parameter	Description	
`global`	When VRF-Lite is configured, apply the command to the global routing and forwarding table.	
`vrf`	Apply the command to the specified VRF instance.	
<vrf-name>	The name of the VRF instance.	
<type>	{ [*AA:NN*][local-AS][no-advertise][no-export]}	
	AA:NN	Specifies the Autonomous System (AS) community number, in AA:NN format.
	`local-AS`	Do not send outside local Autonomous Systems (well-known community).
	`no-advertise`	Do not advertise to any peer (well-known community).
	`no-export`	Do not export to next AS (well-known community).
`exact-match`	Specifies that the exact match of the communities is displayed. This optional parameter cannot be repeated.	

Mode User Exec and Privileged Exec

Examples Note that the AS numbers shown are examples only.

```
awplus# show ip bgp community 64497:64499 exact-match

awplus# show ip bgp community 64497:64499 64500:64501
        exact-match

awplus# show ip bgp community 64497:64499 64500:64501
        no-advertise 64510:64511

awplus# show ip bgp community no-advertise no-advertise
        no-advertise exact-match

awplus# show ip bgp community no-export 64510:64511
        no-advertise local-AS no-export

awplus# show ip bgp community no-export 64510:64511
        no-advertise 64497:64499 64500:64501 no-export

awplus# show ip bgp community no-export 64497:64499
        no-advertise local-AS no-export
```

```
awplus# show ip bgp vrf red no-export
awplus# show ip bgp global 65500:2 65500:3 exact-match
```

Related Commands set community

show ip bgp community-info

Use this command to list all BGP community information.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp community-info`

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp community-info
```

show ip bgp community-list

Use this command to show routes that match the given community-list from a BGP instance.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip bgp community-list [global|vrf <vrf-name>] <listname>
    [exact-match]
```

Parameter	Description
`global`	When VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
`<vrf-name>`	The name of the VRF instance.
`<listname>`	Specifies the community list name.
`exact-match`	Displays only routes that have exactly the same specified communities.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp community-list mylist exact-match

awplus# show ip bgp vrf red community-list myCommunity

awplus# show ip bgp global community-list myExactCommunity
        exact-match
```

show ip bgp dampening

Use this command to show dampened routes from a BGP instance.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip bgp [unicast] dampening {dampened-paths|flap-statistics|
   parameters}
show ip bgp [global|vrf <vrf-name>] dampening {dampened-paths|flap-
   statistics|parameters}
```

Parameter	Description
`global`	When VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
`<vrf-name>`	The name of the VRF instance.
`dampened-paths`	Display paths suppressed due to dampening.
`flap-statistics`	Display flap statistics of routes.
`parameters`	Display details of configured dampening parameters.
`unicast`	Specifies a IPv4 unicast address family. This is the default option. Configures parameters relating to the BGP exchange of routes to unicast destinations.

Mode User Exec and Privileged Exec

Usage Enable BGP dampening to maintain dampened-path information in memory.

Example

```
awplus# show ip bgp dampening dampened-paths
awplus# show ip bgp vrf red dampening dampened-paths
awplus# show ip bgp global dampening flap-statistics
```

Output Figure 42-9: Example output from the **show ip bgp dampening** command

```
dampening 15 750 2000 60 15
 Reachability Half-Life time    : 15 min
 Reuse penalty                  : 750
 Suppress penalty               : 2000
 Max suppress time              : 60 min
 Un-reachability Half-Life time : 15 min
 Max penalty (ceil)             : 11999
 Min penalty (floor)            : 375
```

The following example output shows that the internal route (`i`), has flapped 3 times and is now categorized as history (`h`).

Figure 42-10: Example output from the **show ip bgp dampening flap-statistics** command

```
awplus# show ip bgp dampening flap-statistics
BGP table version is 1, local router ID is 30.30.30.77
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,S
Stale
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network          From            Flaps  Duration  Reuse    Path
 hi1.1.1.0/24       10.100.0.62        3   00:01:20            i
```

The following example output shows a dampened route in the `1.1.1.0/24` network.

Figure 42-11: Example output from the **show ip bgp dampening dampened-path** command

```
awplus# show ip bgp dampening dampened-paths
BGP table version is 1, local router ID is 30.30.30.77
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,S
Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

     Network          From            Reuse     Path
 di 1.1.1.0/24       10.100.0.62     00:35:10     i

Total number of prefixes 1
```

show ip bgp filter-list

Use this command to display routes conforming to the filter-list.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip bgp [unicast] filter-list <listname>
show ip bgp [global|vrf <vrf-name>] filter-list <listname>
```

Parameter	Description
`global`	When VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.
<listname>	Specifies the regular-expression access list name.
`unicast`	Specifies a IPv4 unicast address family. This is the default option. Configures parameters relating to the BGP exchange of routes to unicast destinations.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp filter-list mylist
awplus# show ip bgp unicast filter-list atl
awplus# show ip bgp vrf red filter-list mylist
```

show ip bgp inconsistent-as

Use this command to display routes with inconsistent AS Paths.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip bgp [unicast] inconsistent-as
show ip bgp [global|vrf <vrf-name>] inconsistent-as
```

Parameter	Description
`global`	When VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
`<vrf-name>`	The name of the VRF instance.
`unicast`	Specifies a IPv4 unicast address family. This is the default option. Configures parameters relating to the BGP exchange of routes to unicast destinations.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp inconsistent-as
awplus# show ip bgp ipv4 unicast inconsistent-as
awplus# show ip bgp global inconsistent-as
```

show ip bgp longer-prefixes

Use this command to display the route of the local BGP routing table for a specific prefix with a specific mask or for any prefix having a longer mask than the one specified.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip bgp [unicast] <ip-address/m> longer-prefixes
show ip bgp [global|vrf <vrf-name>] <ip-address/m> longer-prefixes
```

Parameter	Description
`global`	When VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
`<vrf-name>`	The name of the VRF instance.
`unicast`	Specifies a IPv4 unicast address family. This is the default option. Configures parameters relating to the BGP exchange of routes to unicast destinations.
`<ip-address/m>`	Neighbor's IP address and subnet mask, entered in the form A.B.C.D/M. Where M is the subnet mask length.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp 10.10.0.10/24 longer-prefixes
awplus# show ip bgp vrf red 172.16.4.0/24
awplus# show ip bgp global 172.16.0.0/16 longer-prefixes
```

show ip bgp neighbors

Use this command to display detailed information on peering connections to all BGP neighbors.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip bgp [global|vrf <vrf-name>|unicast] neighbors [<ipaddr>
   [advertised-routes|<received>|received-routes|routes]]
```

Parameter	Description
<ipaddr>	Specifies the IPv4 address.
advertised-routes	Displays the routes advertised to a BGP neighbor.
<received>	Displays all received routes, both accepted and rejected.
prefix-filter	Displays the prefix-list filter.
received-routes	Displays the received routes from neighbor. To display all the received routes from the neighbor, configure the BGP soft reconfigure first.
routes	Displays all accepted routes learned from neighbors.
unicast	Specifies a IPv4 unicast address family. This is the default option. Configures parameters relating to the BGP exchange of routes to unicast destinations.
global	When VRF-Lite is configured, apply the command to the global routing and forwarding table.
vrf	Apply the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp neighbors 1.2.3.4 received-routes

awplus# show ip bgp ipv4 unicast neighbors 7.67.7.0 received
       prefix-filter
```

Output Figure 42-12: Example output from the **show ip bgp neighbors** command

```
awplus#show ip bgp neighbors
BGP neighbor is 192.10.23.67, remote AS 1, local AS 1, internal
link
  BGP version 4, remote router ID 172.22.10.10
  BGP state = Established, up for 00:00:22
  Last read 00:00:22, hold time is 240, keepalive interval is 60
seconds
  Neighbor capabilities:
    Route refresh: advertised and received (old and new)
    Address family IPv4 Unicast: advertised and received
  Received 3 messages, 0 notifications, 0 in queue
  Sent 3 messages, 0 notifications, 0 in queue
  Route refresh request: received 0, sent 0
  Minimum time between advertisement runs is 5 seconds

 For address family: IPv4 Unicast
  BGP table version 1, neighbor version 1
  Index 1, Offset 0, Mask 0x2
  AF-dependant capabilities:
    Graceful restart: advertised, received

  Community attribute sent to this neighbor (both)
  0 accepted prefixes
  0 announced prefixes

 Connections established 1; dropped 0
 Graceful-restart Status:
  Remote restart-time is 120 sec

Local host: 192.10.23.80, Local port: 33837
Foreign host: 192.10.23.67, Foreign port: 179
Nexthop: 192.10.23.80
Nexthop global: 1111::80
Nexthop local: fe80::203:47ff:fe97:bb79
BGP connection: non shared network
```

show ip bgp neighbors connection-retrytime

Use this command to display the configured connection-retrytime value of the peer at the session establishment time with the neighbor.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp neighbors {<ip-address>} connection-retrytime`

Parameter	Description
<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp neighbors 10.11.4.26 connection-retrytime
```

show ip bgp neighbors hold-time

Use this command to display the configured holdtime value of the peer at the session establishment time with the neighbor.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp neighbors {<ip-address>} hold-time`

Parameter	Description
<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp neighbors 10.11.4.26 hold-time
```

show ip bgp neighbors keepalive

Use this command to display the number of keepalive messages sent to the neighbor from the peer throughout the session.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp neighbors {<ip-address>} keepalive`

Parameter	Description
<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp neighbors 10.11.4.26 keepalive
```

show ip bgp neighbors keepalive-interval

Use this command to display the configured keepalive-interval value of the peer at the session establishment time with the neighbor.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp neighbors {<ip-address>} keepalive-interval`

Parameter	Description
<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp neighbors 10.11.4.26 keepalive-interval
```

show ip bgp neighbors notification

Use this command to display the number of notification messages sent to the neighbor from the peer throughout the session.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp neighbors {<ip-address>} notification`

Parameter	Description
<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp neighbors 10.11.4.26 notification
```

show ip bgp neighbors open

Use this command to display the number of open messages sent to the neighbor from the peer throughout the session.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp neighbors {<ip-address>} open`

Parameter	Description
<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp neighbors 10.11.4.26 open
```

show ip bgp neighbors rcvd-msgs

Use this command to display the number of messages received by the neighbor from the peer throughout the session.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp neighbors {<ip-address>} rcvd-msgs`

Parameter	Description
<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp neighbors 10.11.4.26 rcvd-msgs
```

show ip bgp neighbors sent-msgs

Use this command to display the number of messages sent to the neighbor from the peer throughout the session.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp neighbors {<ip-address>} sent-msgs`

Parameter	Description
<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp neighbors 10.11.4.26 sent-msgs
```

show ip bgp neighbors update

Use this command to display the number of update messages sent to the neighbor from the peer throughout the session.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp neighbors {<ip-address>} update`

Parameter	Description
<ip-address>	The address of an IPv4 BGP neighbor, in dotted decimal notation A.B.C.D.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp neighbors 10.11.4.26 update
```

show ip bgp paths

Use this command to display BGP path information.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp [unicast] paths`

Parameter	Description
`unicast`	Specifies a IPv4 unicast address family. This is the default option. Configures parameters relating to the BGP exchange of routes to unicast destinations.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp paths
```

show ip bgp prefix-list

Use this command to display routes matching the prefix-list.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip bgp [unicast] prefix-list <list>
show ip bgp [global|vrf <vrf-name>] prefix-list <list>
```

Parameter	Description
`global`	When VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.
<list>	Specifies the name of the IP prefix list.
`unicast`	Specifies a IPv4 unicast address family. This is the default option. Configures parameters relating to the BGP exchange of routes to unicast destinations.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp prefix-list mylist
awplus# show ip bgp vrf red prefix-list myPrefixes
```

show ip bgp quote-regexp

Use this command to display routes matching the AS path regular expression in quotes.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp [global|vrf <vrf-name>] quote-regexp <expression>`

Parameter	Description
`global`	When VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
`<vrf-name>`	The name of the VRF instance.
`<expression>`	Specifies a regular-expression to match the BGP AS paths.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp quote-regexp myexpression
awplus# show ip bgp global quote-regexp 65550 65555
```

show ip bgp regexp

Use this command to display routes matching the AS path regular expression.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip bgp [unicast] regexp <expression>
show ip bgp [global|vrf <vrf-name>] regexp <expression>
```

Parameter	Description
`global`	When VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.
<expression>	Specifies a regular-expression to match the BGP AS paths.
`unicast`	Specifies a IPv4 unicast address family. This is the default option. Configures parameters relating to the BGP exchange of routes to unicast destinations.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp regexp myexpression
awplus# show ip bgp vrf red regexp 65550 65555
```

show ip bgp route-map

Use this command to display routes that match the specified route-map.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip bgp [unicast] route-map <route-map>
show ip bgp [global|vrf <vrf-name>] route-map <route-map>
```

Parameter	Description
`global`	When VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.
<route-map>	Specifies a route-map that is matched.
`unicast`	Specifies a IPv4 unicast address family. This is the default option. Configures parameters relating to the BGP exchange of routes to unicast destinations.

Mode User Exec and Privileged Exec

Example To show routes that match the route-map `myRouteMap` for the global routing instance, use the command:

```
awplus# show ip bgp global route-map myRouteMap
```

show ip bgp scan

Use this command to display BGP scan status.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp scan`

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp scan
```

Output Figure 42-13: Example output from the **show ip bgp scan** command

```
BGP scan is running
BGP scan interval is 60
BGP instance : AS is 11,DEFAULT
Current BGP nexthop cache:
BGP connected route:
 10.10.10.0/24
 10.10.11.0/24
```

show ip bgp summary

Use this command to display a summary of BGP neighbor status.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip bgp [unicast] summary
show ip bgp [global|vrf <vrf-name>] summary
```

Parameter	Description
`global`	When VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
`<vrf-name>`	The name of the VRF instance.
`unicast`	Specifies a IPv4 unicast address family. This is the default option. Configures parameters relating to the BGP exchange of routes to unicast destinations.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp summary
awplus# show ip bgp vrf red summary
```

Output Figure 42-14: Example output from the **show ip bgp summary** command

```
BGP router identifier 10.10.15.50, local AS number 65000
1 BGP AS-PATH entries
0 BGP community entries
Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State
PfxRcd
10.10.9.50      4 65000     460     595  0    0    0 00:17:48    3
10.10.14.51     4 100         93    1200 0    0      00:42:16
Total number of neighbors 2
```

show ip bgp view

Use this command to view the neighbors of the given instance.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp view <instance> [<ip-address>[/M]]`

Parameter	Description
<instance>	The name of the instance to display data for.
<ip-address>	IPv4 address, entered in the form A.B.C.D.
/M	The subnet mask length.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp 128 view instance1 10.10.10.0/24
```

Output Figure 42-15: Example output from the **show ip bgp view** command

```
BGP table version is 0, local router ID is 10.10.10.50
Status codes: s suppressed, d damped, h history, p stale, *
valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network          Next Hop            Metric LocPrf Weight
Path
*>i100.156.70.0/24  10.10.10.52                  0      0 i
*>i100.156.71.0/24  10.10.10.52                  0      0 i
*>i100.156.72.0/24  10.10.10.52                  0      0 i
*>i100.156.73.0/24  10.10.10.52                  0      0 i
*>i100.156.74.0/24  10.10.10.52                  0      0 i
Total number of prefixes 5
```

Related Commands show ip bgp neighbors

show ip bgp view neighbors

Use this command to view the neighbors of the given instance.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip bgp view <instance> neighbors
show ip bgp view <instance> neighbors [<ip-address>]
```

Parameter	Description
<instance>	The name of the instance to display data for.
<ip-address>	The IPv4 address of the neighbor, entered in the form A.B.C.D.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp 128 view instance1 neighbors 10.10.10.5
```

Output Figure 42-16: Example output from the **show ip bgp view neighbors** command

```
BGP neighbor is 10.10.10.52, remote AS 10, local AS 10, internal
link
  BGP version 4, remote router ID 10.10.10.52
  BGP state = Established, up for 00:03:22
  Last read 00:00:13, hold time is 90, keepalive interval 30
seconds
  Neighbor capabilities:
    Route refresh: advertised
    Address family IPv4 Unicast: advertised
  Received 8 messages, 0 notifications, 0 in queue
  Sent 8 messages, 0 notifications, 0 in queue
  Route refresh request: received 0, sent 0
  Minimum time between advertisement runs is 5 seconds
 For address family: IPv4 Unicast
  Community attribute sent to this neighbor (both)
  5 accepted prefixes
  0 announced prefixes
 Connections established 1; dropped 0
Local host: 10.10.10.50, Local port: 179
Foreign host: 10.10.10.52, Foreign port: 36950
Nexthop: 10.10.10.50
Nexthop global: fe80::280:c8ff:feb9:d268
Nexthop local: ::
BGP connection: non shared network
Read thread: on  Write thread: off
```

Related Commands show ip bgp neighbors

show ip bgp view summary

Use this command to view the summary data of neighbors of the given instance.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip bgp view <instance> [unicast] summary`

Parameter	Description
`<instance>`	The name of the instance to display data for.
`unicast`	Specifies a IPv4 unicast address family. This is the default option. Configures parameters relating to the BGP exchange of routes to unicast destinations.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip bgp 128 view instance1 neighbor 10.10.10.5
```

Output The following example shows the summary data of instance named `I2`.

Figure 42-17: Example output from the **show ip bgp view summary** command

```
BGP router identifier 10.10.10.50, local AS number 10
1 BGP AS-PATH entries
0 BGP community entries

Neighbor V  AS MsgRcvd MsgSent TblVer  InQ OutQ Up/Down  State/PfxRcd
10.10.10.52 4  10      1       2        0   0    0 00:00:07        5
Total number of neighbors 1
```

Related Commands show ip bgp neighbors

show ip community-list

Use this command to display routes that match a specified community-list name or number.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip community-list [<listnumber>|<listname>]`

Parameter	Description
<listnumber>	Specifies the community list number in the range <1-199> as specified by a previously issued ip community-list command.
<listname>	Specifies the community list name as specified by a previously issued ip community-list command.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip community-list mylist
awplus# show ip community-list 99
```

show ip extcommunity-list

Use this command to display a configured extcommunity-list.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip extcommunity-list [<1-199>|<extcommunity-listname>]`

Parameter	Description
<1-199>	Extcommunity-list number
<extcommunity-listname>	Extcommunity-list name

Mode User Exec and Privileged Exec

Example

```
awplus# show ip extcommunity-list 33
```

show ip protocols bgp

Use this command to display BGP process parameters and statistics.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip protocols bgp`

Mode User Exec and Privileged Exec

Example To display BGP process parameters and statistics, use the command:

```
awplus# show ip protocols bgp
```

Output Figure 42-18: Example output from the **show ip protocols bgp** command

```
Routing Protocol is "bgp 100"
  IGP synchronization is disabled
  Automatic route summarization is disabled
  Default local-preference applied to incoming route is 100
  Redistributing:
  Neighbor(s):
  Address AddressFamily FiltIn FiltOut DistIn DistOut RouteMapIn RouteMapOut
Weight
10.10.10.1              unicast
```

synchronization

Use this command to enable IGP synchronization of Internal BGP (iBGP) learned routes with the Internal Gateway Protocol (IGP) system in the Router Configuration mode or in the Address-Family Configuration mode.

Use the no variant of this command to disable this function.

Syntax

```
synchronization
no synchronization
```

Default IGP synchronization is disabled.

Mode Router Configuration and Address Family [`ipv4 unicast`] mode

Usage Synchronization is used when a BGP router should not advertise routes learned from iBGP neighbors, unless those routes are also present in an IGP (for example, OSPF). Synchronization may be enabled when all the routers in an autonomous system do not speak BGP, and the autonomous system is a transit for other autonomous systems. The no synchronization command is used when BGP router can advertise routes learned from its iBGP neighbors without waiting for the IGP reachability to be present.

Example The following example enables IGP synchronization of iBGP routes in Router Configuration.

```
awplus# configure terminal
awplus(config)# router bgp 11
awplus(config-router)# synchronization
```

The following example enables IGP synchronization of iBGP routes in the IPv4-Unicast address family.

```
awplus# configure terminal
awplus(config)# router bgp 11
awplus(config)# address-family ipv4 unicast
awplus(config-af)# synchronization
```

timers (BGP)

Use this command sets the BGP keepalive timer and holdtime timer values.

Use the no variant of this command to reset timers to the default.

Syntax

```
timers bgp <keepalive> <holdtime>
no timers bgp [<keepalive> <holdtime>]
```

Parameter	Description
<keepalive>	*<0-65535>* The frequency with which the keepalive messages are sent to the neighbors. The default is 30 seconds.
<holdtime>	*<0-65535>* The interval after which the neighbor is considered dead if keepalive messages are not received. The default holdtime value is 90 seconds.

Mode Router Configuration

Usage This command is used globally to set or unset the keepalive and holdtime values for all the neighbors.

Example

```
awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# timers bgp 40 120

awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# no timers bgp 30 90

awplus# configure terminal
awplus(config)# router bgp 10
awplus(config-router)# no timers bgp
```

undebug bgp

Use this command to disable BGP debugging functions.

Syntax

```
undebug bgp [all|dampening|events|filters|fsm|keepalives|nht|nsm|
   updates]
```

```
undebug all bgp
```

Parameter	Description
`all`	Disable all debugging for BGP.
`dampening`	Disable debugging for BGP dampening.
`events`	Disable debugging for BGP events.
`filters`	Disable debugging for BGP filters.
`fsm`	Disable debugging for BGP Finite State Machine (FSM).
`keepalives`	Disable debugging for BGP keepalives.
`nht`	Disable debugging for BGP NHT (Next Hop Tracking) messages.
`nsm`	Disable debugging for NSM messages.
`updates`	Disable debugging for BGP updates.

Mode Privileged Exec and Global Configuration

Example

```
awplus# undebug bgp events
awplus# undebug bgp nht
awplus# undebug bgp updates
```

Related Commands debug bgp

Chapter 43: Route Map Configuration

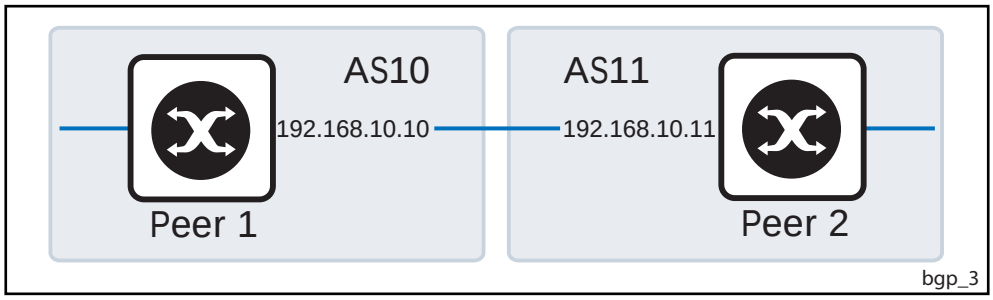
Introduction 43.2
Route-Map 43.2

Introduction

This chapter contains a basic Route Map configuration example. For details about the commands used in these examples, or the outputs from validation commands, see Chapter 44, Route Map Commands.

Route-Map

Use route-maps to filter incoming updates from a BGP peer. In this example, a prefix-list `list1` on Peer 1 is configured to deny entry of any routes with the IP address `1.1.1.0/M (M = 26,27,28)`. To test the filter, Peer 2 is configured to generate network addresses `1.1.1.0/27` and `1.1.2.0/24`. To verify, use the show ip bgp command on page 42.124 on Peer 1; it displays Peer 1 receiving updates from only `1.1.2.0/24`.



Peer 1

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`ip prefix-list prefixlist1 seq 5 deny 1.1.1.0/24 ge 26 le 28`	Create the prefix-list named `prefixlist1` as shown opposite. `prefixlist1` contains two entries. The first entry with a deny action is to not match any routes in the `1.1.1.0/24` range that have prefix lengths from `26` to `28` (inclusive). The second entry allows all other routes.
`awplus(config)#`	
`ip prefix-list prefixlist1 seq 10 permit any`	Also note the sequence number (`seq 5 seq 10)` in the prefix-list specifies the sequence for each entry.
`awplus(config)#`	
`route-map routemap1 permit 1`	Enter the route-map mode to set the match operation.
`awplus(config-route-map)#`	
`match ip address prefix-list prefixlist1`	Set the match criteria. This match criterion on this route-map entry is to match the incoming route updates against the prefix-list prefixlist1. If a route matches the permit criteria of the prefix-list prefixlist1, then packets are permitted by the route-map, since this route-map entry has a permit action. Because this is the only entry route-map, all routes that are not permitted by this entry route-map will be dropped.

Peer 1(cont.)

`awplus(config-route-map)#`	
`exit`	Exit the Route-map mode and return to Global Configuration mode.
`awplus(config)#`	
`router bgp 10`	Define the routing process. The number 10 specifies the AS number of R1.
`awplus(config-router)#`	
`neighbor 192.168.10.11 remote-as 11`	Define BGP neighbors. 192.168.10.11 is the IP address of the neighbor (Peer 2) and 11 is the neighbor's AS number.
`awplus(config-router)#`	
`neighbor 192.168.10.11 route-map routemap1 in`	The route-map is now applied as the filter for route updates that are received from the neighbor 192.168.10.11. Routes are accepted from the neighbor 192.168.10.11 if they match the permit criteria of route-map routemap1.

Peer 2

`awplus(config)#`	
`router bgp 11`	Define the routing process. The number 11 specifies the AS number of Peer 2.
`awplus(config-router)#`	
`neighbor 192.168.10.10 remote-as 10`	Define BGP neighbors. 192.168.10.10 is the IP address of the neighbor (Peer 1) and 10 is the neighbor's AS number.
`awplus(config-router)#`	
`network 1.1.1.0/27`	Specify a route to be advertised by the BGP routing process.
`awplus(config-router)#`	
`network 1.1.2.0/24`	Specify a route to be advertised by the BGP routing process.

Names of Commands Used

ip prefix-list
neighbor remote-as
route-map
match ip address
network (BGP)

Validation Commands

show ip bgp

Chapter 44: Route Map Commands

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set originator-id 44.34
set tag 44.35
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Command List

This chapter provides an alphabetical reference for route map commands. These commands can be divided into the following categories:

- route-map command, used to create a route map and/or route map entry, and to put you into route map mode
- match commands, used to determine which routes or BGP update messages the route map applies to
- set commands, used to modify matching routes or BGP update messages

match as-path

Use this command to add an autonomous system (AS) path match clause to a route map entry. Specify the AS path attribute value or values to match by specifying the name of an AS path access list. To create the AS path access list, enter Global Configuration mode and use the ip as-path access-list command.

A BGP update message matches the route map if its attributes include AS path values that match the AS path access list.

Each entry of a route map can only match against one AS path access list in one AS path match clause. If the route map entry already has an AS path match clause, entering this command replaces that match clause with the new clause.

Note that AS path access lists and route map entries both specify an action of deny or permit. The action in the AS path access list determines whether the route map checks update messages for a given AS path value. The route map action and its set clauses determine what the route map does with update messages that contain that AS path value.

Use the no variant of this command to remove the AS path match clause from a route map entry.

Syntax

```
match as-path <as-path-listname>
no match as-path [<as-path-listname>]
```

Parameter	Description
<as-path-listname>	Specifies an AS path access list name.

Mode Route-map Configuration

Usage This command is valid for BGP update messages only.

Example To add entry `34` to the route map called `myroute`, which will discard update messages if they contain the AS path values that are included in `myaccesslist`, use the commands:

```
awplus# configure terminal
awplus(config)# route-map myroute deny 34
awplus(config-route-map)# match as-path myaccesslist
```

Related Commands

ip as-path access-list
route-map
set as-path
show route-map

match community

Use this command to add a community match clause to a route map entry. Specify the community value or values to match by specifying a community list. To create the community list, enter Global Configuration mode and use the ip community-list command.

A BGP update message matches the route map if its attributes include community values that match the community list.

Each entry of a route map can only match against one community list in one community match clause. If the route map entry already has a community match clause, entering this command replaces that match clause with the new clause.

Note that community lists and route map entries both specify an action of deny or permit. The action in the community list determines whether the route map checks update messages for a given community value. The route map action and its set clauses determine what the route map does with update messages that contain that community value.

Use the no variant of this command to remove the community match clause from a route map.

Syntax

```
match community {<community-listname>|<1-99>|<100-199>}[exact-match]

no match community [<community-listname>|<1-99>|<100-199>|exact-
    match]
```

Parameter	Description
<community-listname>	The community list name or number.
<1-99>	Community list number (standard range).
<100-199>	Community list number (expanded range).
exact-match	Exact matching of communities.

Mode Route-map Configuration

Usage This command is valid for BGP update messages only.

Communities are used to group and filter routes. They are designed to provide the ability to apply policies to large numbers of routes by using match and set commands. Community lists are used to identify and filter routes by their common attributes.

Example To add entry `3` to the route map called `myroute`, which will process update messages if they contain the community values that are included in `mylist`, use the commands:

```
awplus# configure terminal
awplus(config)# route-map myroute permit 3
awplus(config-route-map)# match community mylist
```

Related Commands

ip community-list
route-map
set comm-list delete
set community
show route-map

match interface

Use this command to add an interface match clause to a route map entry. Specify the interface name to match.

A route matches the route map if its interface matches the interface name.

Each entry of a route map can only match against one interface in one interface match clause. If the route map entry already has an interface match clause, entering this command replaces that match clause with the new clause.

Use the no variant of this command to remove the interface match clause from the route map entry. Use the no variant of this command without a specified interface to remove all interfaces.

Syntax

```
match interface <interface>
no match interface [<interface>]
```

Parameter	Description
<interface>	The VLAN to match, e.g. `vlan2`.

Mode Route-map Configuration

Usage This command is valid for RIP and OSPF routes only.

Example To add entry `10` to the route map called `mymap1`, which will process routes if they use the interface `vlan1`, use the commands:

```
awplus# configure terminal
awplus(config)# route-map mymap1 permit 10
awplus(config-route-map)# match interface vlan1
```

To remove all interfaces from the route map called `mymap1`, use the commands:

```
awplus# configure terminal
awplus(config)# route-map mymap1 permit 10
awplus(config-route-map)# no match interface
```

Related Commands

match ip address
match ip next-hop
match route-type
match tag
route-map
show route-map

match ip address

Use this command to add an IP address prefix match clause to a route map entry. You can specify the prefix or prefixes to match by either:

- specifying the name of an access list. To create the access list, enter Global Configuration mode and use the access-list command.
- specifying the name of a prefix list. To create the prefix list, enter Global Configuration mode and use the ip prefix-list command.

A route matches the route map entry if the route's prefix matches the access list or prefix list.

Each entry of a route map can have at most one access list-based IP address match clause and one prefix list-based IP address match clause. If the route map entry already has one of these match clauses, entering this command replaces that match clause with the new clause.

Note that access lists, prefix lists and route map entries all specify an action of deny or permit. The action in the access list or prefix list determines whether the route map checks update messages and routes for a given prefix. The route map action and its set clauses determine what the route map does with routes that contain that prefix.

Use the no variant of this command to remove the IP address match clause from a route map entry. To remove a prefix list-based match clause you must also specify the prefix-list parameter.

Syntax

```
match ip address {<accesslistID>|prefix-list <prefix-listname>}
no match ip address [<accesslistID>]
no match ip address prefix-list <prefix-listname>
```

Parameter	Description
<accesslistID>	{*<access-list-name>*|<1-199>|<1300-2699>} The IP access list name or number.
<access-list-name>	The IP access list name.
<1-199>	The IP access list number.
<1300-2699>	The IP access list number (expanded range).
prefix-list	Use an IP prefix list to specify which prefixes to match.
<prefix-listname>	The prefix list name.

Mode Route-map Configuration

Usage The `match ip address` command specifies the IP address to be matched. If there is a match for the specified IP address, and `permit` is specified, the route is redistributed or controlled, as specified by the set action. If the match criteria are met, and `deny` is specified then the route is `not` redistributed or controlled. If the match criteria are `not` met, the route is neither accepted nor forwarded, irrespective of `permit` or `deny` specifications.

This command is valid for routes in BGP update messages, and for OSPF and RIP routes.

Examples To add entry `3` to the route map called `myroute`, which will process routes that match the ACL called `List1`, use the commands:

```
awplus# configure terminal
awplus(config)# route-map myroute permit 3
awplus(config-route-map)# match ip address List1
```

To add entry `3` to the route map called `rmap1`, which will process routes that match the prefix list called `mylist`, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# match ip address prefix-list mylist
```

Related Commands
access-list (extended numbered)
access-list (standard numbered)
ip prefix-list
route-map
show ip access-list
show route-map

match ip next-hop

Use this command to add a next-hop match clause to a route map entry. You can specify the next hop to match by either:

- specifying the name of an access list. To create the access list, enter Global Configuration mode and use the access-list command.
- specifying the name of a prefix list. To create the prefix list, enter Global Configuration mode and use the ip prefix-list command.

A route matches the route map if the route's next hop matches the access list or prefix list.

Each entry of a route map can have at most one access list-based next-hop match clause and one prefix list-based next-hop match clause. If the route map entry already has one of these match clauses, entering this command replaces that match clause with the new clause.

Note that access lists, prefix lists and route map entries all specify an action of deny or permit. The action in the access list or prefix list determines whether the route map checks update messages and routes for a given next-hop value. The route map action and its set clauses determine what the route map does with update messages and routes that contain that next hop.

Use the no variant of this command to remove the next-hop match clause from a route map entry. To remove a prefix list-based match clause you must also specify the prefix-list parameter.

Syntax

```
match ip next-hop {<accesslistID>|prefix-list <prefix-listname>}
no match ip next-hop [<accesslistID>]
no match ip next-hop prefix-list [<prefix-listname>]
```

Parameter	Description
<accesslistID>	{*<access-list-name>*|<1-199>|<1300-2699>} The IP access list name or number.
<access-list-name>	The IP access list name.
<1-199>	The IP access list number.
<1300-2699>	The IP access list number (expanded range).
prefix-list	Use an IP prefix list to specify which next hop to match.
<prefix-listname>	The prefix list name.

Mode Route-map Configuration

Usage This command is valid for BGP update messages and OSPF and RIP routes.

Examples To add entry 3 to the route map called rmap1, which will process routes whose next hop matches the ACL called mylist, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# match ip next-hop mylist
```

To add entry `3` to the route map called `mymap`, which will process routes whose next hop matches the prefix list called `list1`, use the commands:

```
awplus# configure terminal
awplus(config)# route-map mymap permit 3
awplus(config-route-map)# match ip next-hop prefix-list list1
```

Related Commands

access-list (extended numbered)
access-list (standard numbered)
ip prefix-list
route-map
show ip access-list
show ip prefix-list
show route-map

match ipv6 address

Use this command to specify the match address of route.

Use the no variant of this command to remove the `match ipv6 address` entry.

Syntax

```
match ipv6 address {<access-list-name>|prefix-list <prefix-listname>}
no match ipv6 address [<access-list-name>|prefix-list <prefix-
    listname>]
```

Parameter	Description
<access-list-name>	The name of the IPv6 access list that specifies criteria for the addresses to match. Valid only with BGP and RIPng.
<prefix-listname>	The name of the IPv6 prefix list that specifies criteria for the addresses to be matched. Valid only with BGP and RIPng.

Mode Route-map Configuration

Usage The match ipv6 address <access-list> command specifies the IPv6 address to be matched. If there is a match for the specified IPv6 address, and `permit` is specified, the route is redistributed or controlled as specified by the set action. If the match criteria are met, and `deny` is specified, the route is not redistributed or controlled. If the match criteria are not met, the route is neither accepted nor forwarded, irrespective of `permit` or `deny` specifications.

The match ipv6 address prefix-list command specifies the entries of prefix-lists to be matched. If there is a match for the specified prefix-list entries, and `permit` is specified, the route is redistributed or controlled as specified by the set action. If the match criteria are met, and `deny` is specified, the route is not redistributed or controlled. If the match criteria are not met, the route is neither accepted nor forwarded, irrespective of `permit` or `deny` specifications.

Examples

```
awplus# configure terminal
awplus(config)# route-map rmap1 deny 1
awplus(config-route-map)# match ipv6 address rmap1

awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# match ipv6 address prefix-list mylist
```

match ipv6 next-hop

Use this command to specify a next-hop address to be matched by the route-map.

Use the no variant of this command to disable this function

Syntax

```
match ipv6 next-hop {<access-list-name>|<ipv6-addr>|prefix-list
    <prefix-listname>}
```

```
no match ipv6 next-hop [<access-list-name>|<ipv6-addr>|prefix-list
    [<prefix-listname>]]
```

Parameter	Description
<access-list-name>	The name of the IPv6 access list that specifies criteria for the addresses to match.
<ipv6-addr>	The IPv6 address of the next hop. The IPv6 address uses the format X:X::X:X.
<prefix-listname>	The name of the IPv6 prefix list that specifies criteria for the addresses to be matched.

Mode Route-map Configuration

Usage The `match ipv6 next-hop` command specifies the next-hop address to be matched. If there is a match for the specified next-hop address, and `permit` is specified, the route is redistributed or controlled as specified by the set action. If the match criteria are met, and `deny` is specified, the route is not redistributed or controlled. If the match criteria are not met, the route is neither accepted nor forwarded, irrespective of `permit` or `deny` specifications.

Note This command is valid only for BGP.

Example

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# match ipv6 next-hop 2001:0db8::/32
```

match metric

Use this command to add a metric match clause to a route map entry. Specify the metric value to match.

A route matches the route map if its metric matches the route map's metric. A BGP update message matches the route map if its MED attribute value matches the route map's metric.

Each entry of a route map can only match against one metric value in one metric match clause. If the route map entry already has a metric match clause, entering this command replaces that match clause with the new clause.

Use the no variant of this command to remove the metric match clause from the route map entry.

Syntax

```
match metric <metric>
no match metric [<metric>]
```

Parameter	Description
<metric>	<*0-4294967295*> Specifies the metric value.

Mode Route-map Configuration

Usage This command is valid for BGP update messages and OSPF and RIP routes.

Example To stop entry `3` of the route map called `myroute` from processing routes with a metric of `888999`, use the commands:

```
awplus# configure terminal
awplus(config)# route-map myroute permit 3
awplus(config-route-map)# no match metric 888999
```

Related Commands

route-map
set metric
show route-map

match origin

Use this command to add an origin match clause to a route map entry. Specify the origin attribute value to match.

A BGP update message matches the route map if its origin attribute value matches the route map's origin value.

Each entry of a route map can only match against one origin in one origin match clause. If the route map entry already has an origin match clause, entering this command replaces that match clause with the new clause.

Use the no variant of this command to remove the origin match clause from the route map entry.

Syntax

```
match origin {egp|igp|incomplete}
no match origin [egp|igp|incomplete]
```

Parameter	Description
egp	Learned from an exterior gateway protocol.
igp	Learned from a local interior gateway protocol.
incomplete	Of unknown heritage, for example a static route.

Mode Route-map Configuration

Usage The origin attribute defines the origin of the path information. The egp parameter is indicated as an e in the routing table, and it indicates that the origin of the information is learned via Exterior Gateway Protocol. The igp parameter is indicated as an i in the routing table, and it indicates the origin of the path information is interior to the originating AS. The incomplete parameter is indicated as a ? in the routing table, and indicates that the origin of the path information is unknown or learned through other means. If a static route is redistributed into BGP, the origin of the route is incomplete.

The match origin command specifies the origin to be matched. If there is a match for the specified origin, and permit is specified, the route is redistributed or controlled as specified by the set action. If the match criteria are met, and deny is specified, the route is not redistributed or controlled. If the match criteria are not met, the route is neither accepted nor forwarded, irrespective of permit or deny specifications.

This command is valid for BGP update messages only.

Example To add entry 34 to the route map called "rmap1", which will drop externally-originated routes, use the commands:

```
awplus# configure terminal
awplus(config)# route-map myroute deny 34
awplus(config-route-map)# match origin egp
```

Related Commands
route-map
set origin
show route-map

match route-type

Use this command to add an external route-type match clause to a route map entry. Specify whether to match OSPF type-1 external routes or OSPF type-2 external routes.

An OSPF route matches the route map if its route type matches the route map's route type.

Each entry of a route map can only match against one route type in one match clause. If the route map entry already has a route type match clause, entering this command replaces that match clause with the new clause.

Use the no variant of this command to remove the route type match clause from the route map entry.

Syntax

```
match route-type external {type-1|type-2}
no match route-type external [type-1|type-2]
```

Parameter	Description
type-1	OSPF type-1 external routes.
type-2	OSPF type-2 external routes.

Mode Route-map Configuration

Usage Use the match route-type external command to match specific external route types. AS-external LSA is either Type-1 or Type-2. external type-1 matches only Type 1 external routes, and external type-2 matches only Type 2 external routes.

This command is valid for OSPF routes only.

Example To add entry `10` to the route map called `mymap1`, which will process type-1 external routes, use the commands:

```
awplus# configure terminal
awplus(config)# route-map mymap1 permit 10
awplus(config-route-map)# match route-type external type-1
```

Related Commands

match interface
match ip address
match ip next-hop
match tag
route-map
set metric-type
show route-map

match tag

Use this command to add a tag match clause to a route map entry. Specify the route tag value to match.

An OSPF route matches the route map if it has been tagged with the route map's tag value. Routes can be tagged through OSPF commands or through another route map's set clause.

Each entry of a route map can only match against one tag in one match clause. If the route map entry already has a tag match clause, entering this command replaces that match clause with the new clause.

Use the no variant of this command to remove the tag match clause from the route map entry.

Syntax

```
match tag <0-4294967295>
no match tag [<0-4294967295>]
```

Mode Route-map Configuration

Usage This command is valid for OSPF routes only.

Example To add entry 10 to the route map called `mymap1`, which will process routes that are tagged `100`, use the following commands:

```
awplusc# onfigure terminal
awplus(config)# route-map mymap1 permit 10
awplus(config-route-map)# match tag 100
```

Related Commands

match interface
match ip address
match ip next-hop
match route-type
route-map
set tag
show route-map

route-map

Use this command to configure a route map entry, and to specify whether the device will process or discard matching routes and BGP update messages.

The switch uses a name to identify the route map, and a sequence number to identify each entry in the route map.

The route-map command puts you into route-map configuration mode. In this mode, you can use the following:

- one or more of the match commands to create match clauses. These specify what routes or update messages match the entry.
- one or more of the set commands to create set clauses. These change the attributes of matching routes or update messages.

Use the no variant of this command to delete a route map or to delete an entry from a route map.

Syntax

```
route-map <mapname> {deny|permit} <seq>
no route-map <mapname>
no route-map <mapname> {deny|permit} <seq>
```

Parameter	Description
<mapname>	A name to identify the route map.
deny	The route map causes a routing process to discard matching routes or BGP update messages.
permit	The route map causes a routing process to use matching routes or BGP update messages.
<seq>	<1-65535> The sequence number of the entry. You can use this parameter to control the order of entries in this route map.

Mode Global Configuration

Usage Route maps allow you to control and modify routing information by filtering routes and setting route attributes. You can apply route maps when the device:

- processes BGP update messages that it has received from a peer
- prepares BGP update messages to send to peers
- redistributes routes from one routing protocol into another
- redistributes static routes into routing protocols
- uses BGP route flap dampening

When a routing protocol passes a route or update message through a route map, it checks the entries in order of their sequence numbers, starting with the lowest numbered entry.

If it finds a match on a route map with an action of permit, then it applies any set clauses and accepts the route. Having found a match, the route is not compared against any further entries of the route map.

If it finds a match on a route map with an action of deny, it will discard the matching route.

If it does not find a match, it discards the route or update message. This means that route maps end with an implicit deny entry. To permit all non-matching routes or update messages, end your route map with an entry that has an action of permit and no match clause.

Examples To enter route-map mode for entry 1 of the route map called `route1`, and then add a match and set clause to it, use the commands:

```
awplus# configure terminal
awplus(config)# route-map route1 permit 1
awplus(config-route-map)# match as-path 60
awplus(config-route-map)# set weight 70
```

Note how the prompt changes when you go into route map configuration mode.

To make the device process non-matching update messages instead of discarding them, add a command like the following one:

```
awplus(config)# route-map route1 permit 100
```

Related Commands show route-map

For BGP:
bgp dampening
neighbor default-originate
neighbor route-map
neighbor unsuppress-map
network (BGP)
redistribute (into BGP)
show ip bgp route-map

For OSPF:
default-information originate (OSPF)
redistribute (into OSPF)

For RIP:
redistribute (RIP)

set aggregator

Use this command to add an aggregator set clause to a route map entry.

When a BGP update message matches the route map entry, the device sets the update's aggregator attribute. The aggregator attribute specifies the AS and IP address of the device that performed the aggregation.

Use the no variant of this command to remove the set clause.

Syntax

```
set aggregator as <asnum> <ip-address>
no set aggregator as
```

Parameter	Description
<asnum>	The AS number of the aggregator.
<ip-address>	The IP address of the aggregator.

Mode Route-map Configuration

Usage An Autonomous System (AS) is a collection of networks under a common administration sharing a common routing strategy. It is subdivided by areas, and is assigned a unique 16-bit number. Use the set aggregator command to assign an AS number for the aggregator.

This command is valid for BGP update messages only.

Example To use entry `3` of the route map called `myroute` to set the aggregator attribute to `43 10.10.0.3` in matching update messages, use the commands:

```
awplus# configure terminal
awplus(config)# route-map myroute permit 3
awplus(config-route-map)# set aggregator as 43 10.10.0.3
```

To remove all aggregator attributes for entry `3` of the route map called `myroute`, use the commands:

```
awplus# configure terminal
awplus(config)# route-map myroute permit 3
awplus(config-route-map)# no set aggregator as
```

Related Commands route-map
show route-map

set as-path

Use this command to add an AS path set clause to a route map entry.

When a BGP update message matches the route map entry, the device prepends the specified Autonomous System Number (ASN) or ASNs to the update's AS path attribute.

The AS path attribute is a list of the autonomous systems through which the announcement for the prefix has passed. As prefixes pass between autonomous systems, each autonomous system adds its ASN to the beginning of the list. This means that the AS path attribute can be used to make routing decisions.

Use the no variant of this command to remove the set clause.

Syntax

```
set as-path prepend <1-65535> [<1-65535>]...
no set as-path prepend [<1-65535> [<1-65535>]...]
```

Parameter	Description
`prepend`	Prepends the autonomous system path.
<1-65535>	The number to prepend to the AS path. If you specify multiple ASNs, separate them with spaces.

Mode Route-map mode

Usage Use the set as-path command to specify an autonomous system path. By specifying the length of the AS-Path, the device influences the best path selection by a neighbor. Use the `prepend` parameter with this command to prepend an AS path string to routes increasing the AS path length.

This command is valid for BGP update messages only.

Example To use entry `3` of the route map called `myroute` to prepend ASN `8` and `24` to the AS path of matching update messages, use the commands:

```
awplus# configure terminal
awplus(config)# route-map myroute permit 3
awplus(config-route-map)# set as-path prepend 8 24
```

Related Commands

match as-path
route-map
show route-map

set atomic-aggregate

Use this command to add an atomic aggregate set clause to a route map entry.

When a BGP update message matches the route map entry, the device adds the atomic aggregate attribute to the update.

Use the no variant of this command to remove the set clause.

Syntax

```
set atomic-aggregate
no set atomic-aggregate
```

Mode Route-map Configuration

Usage This command is valid for BGP update messages only.

Example To use entry `3` of the route map called `rmap1` to add the atomic aggregator attribute to matching update messages, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set atomic-aggregate
```

Related Commands route-map
show route-map

set comm-list delete

Use this command to delete one or more communities from the community attribute of a BGP update message. Specify the communities to delete by specifying a community list. To create the community list, enter Global Configuration mode and use the ip community-list command.

When a BGP update message matches the route map entry, the device deletes the specified communities from the update's comm.unity attribute.

Use the no variant of this command to stop deleting the communities.

Syntax

```
set comm-list {<1-199>|<100-199>|<word>} delete
no set comm-list {<1-199>|<100-199>|<word>} delete
```

Parameter	Description
<1-99>	Standard community-list number.
<100-199>	Expanded community-list number.
<word>	Name of the Community-list.

Mode Route-map Configuration

Usage This command is valid for BGP update messages only.

Example To use entry `3` of the route map called `myroute` to delete the communities in community list `34` from matching update messages, use the commands:

```
awplus# configure terminal
awplus(config)# route-map myroute permit 3
awplus(config-route-map)# set comm-list 34 delete
```

Related Commands

ip community-list
match community
route-map
set community
show route-map

set community

Use this command to add a community set clause to a route map entry.

When a BGP update message matches the route map entry, the device takes one of the following actions:

- changes the update's community attribute to the specified value or values, or
- adds the specified community value or values to the update's community attribute, if you specify the additive parameter after specifying another parameter. or
- removes the community attribute from the update, if you specify the none parameter

Use the no variant of this command to remove the set clause.

Syntax

```
set community {[<1-65535>][AA:NN] [internet] [local-AS]
    [no-advertise] [no-export] [additive]}

no set community {[AA:NN] [internet] [local-AS] [no-advertise]
    [no-export] [additive]}

set community none

no set community none
```

Parameter	Description
<1-65535>	The AS number of the community as an integer not in AA:NN format.
AA:NN	The Autonomous System (AS) number of the community, in AA:NN format. AS numbers are assigned to the regional registries by the IANA (www.iana.org) and can be obtained from the registry in your region. AA and NN are both integers from 1 to 65535. AA is the AS number; NN is a value chosen by the ASN administrator.
`local-AS`	The community of routes that must not be advertised to external BGP peers (this includes peers in other members' Autonomous Systems inside a BGP confederation).
`internet`	The community of routes that can be advertised to all BGP peers.
`no-advertise`	The community of routes that must not be advertised to other BGP peers.
`no-export`	The community of routes that must not be advertised outside a BGP confederation boundary (a standalone Autonomous System that is not part of a confederation should be considered a confederation itself).
`none`	The device removes the community attribute from matching update messages.
`additive`	The device adds the specified community value to the update message's community attribute, instead of replacing the existing attribute. By default this parameter is not included, so the device replaces the existing attribute.

Mode Route-map Configuration

Usage This command is valid for BGP update messages only.

Examples

To use entry `3` of the route map called `rmap1` to put matching routes into the no-advertise community, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set community no-advertise
```

To use entry `3` of the route map called `rmap1` to put matching routes into several communities, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set community 10:01 23:34 12:14 no-
export
```

To use entry `3` of the route map called `rmap1` to put matching routes into a single AS community numbered `16384`, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set community 16384 no-export
```

Related Commands

match community
route-map
set aggregator
set comm-list delete
set extcommunity
show route-map

set dampening

Use this command to add a route flap dampening set clause to a route map entry.

Also use the route map by specifying it in the command bgp dampening route-map.

When a route matches the route map entry, the device enables route flap dampening for that route. If the set clause includes dampening parameter values, the device uses those values when dampening the matching route.

Use the no variant of this command to remove the set clause. This disables dampening on matching routes.

Syntax

```
set dampening

set dampening [<reachtime>]

set dampening <reachtime> [<reuse> <suppress> <maxsuppress>]
    [<unreachtime>]

no set dampening

no set dampening [<reachtime>]

no set dampening <reachtime> [<reuse> <suppress> <maxsuppress>]
    [<unreachtime>]
```

Parameter	Description
<reachtime>	<*1-45*> The time it takes, in minutes, for the route's instability penalty to halve if the route remains stable. The instability penalty is called the Figure of Merit (FoM). For example, if reachtime is 15, the FoM of a stable route halves over a 15 minute period, quarters over a 30 minute period, and so on. The default is 15 minutes.
<reuse>	<*1-20000*> The value that the instability penalty (FoM) must reach for the device to use a suppressed route again. Once a route is suppressed, it remains suppressed until its FoM falls below this threshold. Reuse must not exceed suppress. The default is 750.
<suppress>	<*1-20000*> The instability penalty (FoM) at which the route is suppressed. Suppress must be greater than or equal to reuse. If suppress is less than 1000, a route is suppressed when it becomes unreachable for the first time. The default is 2000.
<maxsuppress>	<*1-255*> A number that is multiplied by reachtime to give the maximum time in minutes for which a suppressed route must remain stable in order to become unsuppressed. The lowest maxsuppress value of 1 gives a maximum suppression time of 1 x reachtime, and the highest maxsuppress value of 255 gives a maximum suppression time of 255 x reachtime. For example, if reachtime is 15 and maxsuppress is 4, the route is unsuppressed after 60 minutes of stability even if its FoM still exceeds reuse. The default is 4.

Parameter(cont.)	Description(cont.)
<unreachtime>	*<1-45>* The time it takes, in minutes, for the route's instability penalty to halve if the route remains unstable. The default is 15 minutes.

Mode Route-map Configuration

Usage The suppress value must be greater than or equal to the reuse value.

Set the unreachability half-life time to be equal to, or greater than, reachability half-life time. The suppress-limit value must be greater than or equal to the reuse limit value.

This command is valid for BGP routes only.

Example To use entry 24 of the route map called `R1` to enable dampening of matching routes and set the dampening parameters, use the commands:

```
awplus# configure terminal
awplus(config)# route-map R1 permit 24
awplus(config-route-map)# set dampening 20 333 534 30
```

Related Commands
bgp dampening
route-map
show route-map

set extcommunity

Use this command to add an extended community set clause to a route map entry. A route map entry can have a route target extended community set clause, a site-of-origin extended community set clause, or both.

When a BGP update message matches the route map entry, the device sets the update's extended community attribute to the specified value or values.

Use the no variant of this command to remove the set clause.

Syntax

```
set extcommunity {rt|soo} <extcomm-number>
no set extcommunity {rt|soo} [<extcomm-number>]
```

Parameter	Description
`rt`	Configure a route target extended community. This consists of routers that will receive matching routes.
`soo`	Configure a site-of-origin extended community. This consists of routers that will inject matching routes into BGP.
<extcomm-number>	The extended community number, in the format AA:NN or IPADD:N.

Mode Route-map Configuration

Usage This command is valid for BGP update messages only.

Examples To use entry `3` of the route map called `rmap1` to set the route target extended community attribute to 06:01, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set extcommunity rt 06:01
```

To instead specify the extended community number in dotted decimal notation, use the command:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set extcommunity rt 0.0.0.6:01
```

To use entry `3` of the route map called `rmap1` to set the site-of-origin extended community attribute to 06:01, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set extcommunity soo 06:01
```

To instead specify the extended community number in dotted decimal notation, use the command:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set extcommunity soo 0.0.0.6:01
```

Related Commands

match community
route-map
set comm-list delete
set community
show route-map

set ip next-hop (route map)

Use this command to add a next-hop set clause to a route map entry.

When a route or BGP update message matches the route map entry, the device sets the route's next hop to the specified IP address.

Use the no variant of this command to remove the set clause.

Syntax

```
set ip next-hop <ip-address>
no set ip next-hop [<ip-address>]
```

Parameter	Description
<ip-address>	The IP address of the next hop, entered in the form A.B.C.D.

Mode Route-map Configuration

Usage Use this command to set the next-hop IP address to the routes.

This command is valid for BGP update messages, and OSPF and RIP routes.

Example To use entry 3 of the route map called `mymap` to give matching routes a next hop of 10.10.0.67, use the commands:

```
awplus# configure terminal
awplus(config)# route-map mymap permit 3
awplus(config-route-map)# set ip next-hop 10.10.0.67
```

Related Commands

match ip next-hop
route-map
show route-map

set ipv6 next-hop

Use this command to set a next hop-address.

Use the no variant of this command to delete an entry.

Syntax

```
set ipv6 next-hop {<ipv6-addr-global>|local <ipv6-addr>}
no set ipv6 next-hop [<ipv6-addr-global>|local [<ipv6-addr>]]
```

Parameter	Description
<ipv6-addr-global>	The IPv6 global address of next hop. The IPv6 address uses the format X:X::X:X.
`local`	Specifies that the address is local.
<ipv6-addr>	The IPv6 local address of next hop. The IPv6 address uses the format X:X::X:X.

Mode Route-map Configuration

Usage Use this command to set the next-hop IPv6 address to the routes.

This command is valid only for BGP.

Examples

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set ipv6 next-hop local
fe80::203:47ff:fe97:66dc
awplus(config-route-map)# no set ipv6 next-hop
```

set local-preference

This command changes the default local preference value.

The local preference indicates the BGP local preference path attribute when there are multiple paths to the same destination. The path with the higher preference is chosen.

Use this command to define the preference of a particular path. The preference is sent to all routers and access servers in the local autonomous system.

The no variant of this command reverts to the default setting.

Syntax

```
set local-preference <pref-value>
no set local-preference [<pref-value>]
```

Parameter	Description
<pref-value>	<0-4294967295> Configure local preference value. The default local preference value is 100.

Mode Route-map Configuration

Examples

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set local-preference 2345555
```

```
awplus# configure terminal
awplus(config)# router bgp 100
awplus(config-route-map)# no set local-preference
```

Related Commands For related Route Map commands:
route-map
show route-map

For related BGP commands:
bgp default local-preference
neighbor route-map

set metric

Use this command to add a metric set clause to a route map entry.

When a route or BGP update message matches the route map entry, the device takes one of the following actions:

- changes the metric (or for BGP, the MED attribute value) to the specified value, or
- adds or subtracts the specified value from the metric or MED attribute, if you specify **+** or **-** before the value (for example, to increase the metric by 2, enter +2)

Use the no variant of this command to remove the set clause.

Syntax

```
set metric {+<metric-value>|-<metric-value>|<metric-value>}
no set metric [+<metric-value>|-<metric-value> |<metric-value>]
```

Parameter	Description
+	Increase the metric or MED attribute by the specified amount.
–	Decrease the metric or MED attribute by the specified amount.
<metric-value>	<0-4294967295> The new metric or MED attribute value, or the amount by which to increase or decrease the existing value.

Mode Route-map Configuration

Usage For BGP, if you want the device to compare MED values in update messages from peers in different ASes, also enter the command bgp always-compare-med. The device always compares MED values in update messages from peers in the same AS.

This command is valid for BGP update messages, and OSPF and RIP routes.

Examples To use entry 3 of the route map called rmap1 to give matching routes a metric of 600, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set metric 600
```

To use entry 3 of the route map called rmap1 to increase the metric of matching routes by 2, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set metric +2
```

Related Commands
match metric
route-map
show route-maps

set metric-type

Use this command to add a metric-type set clause to a route map entry.

When a route matches the route map entry, the device sets its route type to the specified value.

Use the no variant of this command to remove the set clause.

Syntax

```
set metric-type {type-1|type-2}
no set metric-type [type-1|type-2]
```

Parameter	Description
`type-1`	Redistribute matching routes into OSPF as type-1 external routes.
`type-2`	Redistribute matching routes into OSPF as type-2 external routes.

Mode Route-map Configuration

Usage This command is valid for OSPF routes only.

Example To use entry `3` of the route map called `rmap1` to redistribute matching routes into OSPF as type-1 external routes, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set metric-type 1
```

Related Commands

default-information originate (OSPF)
redistribute (into OSPF)
match route-type
route-map
show route-map

set origin

Use this command to add an origin set clause to a route map entry.

When a BGP update message matches the route map entry, the device sets its origin attribute to the specified value.

Use the no variant of this command to remove the set clause.

Syntax

```
set origin {egp|igp|incomplete}
no set origin [egp|igp|incomplete]
```

Parameter	Description
`egp`	Learned from an exterior gateway protocol.
`igp`	Learned from a local interior gateway protocol.
`incomplete`	Of unknown heritage, for example a static route.

Mode Route-map Configuration

Usage This command is valid for BGP update messages only.

Example To use entry `3` of the route map called `rmap1` to give matching update messages an origin of `egp`, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set origin egp
```

Related Commands

match origin
route-map
show route-map

set originator-id

Use this command to add an originator ID set clause to a route map entry.

The originator ID is the router ID of the IBGP peer that first learned this route, either via an EBGP peer or by some other means such as importing it.

When a BGP update message matches the route map entry, the device sets its originator ID attribute to the specified value.

Use the no variant of this command to remove the set clause.

Syntax

```
set originator-id <ip-address>
no set originator-id [<ip-address>]
```

Parameter	Description
<ip-address>	The IP address of the originator, entered in the form A.B.C.D.

Mode Route-map Configuration

Usage This command is valid for BGP update messages only.

Example To use entry `3` of the route map called `rmap1` to give matching update messages an originator ID of `1.1.1.1`, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set originator-id 1.1.1.1
```

Related Commands

route-map
show route-map

set tag

Use this command to add a tag set clause to a route map entry.

When a route matches the route map entry, the device sets its tag to the specified value when it redistributes the route into OSPF.

Use the no variant of this command to remove the set clause.

Syntax

```
set tag <tag-value>
no set tag [<tag-value>]
```

Parameter	Description
<tag-value>	*<0-4294967295>* Value to tag matching routes with.

Mode Route-map Configuration

Usage This command is valid only when redistributing routes into OSPF.

Example To use entry 3 of the route map called `rmap1` to tag matching routes with the number 6, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set tag 6
```

Related Commands

default-information originate (OSPF)
redistribute (into OSPF)
match tag
route-map
show route-map

set weight

Use this command to add a weight set clause to a route map entry.

The weight value assists in best path selection of BGP routes. It is stored with the route in the BGP routing table, but is not advertised to peers. When there are multiple routes with a common destination, the device uses the route with the highest weight value.

When a route matches the route map entry, the device sets its weight to the specified value.

Use the no variant of this command to remove the set clause.

Syntax

```
set weight <weight>
no set weight [<weight>]
```

Parameter	Description
<weight>	*<0-4294967295>* The weight value.

Mode Route-map Configuration

Usage This command is valid for BGP routes only.

Example To use entry `3` of the route map called `rmap1` to give matching routes a weight of `60`, use the commands:

```
awplus# configure terminal
awplus(config)# route-map rmap1 permit 3
awplus(config-route-map)# set weight 60
```

Related Commands

route-map
show route-map

show route-map

Use this command to display information about one or all route maps.

Syntax `show route-map <map-name>`

Parameter	Description
<map-name>	A name to identify the route map.

Mode User Exec and Privileged Exec

Example To display information about the route-map named `example-map`, use the command:

```
awplus# show route-map example-map
```

Output Figure 44-1: Example output from the show route-map command

```
route-map example-map, permit, sequence 1
  Match clauses:
    ip address prefix-list example-pref
  Set clauses:
    metric 100
route-map example-map, permit, sequence 200
  Match clauses:
  Set clauses:
```

Related Commands route-map

Chapter 45: VRF-Lite Introduction and Configuration

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Introduction

This chapter describes Virtual Routing and Forwarding Lite (VRF-Lite) on the switch. For detailed descriptions of the commands used to configure VRF-Lite, see Chapter 46, VRF-Lite Commands.

VRF Software Feature Licensing

To operate the VRF-Lite feature requires a special software license. A VRF-Lite feature license key is distributed in the Advanced Layer 3 License Bundle, which enables up to 8 VRF-Lite instances to be configured.

The number of configurable VRF-Lite instances can be increased via a an additional VRF-Lite-63 license. The advanced Layer 3 License Bundle containing the VRF-Lite feature that provides for the additional VRF-Lite instances is available though the AW+ licensing web portal (http://licensing.alliedtelesis.com/).

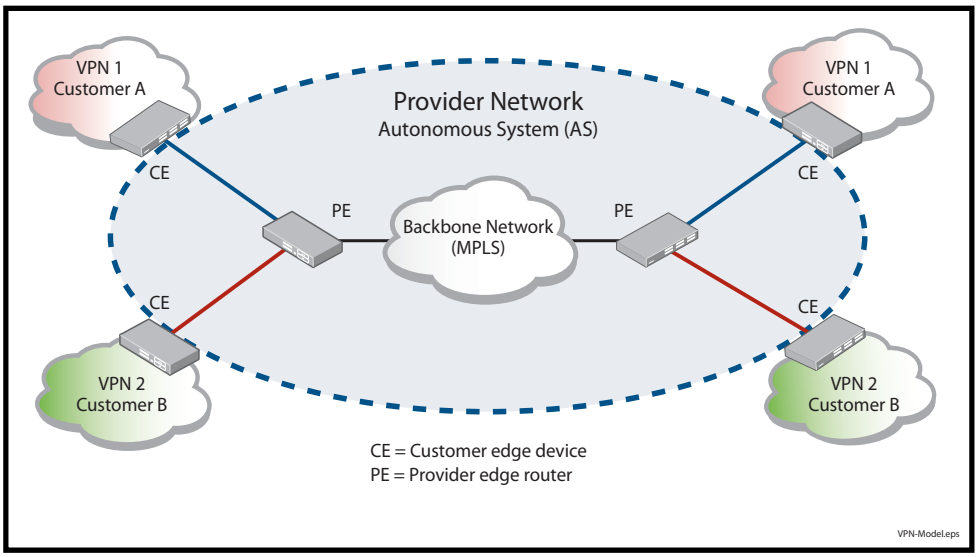
A VRF-Lite-63 license requires an Advanced Layer 3 License Bundle in order to operate.

Note Enabling multiple VRFs means that there will be more routing entries on the device system-wide. This may affect the number or routes used by BGP or OSPF specified by the license key on the device.

VRF-Lite

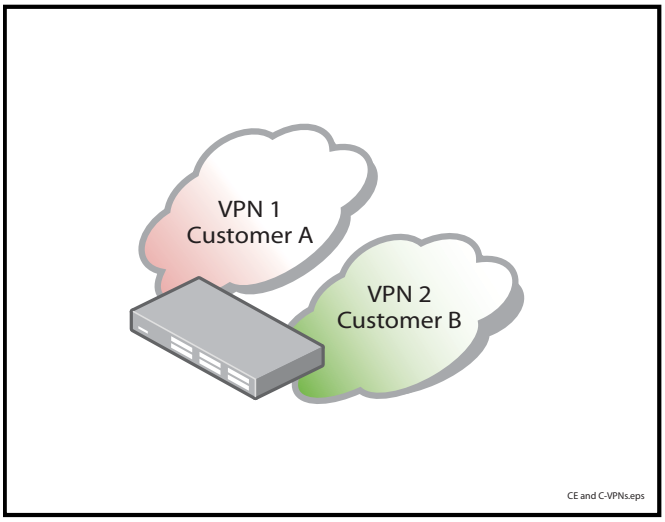
Virtual Routing and Forwarding Lite (VRF-Lite) provides a cut back (lightweight) version of the full VRF capability that is used to create large-scale Virtual Private Networks (VPNs). Figure 45-1 shows a conceptual diagram of a VRF network that utilizes a Multiprotocol Label Switching (MPLS) network to transport the backbone traffic.

Figure 45-1: VRF network - conceptual diagram



In functional terms, VRF-Lite provides multiple customer VPNs within a single device. VRF-Lite can be considered to be VRF without the backbone network component. This concept is illustrated in Figure 45-2 below:

Figure 45-2: VRF-Lite network - conceptual diagram

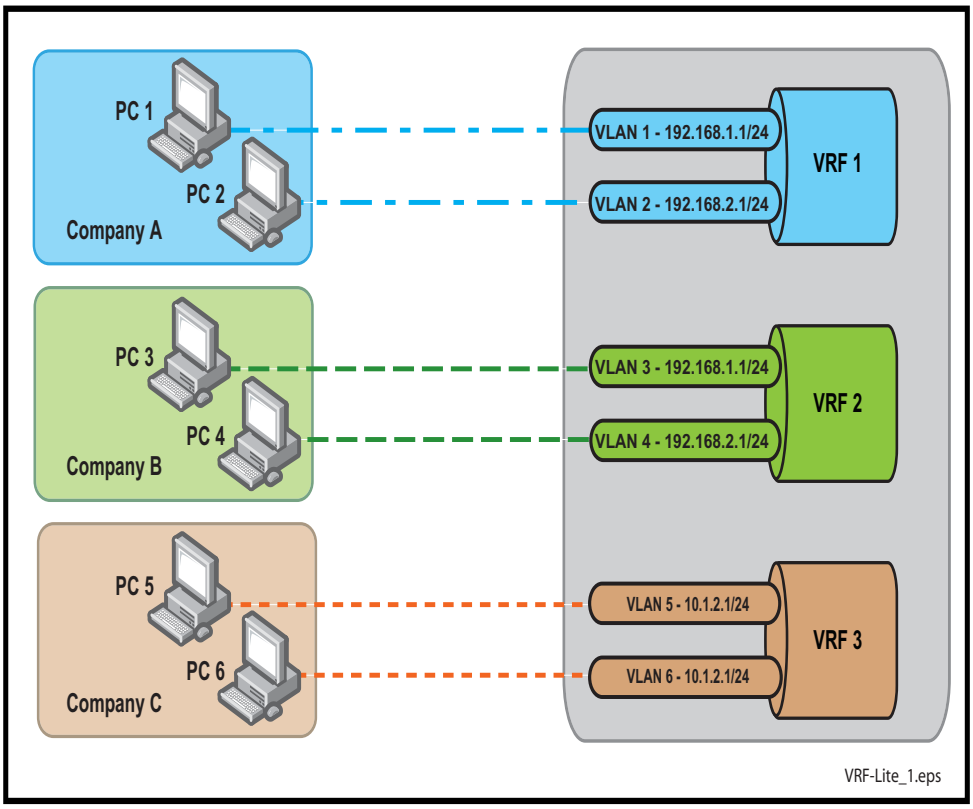


Within a single device, VRF-Lite provides the capability to operate up to 64 routing environments - called VRF instances. These are made up of 63 configurable VRF instances, plus the default Global VRF instance.

Figure 45-3 shows a device that is supporting three separate and independently operating private networks, each allocated to a particular company. Because each company's traffic is completely separate, their address ranges could overlap. For example, Company A and Company B could both use the same private address range such as 192.168.x.x.

Each interface on the device is assigned to one specific VRF instance. This enables traffic flow within VRF instances (routing domains), but prevents its flow between domains - unless specifically configured using techniques such as static routing or route leaking. Also notice that each VLAN is associated to one specific VRF instance. This association between VLANs and VRF instances is essential to the association of interfaces (and their connected devices, PCs etc) to VRF instances.

Figure 45-3: VRF-Lite switch with three company-allocated VRF instances



Conventionally, VRF uses BGP (Border Gateway Protocol) and its recently extended BGP route distinguishing features, together with MPLS. This combination enables the creation of completely separate individual networks to operate over a common physical network (VPN).

Extended VRF-Lite Support Environments

VRF-Lite also supports the following network environments:

- VLAN Tagging with Multiple VRF-Lite Instances

A single physical port, or aggregated link, can be associated with multiple VLANs via 802.1q trunking. One or more VLANs in a 802.1Q trunked link can be associated with a different VRF instance. An 802.1q trunked link can span multiple VRF instances.

- VRF-Lite is supported with VCStack (Virtual Chassis Stacking)
- Support for route limits
- User-configurable static and dynamic routing resource limits can be applied on a per-VRF basis using the commands:

  max-static-routes command on page 8.21

  max-fib-routes command on page 8.20

Supplementary Information

For more information on the above topics, refer to: How to Configure VRF-Lite at http://www.alliedtelesis.com/support/documentation.

Configuring VRF-Lite

This section provides an introduction to configuring VRF-Lite by showing simple examples of how VRF-Lite might be used. For a more in-depth explanation of VRF-Lite and more complex network configurations, refer to: How to Configure VRF-Lite at, http://www.alliedtelesis.com/support/documentation.

Creating and Partitioning VRF Instances

VRF-Lite enables your switch to maintain up to eight independent IP routing tables, plus a global routing and forwarding table, within which all IP routes are initially stored.

In VRF-Lite, an interface (a VLAN) can only be a member of either a single VRF instance, or of the global routing domain. Adding an interface to a VRF instance will automatically remove it from the Global VRF domain. Here are some short examples showing how to create VRF instances.

It is worth noting that although the VRF-Lite command-set contains commands to configure the Route Distinguisher and Address Families features, these entities are not mapped to components across the wide area network. Also, although within VRF-Lite these commands provide only a subset of their functionality for full VPN networking, they do still need to be configured in order to run VRF-Lite correctly.

Example A switch is located in a leisure complex and connects computer equipment in a cinema and a restaurant. Because the cinema and the restaurant are owned by different companies, their networks must be kept separate.

Use the following commands to create the VRF instance named cinema:

```
awplus# config terminal
awplus(config)# ip vrf cinema
```

Once you have created a VRF instance, you can assign one or more VLANs to it.

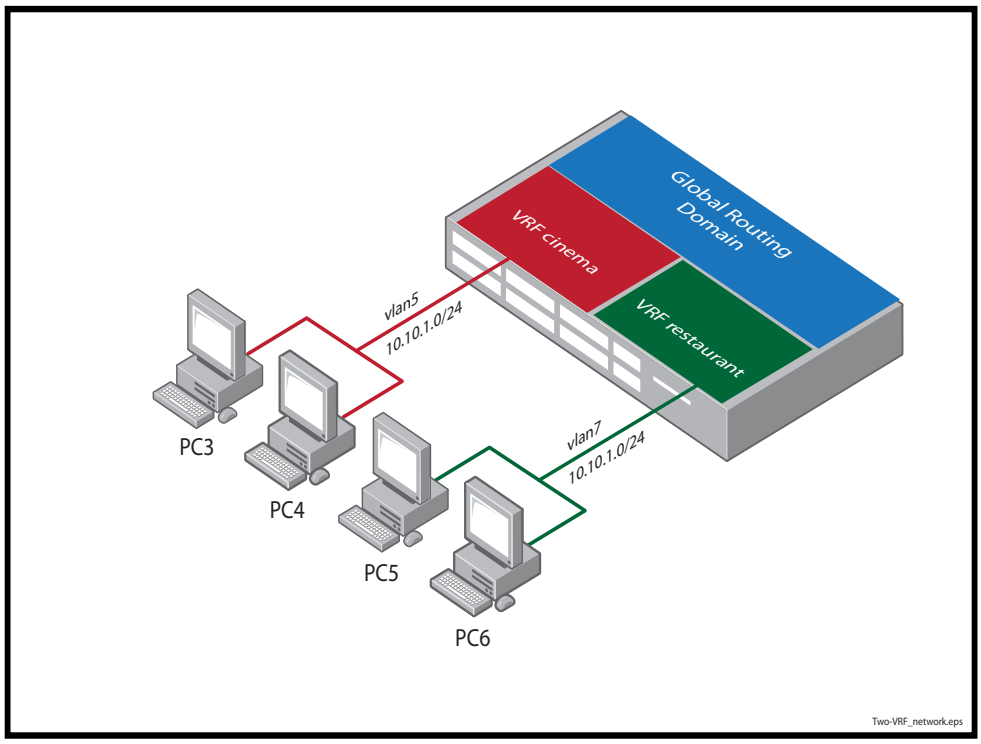
In the following example, VLAN 5 is added to the VRF instance cinema.

```
awplus# config terminal
awplus(config)# interface vlan5
awplus(config)# ip vrf forwarding cinema
```

Configuring a second VRF, named restaurant and associating this with vlan7, will result in the switch being configured to support the network shown in Figure 45-4 on page 45.7. In this configuration no inter domain routing exists. Each of the two VRF instances (cinema and restaurant) and the Global routing domain operate as completely separate and isolated routing environments.

Because of the isolation that exists between the routing instances, VRF instance cinema and VRF instance restaurant are both able to operate with the same IP subnet address ranges, 10.10.1.0/24.

Figure 45-4: Two VRF instance configuration



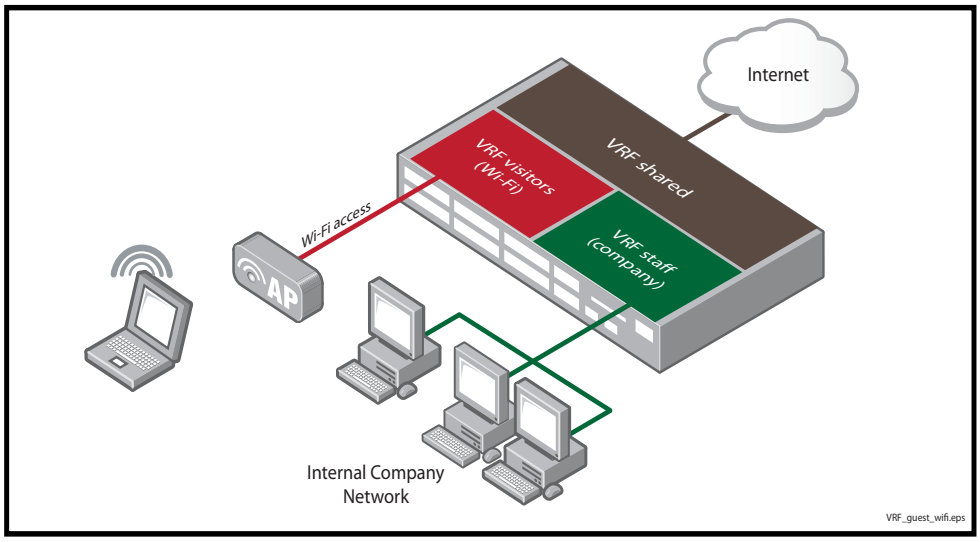
Sharing Connectivity Between VRF Instances

Occasionally you may want VRF instances to share a common connection. Here are two examples that show VRF-Lite being used to partition connectivity, whilst also permitting a degree of inter-domain connectivity.

Using VRF-Lite to share Internet connectivity

This first example is one where two VRF instances share a single Internet connection. In Figure 45-5 a company's staff and its visitors share a common Internet connection. Company employees access the Internet using their own PCs via the corporate LAN, while company visitors gain access via a Wi-Fi connection on their laptops.

Figure 45-5: Using VRF-Lite to share Internet connectivity



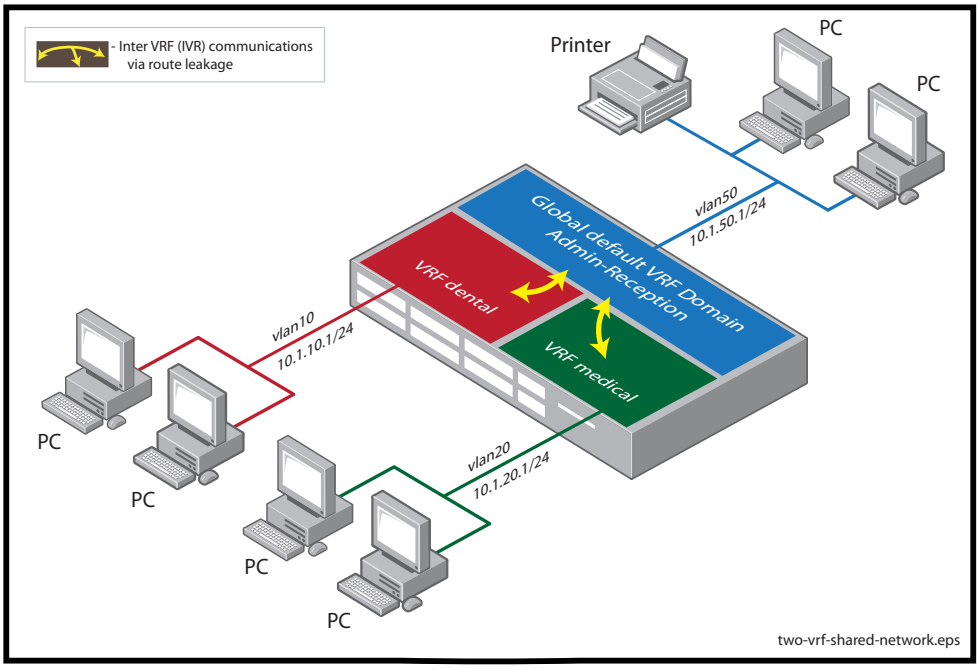
For security reasons the staff and visitor traffic must always be kept separate. The staff are able to access the network over physical (wired) connections and are collectively allocated the VRF instance name, staff. Company visitors are provided with wireless Wi-Fi access and are collectively allocated the VRF instance name, visitors. A third VRF instance named shared allows both staff and visitors to share the single internet connection.

Where duplicated addresses exist, the switch would be unable to determine the session originator of traffic returning from Internet-based sites. Therefore overlapping host addresses do not work in this configuration.

Using VRF-Lite to partially share a partitioned network

In the example, shown in Figure 45-6, a device running VRF-Lite is located in a medical centre that contains three areas, a dental clinic, a general practitioners surgery, and a central administration and reception area. For privacy reasons, patient records databases are held separately by the doctors and the dentists, each utilizing totally separate networks. The central admin area carries out functions such as appointments and billing for both clinical areas, and therefore requires some network sharing to specific devices such as an e-mail server and central printer etc. However, there is to be no direct connectivity between the networks belonging to the two clinical areas.

Figure 45-6: Practical network utilizing VRF-Lite domain partitioning



The following VRF instances, VLANs, and IP addresses are allocated.

- Central-Admin area
  - « Global Routing Domain
  - « VLAN 50 name, central-admin
  - « IP subnet 10.1.50.0/24
- Dental Clinic
  - « VRF instance, dental
  - « VLAN 10 name dental
  - « IP subnet 10.1.10.0/24
- Medical Surgery
  - « VRF instance, medical
  - « VLAN 20 name medical
  - « IP subnet 10.1.20.0/24

Here is how such a network could be configured:

Step 1: Configure the Global VRF Domain, its VLANs and IP addresses

Create the Global VRF domain	
This step is not required for the Global VRF domain, because this is always present.	
Create VLAN50 and name it “central-admin”	
`awplus(config)#`	
`vlan database`	Enter VLAN database mode.
`awplus(config-vlan)#`	
`vlan 50 name central-admin state enable`	Create VLAN 50, name it “central-admin” and enable it.
`awplus(config-vlan)#`	
`exit`	Return to Global Configuration mode.
Assign IP address 10.1.50.1/24	
`awplus(config)#`	
`interface vlan50`	Enter the Interface mode for VLAN50.
`awplus(config-if)#`	
`ip address 10.1.50.1/24`	Assign an IP address to VLAN50
`awplus(config-if)#`	
`exit`	Return to the Global Config mode
`awplus(config)#`	
`exit`	Return to the Privileged Exec mode

Step 2: Configure the dental VRF instance, its VLANs and IP addresses

`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`ip vrf dental`	Create the VRF instance called dental.
Create VLAN10 and name it “dental”	
`awplus(config)#`	
`vlan database`	Enter VLAN database mode.
`awplus(config-vlan)#`	
`vlan 10 name dental state enable`	Create VLAN 10 name it dental and enable it.
`awplus(config-vlan)#`	
`exit`	Return to Global Configuration mode.
Assign VLAN 10 to VRF dental and IP address 10.1.10.1/24	
`awplus(config)#`	
`interface vlan10`	Enter the Interface mode for VLAN10.

Step 2: Configure the dental VRF instance, its VLANs and IP addresses(cont.)

`awplus(config-if)#` `ip vrf forwarding dental`	Associate vlan10 with VRF instance dental.
`awplus(config-if)#` `ip address 10.1.10.1/24`	Assign an IP address to vlan10
`awplus(config-if)#` `exit`	Return to the Global Config mode
`awplus(config)#` `exit`	Return to the Privileged Exec mode
`awplus#` `show ip vrf`	Inspect the show output for correct configuration

Step 3: Configure the medical VRF instance, its VLANs and IP addresses

Create VRF medical and assign it an IP address	
`awplus#` `configure terminal`	Enter Global Configuration mode.
`awplus(config)#` `ip vrf medical`	Create the VRF instance called medical.
Create VLAN20 and name it “medical”	
`awplus(config)#` `vlan database`	Enter VLAN database mode.
`awplus(config-vlan)#` `vlan 20 name medical state enable`	Create VLAN 20 name it medical and enable it.
`awplus(config-vlan)#` `exit`	Return to Global Configuration mode.
Assign VLAN 20 to VRF medical and IP address 10.1.20.1/24	
`awplus(config)#` `interface vlan20`	Enter the Interface mode for VLAN20.
`awplus(config-if)#` `ip vrf forwarding medical`	Associate vlan20 with VRF instance medical.
`awplus(config-if)#` `ip address 10.1.20.1/24`	Assign an IP address to VLAN20
`awplus(config-if)#` `exit`	Return to the Global Config mode
`awplus(config)#` `exit`	Return to the Privileged Exec mode
`awplus#` `show ip vrf`	Inspect the show output for correct configuration

Step 4: Configure static and default routes

For more information on creating static routes see the section "Inter-VRF Routing" on page 45.13.

Create a default route from the dental VRF domain to the central-admin global routing domain.

```
awplus(config)#
ip route vrf dental 0.0.0.0/0 vlan50
```
Create default route.

Create a default route from the medical VRF domain to the central-admin global routing domain

```
awplus(config)#
ip route vrf medical 0.0.0.0/0 vlan50
```
Create default route.

Create a default route to send 10.1.10.0/24 traffic from the central-admin network, to the dental network

```
awplus(config)#
ip route 10.1.10.0/24 vlan10
```
Create default route.

Create a default route to send 10.1.20.0/24 traffic from the central-admin network to the medical network

```
awplus(config)#
ip route 10.1.20.0/24 vlan20
```
Create default route.

Note The static routes set up in the above table only permit traffic flow between the central-admin area and each practice area. Traffic between the dental and medical areas remains blocked.

Intra-VRF Routing

Each VRF instance operates as a separate router, and therefore intra-VRF routing occurs in the same way as it does in a standard router.

For each VRF instance, the switch maintains a table of the current best routes to destinations - the routes that the switch uses for intra-VRF routing - which is called a Forwarding Information Base. Any static or connected routes you configure are automatically added to the instance's FIB.

If you configure routing protocols for a VRF instance, the switch also maintains Routing Information Bases (RIBs) for that instance. RIBs contain the routes from the routing protocols and are a source of routes for populating the instance's FIB.

A router creates and populates a RIB when you configure a routing protocol. Similarly, VRF lite creates and populates a RIB when you configure a routing protocol and associate it with a VRF instance.

Inter-VRF Routing

In some circumstances you may want to allow traffic between two interfaces that are located in different VRF instances. A common reason is to utilize shared network equipment or resources, such as an Internet connection or - as in the medical centre example - for separate organizations to share resources with a central admin area.

Inter-VRF routing can be achieved by either statically, or dynamically, taking a route entry and its next-hop interface from one VRF, and adding it into the routing table of another. A dynamic inter-VRF route can be added by using the BGP route import/export feature. A static inter-VRF route can be added by a user command. For more information on static routing, see "Static Inter-VRF Routing" on page 45.14.

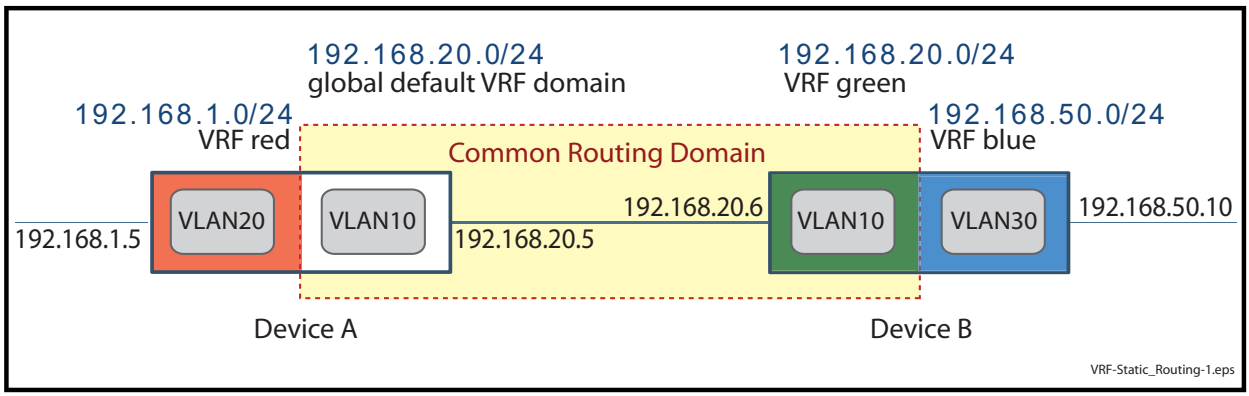
Static and dynamic inter-VRF communication can be applied simultaneously or separately. Dynamic inter-VRF communication is achieved using BGP. Routing protocols such as OSPF, and RIP cannot be used to achieve inter-VRF communication.

Note the difference between Inter-VRF routing (described above) and Intra-VRF routing. Inter-VRF routing is the process of transferring routes between different VRF instances within the switch (or router); whereas Intra VRF routing is the process of transferring routes between a specific VRF instance on the switch and other routers that share the same routing instance (or routing domain).

Static Inter-VRF Routing

Static inter-VRF routing (using VRF-Lite) involves creating static routes between VRF instances on the same device. Figure 45-7 illustrates how static routing can be applied to achieve inter-VRF communication. Note that although each of the following steps creates a valid static route, creating too many inter-domain static routes may begin to defeat the purpose of using isolated VRF instances.

Figure 45-7: Inter-VRF communication using static routes



Configuring inter-VRF static routes with VRF-Lite

Static routes on Switch A	Static routes on Switch B
ip route vrf red 192.168.20.0/24 vlan10 This creates an inter-domain static route from the source vrf red, to the IP subnet 192.168.20.0/24 via vlan10, which is in the global VRF domain. See Footnote 1.	**ip route vrf blue 192.168.20.0/24 vlan10** This creates an inter-domain static route from the source vrf blue, to the IP subnet 192.168.20.0/24 via vlan10. See Footnote 1.
ip route 192.168.1.0/24 vlan20 This creates an inter-domain static route from the source global VRF domain, to the subnet 192.168.1.0/24 via vlan20. See Footnote 1.	**ip route vrf green 192.168.50.0/24 vlan30** This creates an inter-domain static route from the source vrf green, to the subnet 192.168.50.0/24 via vlan30. See Footnote 1.
ip route vrf red 192.168.50.0/24 192.168.20.6 vlan10 This creates an inter-domain static route from the source vrf red, to 192.168.50.0/24 with a next hop of 192.168.20.6 (egressing) via vlan10. See Footnote 1.	**ip route vrf blue 192.168.1.0/24 192.168.20.5 vlan10** This creates an inter-domain static route from the source vrf blue, to 192.168.1.0/24 with a next hop of 192.168.20.5 (egressing) via vlan10. See Footnote 1.
ip route 192.168.50.0/24 192.168.20.6 This creates a static route from the global VRF domain, to IP subnet 192.168.50.0/24 (VRF blue via switch B) with a next hop of 192.168.20.6. See Footnote 2.	**ip route vrf green 192.168.1.0/24 192.168.20.5** This creates a static route from the source vrf green, to 192.168.1.0/24 with a next hop of 192.168.20.5. See Footnote 2.

Footnotes

1. Stating the target (egressing) VLAN is required when configuring static routes between VRF instances (inter-domain routing).
2. Stating the egressing VLAN is NOT required when configuring static routes within the same VRF instance (intra-domain routing).

Dynamic VRF Routing

Another alternative to static inter VRF routes is to use dynamic routes managed by BGP. This entails further BGP configuration within the VRF instances using BGP Address Families and Route Targets (RTs). This advanced topic is beyond the scope of this introductory chapter. For more information see: How to Configure VRF-Lite at, http://www.alliedtelesis.com/support/documentation.

Utilities Available within VRF-Lite

A number of network utility and management features are now supported within a VRF-Lite environment. These include:

- Ping
- Trace Route
- Telnet Client
- SSH Client
- TCP Dump

Note that unless specifically configured with either static or leaked routes, these commands will not operate across routing domains. This is shown in the following examples:

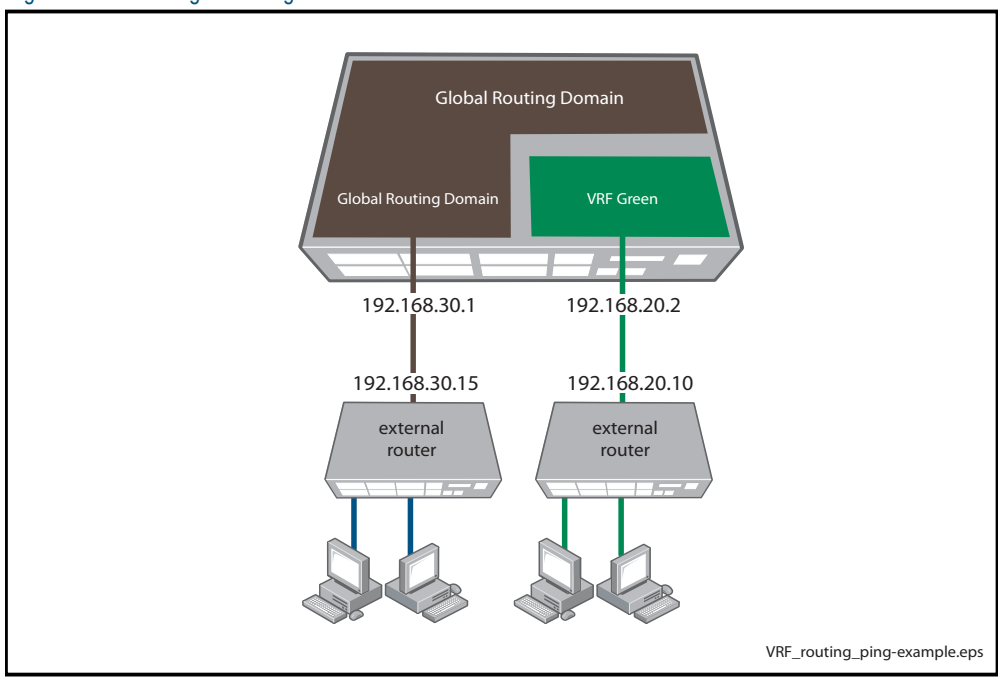
Example 1 In the example shown in Figure 45-8, use the following command to ping the IP address 192.168.30.15 from the global routing domain, to a destination that resides within the same domain:

```
awplus# ping 192.168.30.15
```

Example 2 In the example shown in Figure 45-8, use the following command to ping from within VRF green to destination the 192.168.20.10 that resides within the same routing domain

```
awplus# ping vrf green 192.168.20.10
```

Figure 45-8: Using the Ping command with VRF-Lite



Note Running the ping command across VRF instances, or from the Global Routing Domain to a target located within a VRF instance, will not work unless either static or leaked routes exist on both the source and target devices. See “Static Inter-VRF Routing” on page 14.

Utilities Unavailable within VRF-Lite

In this VRF-lite implementation, the following applications and Layer 4+ services are not supported on a per-VRF basis:

- Telnet Server
- SSH Server
- File Copy
- System Log
- SNMP Server
- DHCP server
- DHCP relay
- NTP Server

Although not supported within VRF instances, these services are supported in the global VRF domain context, which is equivalent to a non-VRF environment.

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Introduction

This chapter provides an alphabetical reference of commands used to configure Virtual Routing and Forwarding Lite (VRF-Lite). For more information about VRF-Lite, see Chapter 45, VRF-Lite Introduction and Configuration.

Command List

address-family ipv4 (BGP)

This command enters the IPv4 address-family command mode. In this mode you can configure address-family specific parameters. When using VRF-Lite you can configure an address-family for a specific VRF instance.

Syntax

```
address-family ipv4 [unicast|vrf <vrf-name>]
```

```
no address-family ipv4 [unicast|vrf <vrf-name>]
```

For a more detailed description of this command, see: the address-family ipv4 (BGP) command on page 42.4.

address-family ipv4 (RIP)

This command enters the IPv4 address-family command mode for RIP.

Syntax

```
address-family ipv4 vrf <vrf-name>
```

```
no address-family ipv4 vrf <vrf-name>
```

For a more detailed description of this command, see: the address-family ipv4 (RIP) command on page 34.4.

arp (IP address MAC address)

This command adds a static ARP entry to the ARP cache. You can add ARP entries to either the global cache or for a specific VRF instance.

Syntax

```
arp [vrf <vrf-name>] <ip-addr> <mac-address> [<port-number>]
   [alias]
```

```
no arp [vrf <vrf-name>] <ip-addr>
```

For a more detailed description of this command, see: the arp (IP address MAC address) command on page 25.4.

arp opportunistic-nd

This command enables and disables opportunistic neighbor discovery for a VRF instance when a VRF instance name is specified. If no VRF instance is specified then this command enables or disables opportunistic neighbor discovery for the global ARP cache.

Syntax

```
arp opportunistic-nd [vrf <vrf-name>]
no arp opportunistic-nd [vrf <vrf-name>]
```

For a more detailed description of this command, see: the arp opportunistic-nd command on page 25.8.

clear arp-cache

This command deletes the dynamic ARP entries either from the general ARP cache, or from the ARP cache of a specific VRF instance.

Syntax

```
clear arp-cache [vrf <vrf-name>|global]
```

For a more detailed description of this command, see: the clear arp-cache command on page 25.10.

clear ip bgp *

Use this command to reset all BGP connections within a specified VRF instance, either by fully resetting sessions, or by performing soft resets.

Syntax

```
clear ip bgp * [vrf <vrf-name>]
clear ip bgp * [vrf <vrf-name>] in
clear ip bgp * [vrf <vrf-name>] out
clear ip bgp * [vrf <vrf-name>] soft [in|out]
```

For a more detailed description of this command, see: the clear ip bgp * command on page 42.44.

clear ip bgp (ip address)

Use this command to reset the IPv4 BGP connection to the peer specified by the IP address. When running VRF, you can apply this command per VRF Instance.

Syntax

```
clear ip bgp <ip-address> [vrf <vrf-name>] [in|out|soft [in|
   out]]
clear ip bgp <ip-address> [vrf <vrf-name>] ipv4 {unicast|
   multicast} [in [prefix-filter]|out|soft [in|out]]
```

For a more detailed description of this command, see: the clear ip bgp (ip address) command on page 42.45.

clear ip rip route

Use this command to clear specific data from the RIP routing table, optionally for a specified VRF instance.

Syntax

```
clear ip rip [vrf <vrf-name>] route {<ip-dest-network/prefix-
   length> |static|connected|rip|ospf|bgp|all}
```

For a more detailed description of this command, see: the clear ip rip route command on page 34.6.

crypto key pubkey-chain knownhosts

This command adds a public key of the specified SSH server to the known host database on your switch. This command can be applied to specific VRF instances.

Syntax

```
crypto key pubkey-chain knownhosts [vrf <vrf-name>] [ip|ipv6]
   <hostname> [rsa|dsa|rsa1]

no crypto key pubkey-chain knownhosts [vrf <vrf-name>] <1-
   65535>
```

For a more detailed description of this command, see: the crypto key pubkey-chain knownhosts command on page 76.8.

default-metric (RIP)

Use this command to specify the metrics to be assigned to redistributed routes.

Syntax

```
default-metric <metric>

no default-metric [<metric>]
```

For a more detailed description of this command, see: the default-metric (RIP) command on page 34.9.

description (VRF)

Use this command to add text that describes a specific VRF instance. Descriptions can be up to 80 characters long.

The no variant of this command removes the description of the selected VRF instance.

Syntax

```
description <descriptive-text>
no description
```

Parameter	Description
<descriptive-text>	A string of up to 80 characters that describes the VRF instance.

Mode VRF Configuration

Example To add the description for a VRF instance named blue, use the following commands:

```
awplus# config terminal
awplus(config)# ip vrf blue
awplus(config-vrf)# description the text description of vrf
blue
```

Related Commands show ip vrf

distance (RIP)

This command sets the administrative distance for RIP routes. Your device uses this value to select between two or more routes to the same destination from two different routing protocols. When running VRF this command can be applied to specific VRF instances.

Syntax

```
distance <1-255> [<ip-addr/prefix-length> [<access-list>]]
no distance [<1-255>] [<ip-addr/prefix-length> [<access-
   list>]]
```

For more information on this command, see the distance (RIP) command on page 34.10.

distribute-list (RIP)

Use this command to filter incoming or outgoing route updates using the access-list or the prefix-list. When running VRF this command can be applied to specific VRF instances.

Syntax

```
distribute-list {<access-list> | prefix <prefix-list>} {in|
   out} [<interface>]
no distribute-list {<access-list> | prefix <prefix-list>} {in|
   out} [<interface>]
```

For more information on this command, see the distribute-list (RIP) command on page 34.11.

export map

This command associates a route map with a specific VRF instance. It provides a finer control over the routes that are exported out of a VRF instance by the route-target command. Note, however, that this command does not replace the need for a route-target export in the VRF configuration.

The no variant of this command disables the capability to export route map entries for a specified VRF instance.

Syntax

```
export map <route-map>
no export map
```

Parameter	Description
<route-map>	The route-map name.

Mode VRF Configuration

Usage Use this command to export route-map entries in VRF configuration mode.

Example To export the route map named routemap2 for the VRF instance named blue, use the following commands:

```
awplus# config terminal
awplus(config)# ip vrf blue
awplus(config-vrf)# export map routemap2
```

Related Commands import map

fullupdate (RIP)

Use this command to specify which routes RIP should advertise when performing a triggered update. By default, when a triggered update is sent, RIP will only advertise those routes that have changed since the last update. You can apply this command to either the global routing environment, or to specific VRF instances.

Syntax

```
fullupdate
no fullupdate
```

For more information on this command, see the fullupdate (RIP) command on page 34.12.

import map

The import map command associates a route map with a specific VRF instance. The import map command does not replace the need for a route-target import in the VRF configuration. It provides a finer control over the routes imported into a VRF instance by the route-target command.

The no variant of this command disables the capability to import route map entries for a specified VRF instance.

Syntax

```
import map <route-map>
no import map
```

Parameter	Description
<route-map>	The route-map name.

Mode VRF Configuration

Usage Use this command to import route-map entries into the specified VRF instance.

Example To import the route map named `routemap2` for the VRF instance named `blue`, use the following commands:

```
awplus# config terminal
awplus(config)# ip vrf blue
awplus(config-vrf)# import map routemap2
```

Related Commands export map

ip route static inter-vrf

Applying this command enables static inter-VRF routing. Note that static inter-VRF routing must be enabled before you can use the ip route command on page 46.9 to create a static inter-VRF route.

The no variant of this command disables static inter-vrf routing.

Syntax

```
ip route static inter-vrf
```

```
no ip route static inter-vrf
```

Mode VRF Configuration

Default Static inter-vrf routing is enabled.

Example To enable static inter-VRF routing, use the following commands:

```
awplus# config terminal
awplus(config)# ip route static inter-vrf
```

Related Commands show ip route

ip route

This command adds a static route to the Routing Information Base (RIB). If this route is the best route for the destination, then your device adds it to the Forwarding Information Base (FIB). Your device uses the FIB to advertise routes to neighbors and forward packets.

When using VRF (Virtual Routing and Forwarding), you can use this command to configure a static inter-VRF route to a destination network that is reachable by a remote gateway located in a different VRF instance. Note that to apply the command in this way, the ip route static inter-vrf command must be enabled (its default condition).

Syntax

```
ip route [vrf <vrf-name>] <subnet&mask> [<gateway-ip>]
   [<interface>] [<distance>]
```

```
no ip route [vrf <vrf-name>] <subnet&mask> [<gateway-ip>]
[<interface>] [<distance>]
```

For a more detailed description of this command, see: the ip route command on page 32.2.

ip vrf

This command creates a VRF instance and specifies its unique name. You can also optionally specify a VRF ID. If you do not specify the VRF ID, a unique ID will automatically be created and assigned to the VRF instance.

The no variant of this command removes a selected VRF instance. All interfaces previously belonging to the removed instance are then returned to the global routing and forwarding environment.

Syntax

```
ip vrf <vrf-name> [<vrf-inst-id>]

no ip vrf <vrf-name> [<vrf-inst-id>]
```

Parameter	Description
<vrf-name>	The name of the VRF instance.
<vrf-inst-id>	The ID of the VRF instance, a number in the range 1 to 8.

Mode Global Configuration

Default Static inter-vrf routing is enabled.

Example To create a VRF instance named `vrf blue` and assign it the ID number `2`, use the following commands:

```
awplus# config terminal
awplus(config)# ip vrf blue 2
```

ip vrf forwarding

This command associates a VRF instance with an interface.

The no variant of this command disassociates the VRF instance from its interface.

Syntax

```
ip vrf forwarding <vrf-name>
no ip vrf <vrf-name>
```

Parameter	Description
<vrf-name>	The name of the VRF instance.

Mode Interface Configuration

Default The default for an interface is the global routing table.

Examples For LAN interfaces, to associate the VRF instance named `blue` with the VLAN interface `vlan-admin`, use the following commands:

```
awplus# config terminal
awplus(config)# interface vlan-admin
awplus(config-if)# ip vrf forwarding blue
```

Related Commands

show ip vrf
show ip vrf detail

max-fib-routes (VRF)

This command now enables you to control the maximum number of FIB routes configured for a VRF Instance. It operates by providing parameters that enable you to configure preset maximums and warning message thresholds.

Note

To set the max-fib-routes for the Global VRF, use the max-fib-routes command on page 8.20

To set static routes, for the Global VRF, use the max-static-routes command on page 8.21.

To set static routes, for a VRF Instance use the max-static-routes command on page 46.13.

Syntax

```
max-fib-routes <1-4294967294> [<1-100>|warning-only]

no max-fib-routes
```

Parameter	Description
`max-fib-routes`	The maximum number of routes that can be stored in Forwarding Information dataBase for either the Global VRF or a VRF instance.
`<1-4294967294>`	The allowable configurable range for setting maximum the number of FIB-routes.
`<1-100>`	This parameter enables you to optionally apply apply a percentage value. This percentage will be based on the maximum number of FIB routes you have specified. This will cause a warning message to appear when your routes reach your specified percentage value. Routes can continue to be added until your configured maximum value is reached.
`warning-only`	This parameter enables you to optionally apply a warning message. If you set this option a warning message will appear if your maximum configured value configured. Routes can continue to be added until your switch reaches either the maximum capacity value of 4294967294, or a practical system limit.

Mode VRF-Mode

Default Sets the maximum number of dynamic routes to `4294967294` and no warning threshold.

Examples To set the maximum number of dynamic routes to 2000 and warning threshold of 75%, on VRF instance blue, use the following commands:

```
awplus# config terminal
awplus(config)# ip vrf blue
awplus(config-vrf)# max-fib-routes 2000 75
```

Related Commands

max-fib-routes
show ip route

max-static-routes

Use this command to set the maximum number of static routes (excluding FIB - Forwarding Information Base routes) for VRF Instances. A limit of 1000 static routes can be assigned to each individual VRF instance. For example you can assign 800 static routes to the Global VRF, then also assign 600 static routes to VRF instance Blue, and a further 600 routes to VRF instance Green. .

Note To set the max-static-routes for a the Global VRF Instance, use the max-static-routes command on page 8.21.

To set dynamic FIB routes, use the max-fib-routes (VRF) command on page 46.12.

Use the no variant of this command to reset the maximum number of static routes to the default value of 1000.

Syntax

```
max-static-routes <1-1000>
no max-static-routes
```

Default The default number of static routes is the maximum number of static routes (1000).

Mode VRF-Mode

Example To assign 200 static routes to VRF instance Blue, use the following commands::

```
awplus# configure terminal
awplus(config)# ip vrf blue
awplus(condig-vrf)# max-static-routes 200
```

Note Static routes are applied before adding routes to the RIB (Routing Information Base). Therefore, rejected static routes will not appear in the running config.

Related Commands max-fib-routes (VRF)

neighbor next-hop-self

Use this command to configure the router as the next hop for a BGP-speaking neighbor or peer group. This command can be run for a specific VRF instance.

Syntax

```
neighbor <neighborid> next-hop-self
```

For a more detailed description of this command, see: the neighbor next-hop-self command on page 42.88.

neighbor password

Use this command to enable MD5 authentication on a TCP connection between BGP neighbors.

Syntax

```
neighbor {<ip-address>|<peer-group-name>} password <password>
no neighbor {<ip-address>|<peer-group-name>} password
   [<password>]
```

For a more detailed description of this command, see: the neighbor password command on page 42.91.

neighbor remote-as

Use this command to configure an internal or external BGP (iBGP or eBGP) peering relationship with another router. This command can be run for a specific VRF instance.

Syntax

```
neighbor <neighborid> remote-as <as-number> [global|vrf
   <vrf-name>]
no neighbor <neighborid> remote-as <as-number>
```

For a more detailed description of this command, see: the neighbor remote-as command on page 42.96.

network (RIP)

This command specifies that a network or VLAN within a VRF instance will run OSPF.

Syntax

```
network {<network-address>[/<subnet-prefix-length>]|<vlan-
   name>}
no network {<network-address>[/<subnet-mask>]|<vlan-name>}
```

For a more detailed description of this command, see: the network (RIP) command on page 34.32.

offset-list (RIP)

Use this command to add an offset to the in and out metrics of routes learned through RIP, optionally for specific VRF instances.

Syntax

```
offset-list <access-list> {in|out} <offset> [<interface>]
no offset-list <access-list> {in|out} <offset> [<interface>]
```

For a more detailed description of this command, see: the offset-list (RIP) command on page 34.34

passive-interface (RIP)

Use this command to block RIP broadcasts on the VLAN interface.

Syntax

```
passive-interface <interface>

no passive-interface <interface>
```

For a more detailed description of this command, see: the passive-interface (RIP) command on page 34.35

ping

This command sends a query to another IPv4 host (send Echo Request messages).

You can run this command for a specific virtual routing instance.

Syntax

```
ping [vrf <vrf-name>] [ip] <host> [broadcast] [df-bit {yes|
   no}] [interval <0-128>] [pattern <hex-data-pattern>]
   [repeat {<1-2147483647>|continuous}] [size <36-18024>]
   [source <ip-addr>] [timeout <1-65535>] [tos <0-255>]
```

For a more detailed description of this command, see: the ping command on page 25.46.

rd (route distinguisher)

This command creates a Route Distinguisher (RD). The RD forms part of the route table creation process for a VRF instance and is implemented only when using BGP routing.

Syntax `rd {<ASN:n>|<ip-address:n>}`

Caution

This command does not contain a "no" variant. To remove the rd requires deleting the VRF instance to which it is assigned. Therefore, it is important that you carefully enter the correct value for the rd.

Parameter	Description
<ASN:n>	The RD reference number. This is based on the formal RD format structure of, ASN number:Ref number. The ASN value can be any number between 1 and 65535, and the value n can be any number between 1 and 4294967295.
<ip-address:n>	The RD reference number. This is based on the formal RD format structure of, IP-address:Ref number. The IP-address must be in IPv4 format. The value `n` can be any number between 1 and 65535.

Note

The above table refers to an ASN or Autonomous System Number. If you have a formal ASN number assigned to your BGP network, you should enter this value. Alternatively; because the Route Distinguisher has limited functionality in VRF Lite, you can use an unofficial value for your ASN when configuring "this particular" command.

Mode VRF Configuration

Usage For the implementation of VRF-lite installed on your switch, this command has little practical functionality. However, the switch does check certain components of the RD that you enter. For this reason, the RD syntax must comply with the structural formats defined below, and each value that you assign to a VRF instance must be unique on the switch. Good networking practice is to use common values for the RD and RT within a VRF instance.

Default No default RD is configured.

Example To create an RD `100:2` that is associated with `vrf red` use the following commands:

```
awplus# config terminal
awplus(config)# ip vrf red
awplus(config-vrf)# rd 100:2
```

Related Commands show ip vrf

redistribute (into BGP)

Use this command to inject routes from one routing process into another.

Syntax

```
redistribute {ospf|rip|connected|static} [route-map <route-map-entry-pointer>]
```

```
no redistribute {ospf|rip|connected|static} [route-map <route-map-entry-pointer>]
```

For a more detailed description of this command, see: the redistribute (into BGP) command on page 42.117 in Chapter 42, BGP Commands.

redistribute (into OSPF)

Use this command to redistribute routes from other routing protocols, static routes and connected routes into an OSPF routing table. Although this command has no specific VRF components, this command fragment is included for completeness with the other redistribute commands shown in this chapter.

Syntax

```
redistribute {bgp|connected|rip|static} {metric|metric-type|route-map|tag}
```

```
no redistribute {bgp|connected|rip|static} {metric|metric-type|route-map|tag}
```

For a more detailed description of this command, see: the redistribute (into OSPF) command on page 38.57.

redistribute (RIP)

Use this command to redistribute information from other routing protocols into RIP. When using VRF-Lite, you can apply this command to a specific VRF instance.

Syntax

```
redistribute {connected|static|ospf|bgp} [metric <0-16>] [routemap <routemap>]
```

```
no redistribute {connected|static|ospf|bgp} [metric] [routemap]
```

For a more detailed description of this command, see: the redistribute (RIP) command on page 34.37.

route (RIP)

Use this command to configure static RIP routes within either the Global routing domain, or within a specific VRF instance.

Syntax

```
route <ip-addr/prefix-length>
```

```
no route <ip-addr/prefix-length>
```

For a more detailed description of this command, see: the route (RIP) command on page 34.40.

route-target

Use this command within a specific VRF instance, to create a route-target within the BGP extended communities path attribute field. This value can then be included in a list of import and export route target extended communities for the specified VRF instance. Learned routes that carry a specific route-target extended community are then imported into all VRFs configured with that extended community as an imported route-target.

The no variant of this command removes a route-target extended community for the VRF instance specified.

Syntax

```
route-target {import|export|both} {ASN:n|ip-address:n}
no route-target {import|export|both} {ASN:n|ip-address:n}
```

Parameter	Description
`route-target`	Specifies a BGP extended community as a route-target.
`import`	Adds the route target to its import list.
`export`	Adds the route target to its export list.
`both`	Adds the route target to both the import and export lists.
<ASN:n>	The route target reference number. This uses the same structure that is defined for the RD. This being, ASN number:Ref number. The ASN value can be any number between 1 and 65535, and the value n can be any number between 1 and 4294967295.
<ip-address:n>	The route target reference number. This uses the same structure that is defined for the RD (Route Distinguisher). This being, IP-address:Ref number. In practice, the IP-address can be an entry in IPv4 format, or an integer number between 1 and 4294967295. The value n can be any number between 1 and 65535.

Mode VRF Configuration

Default No route-target community attributes are associated with a VRF instance.

Usage In VRF systems that use MPLS, there is an close relationship between the Route Target (RT) and the Route Distinguisher (RD) values. For VRF-Lite however, this relationship is only implicit in that they share the same format structure.

Example Use the following commands to create a route-target extended community for ASN value 200, and a Reference number of 3, within the VRF instance blue:

```
awplus# config terminal
awplus(config)# ip vrf blue
awplus(config-vrf)# route-target import 200:1
```

Related Commands
ip vrf
show ip vrf

router ospf

Use this command to enter Router Configuration mode to configure an OSPF routing process. You must specify the process ID with this command for multiple OSPF routing processes on the switch.

Syntax

```
router ospf [<process-id>] [<vrf-instance>]
no router ospf [<process-id>]
```

For a more detailed description of this command, see: the router ospf command on page 38.59.

router-id (VRF)

Use this command to specify a router identifier (in IP address format). When using VRF-Lite, the router-id is configured for the specified VRF instance.

Use the no variant of this command to force OSPF to use the previous OSPF router-id behavior.

Syntax

```
router-id <ip-address>
no router-id
```

Parameter	Description
<ip-address>	Specifies the router ID in IPv4 address format.

Mode Router Configuration

Usage Configure each router with a unique router-id. In an OSPF router process that has active neighbors, a new router-id is used at the next reload or when you restart OSPF manually.

Example The following example shows a fixed router ID `10.10.10.60` for the VRF instance `red`:

```
awplus# configure terminal
awplus(config)# ip vrf red
awplus(config-router)# router-id 10.10.10.60
```

Related Commands

show ip ospf
show ip vrf

show arp

Use this command to display entries in the ARP routing and forwarding table for either the global routing and forwarding database or for a specific VRF instance. The ARP cache contains mappings of IP addresses to physical addresses for hosts. To have a dynamic entry in the ARP cache, a host must have used the ARP protocol to access another host.

Syntax `show arp [global|vrf <vrf-name>]`

For a more detailed description of this command, see: the show arp command on page 25.48.

show crypto key pubkey-chain knownhosts

Use this command to display information about the known host database from the specified VRF.

Syntax
```
show crypto key pubkey-chain knownhosts [vrf <vrf-name>|
   global] [<1-65535>]
```

For a more detailed description of this command, see: the show crypto key pubkey-chain knownhosts command on page 76.17.

show ip bgp cidr-only

Use this command to display routes with non-natural network masks.

Syntax `show ip bgp [global|vrf <vrf-name>] cidr-only`

For a more detailed description of this command, see: the show ip bgp cidr-only command on page 42.126.

show ip bgp community

Use this command to display routes that match specified communities from a BGP instance, either the global routing domain or a named VRF.

Syntax
```
show ip bgp community [global|vrf <vrf-name>] [<type>] [exact-
   match]
```

For a more detailed description of this command, see: the show ip bgp community command on page 42.127.

show ip bgp community-list

Use this command to show routes that match the given community-list from a BGP instance, either the global routing domain or a named VRF.

Syntax `show ip bgp community-list [global|vrf <vrf-name>] <listname> [exact-match]`

For a more detailed description of this command, see: the show ip bgp community-list command on page 42.130.

show ip bgp dampening

Use this command to show dampened routes from a BGP instance, in either the global routing domain or a named VRF.

Syntax `show ip bgp [global|vrf <vrf-name>] dampening {dampened-paths|flap-statistics|parameters}`

For a more detailed description of this command, see: the show ip bgp dampening command on page 42.131.

show ip bgp filter-list

Use this command to display routes conforming to the filter-list.

Syntax `show ip bgp [global|vrf <vrf-name>] filter-list <listname>`

For a more detailed description of this command, see: the show ip bgp filter-list command on page 42.133.

show ip bgp inconsistent-as

Use this command to display routes with inconsistent AS Paths.

Syntax `show ip bgp [global|vrf <vrf-name>] inconsistent-as`

For a more detailed description of this command, see: the show ip bgp inconsistent-as command on page 42.134.

show ip bgp longer-prefixes

Use this command to display the route of the local BGP routing table for a specific prefix with a specific mask or for any prefix having a longer mask than the one specified.

Syntax `show ip bgp [unicast] <ip-address/m> longer-prefixes`

For a more detailed description of this command, see: the show ip bgp longer-prefixes command on page 46.21.

show ip bgp prefix-list

Use this command to display routes matching the prefix-list.

Syntax `show ip bgp [global|vrf <vrf-name>] prefix-list <list>`

For a more detailed description of this command, see: the show ip bgp prefix-list command on page 46.22.

show ip bgp quote-regexp

Use this command to display routes matching the AS path regular expression in quotes.

Syntax `show ip bgp [global|vrf <vrf-name>] quote-regexp <expression>`

For a more detailed description of this command, see: the show ip bgp quote-regexp command on page 46.22.

show ip bgp regexp

Use this command to display routes matching the AS path regular expression.

Syntax `show ip bgp [global|vrf <vrf-name>] regexp <expression>`

For a more detailed description of this command, see: the show ip bgp regexp command on page 46.22.

show ip bgp route-map

Use this command to display routes that match the specified route-map.

Syntax `show ip bgp [global|vrf <vrf-name>] route-map <route-map>`

For a more detailed description of this command, see: the show ip bgp route-map command on page 46.22.

show ip bgp summary

Use this command to display a summary of BGP neighbor status.

Syntax `show ip bgp [global|vrf <vrf-name>] summary`

For a more detailed description of this command, see: the show ip bgp summary command on page 46.22.

show ip interface vrf

Use this command to display protocol and status information about configured interfaces and their assigned IP addresses.

Syntax `show ip interface [vrf <vrf-name>|global]`

For a more detailed description of this command, see: the show ip interface vrf command on page 25.57.

show ip rip vrf database

Use this command to display information about the RIP database that is associated with a specific VRF instance.

Syntax `show ip rip {vrf <vrf-name>|global} database [full]`

For a more detailed description of this command, see: the show ip rip vrf database command on page 34.47.

show ip rip vrf interface

Use this command to display information about the RIP interfaces that are associated with a specific VRF instance.

Syntax `show ip rip {vrf <vrf-name>|global} interface [<interface-name>]`

For a more detailed description of this command, see: the show ip rip vrf interface command on page 34.48.

show ip route

Use this command to display the current state of the routing table.

Syntax `show ip route {vrf <vrf-name>|global} [bgp|connected|ospf|rip|static]`

For a more detailed description of this command, see: the show ip route command on page 32.6.

show ip route database

Use this command to display all routing entries for a protocol in the RIB associated with either the global routing and forwarding database, or for a selected VRF instance.

Syntax `show ip route [vrf <vrf-name>|global] database [bgp|connected|ospf|rip|static]`

For a more detailed description of this command, see: the show ip route database command on page 32.9.

show ip route summary

This command displays a summary of the current RIB entries for either the global routing and forwarding database, or for a selected VRF instance.

Syntax `show ip route summary [vrf <vrf-name>|global]`

For a more detailed description of this command, see: the show ip route summary command on page 32.11.

show ip vrf

This command displays brief configurations for a specific VRF instance.

Syntax `show ip vrf <vrf-name>`

Parameter	Description
<vrf-name>	The name of the VRF instance.

Mode User Exec and Privileged Exec

Example To display brief information for the VRF instance red, use the command:

```
awplus# show ip vrf red
```

Output Figure 46-1: Example output from the **show ip vrf red** command

```
Name                    Default RD          Interfaces
red                     500:1               lo1, vlan1
```

Related Commands show ip vrf interface

show ip vrf detail

This command displays the detailed configuration for a specific VRF instance.

Syntax `show ip vrf detail <vrf-name>`

Parameter	Description
<vrf-name>	The name of the VRF instance.

Mode User Exec and Privileged Exec

Example To display the detailed information for all VRF instances, use the command:

```
awplus# show ip vrf detail
```

Output Figure 46-2: Example output from the **show ip detail** command, for all VRF instances

```
VRF blue; Description: VRF for customer blue
FIB ID 3; Router ID: 192.168.30.1 (automatic)
Default RD 500:3
  Interfaces:
    lo3, vlan3
  Export route-target communities
    RT: 500:3
  Import route-target communities
    RT: 500:4
  Import route-map: blue45
  No export route-map

VRF red
FIB ID 1; Router ID: 192.168.10.1 (automatic)
Default RD 500:1
  Interfaces:
    lo1, vlan1
  Export route-target communities
    RT: 500:1
  Import route-target communities
    RT: 500:1
  Import route-map: red43
  No export route-map
```

Related Commands show ip vrf

show ip vrf interface

This command displays protocol, operational status, and address information, for interfaces existing within either a specified VRF instance, or all VRF instances.

Syntax `show ip vrf interface <vrf-name>`

Parameter	Description
<vrf-name>	The name of the VRF instance.

Mode User Exec and Privileged Exec

Example To display all interfaces and IP addresses associated with all VRF instances, use the command:

```
awplus# show ip vrf interface
```

Output Figure 46-3: Example output from the **show ip vrf interface** command

```
Interface              IP-Address         Status          Protocol   Vrf
lo1                    unassigned         admin up        running    red
lo2                    unassigned         admin up        running    green
vlan1                  192.168.10.1/24    admin up        running    red
vlan2                  192.168.20.1/24    admin up        running    green
```

Example To display all interfaces and IP addresses associated with the VRF instance `red`, use the command:

```
awplus# show ip vrf interface red
```

Output Figure 46-4: Example output from the **show ip vrf interface red** command

```
Interface              IP-Address         Status          Protocol   Vrf
lo1                    unassigned         admin up        running    red
vlan1                  192.168.10.1/24    admin up        running    red
```

Related Commands show ip vrf

show running-config vrf

This command displays the running system VRF related configurations for all VRF instances.

Syntax `show running-config vrf`

Mode Privileged Exec

Example To display the running system VRF related configurations, use the command:

```
awplus# show running-config vrf
```

Output Figure 46-5: Example output from the **show running config vrf** command

```
ip vrf red
rd 500:1
route-target export 500:1
route-target export 500:4
import map red 43
!
```

Related Commands show ip vrf

ssh

Use this command to initiate a Secure Shell connection to a remote SSH server in the context of a specific VRF instance.

Syntax `ssh [vrf <vrf-name>] [ip|ipv6][{[user <username>]|[port <1-65535>]|[version {1|2]}}] <hostname> [<line>]`

For a more detailed description of this command, see: the ssh command on page 76.27.

tcpdump

Use this command to start a tcpdump associated with a specific VRF instance.

Syntax `tcpdump [vrf <vrf-name>] <line>`

For a more detailed description of this command, see: the tcpdump command on page 25.62.

telnet

Use this command to open a telnet session to a remote device in the context of a specific VRF instance.

Syntax `telnet [vrf <vrf-name>] {<hostname>|ip <ipv4-addr>|ipv6 <ipv6-addr>} [<port>]`

For a more detailed description of this command, see: the telnet command on page 5.33.

timers (RIP)

Use this command to adjust routing network timers for a VRF instance.

Syntax `timers basic <update> <timeout> <garbage>`

`no timers basic`

For a more detailed description of this command, see: the timers (RIP) command on page 34.49.

traceroute

Use this command to trace the VRF route packets take in the context of a specific VRF instance when travelling to their destination address.

Syntax `traceroute [vrf <vrf-name>] {<ip-addr>|<hostname>}`

For a more detailed description of this command, see: the traceroute command on page 25.63.

version

Use this command to specify a RIP version used by the device for a VRF instance.

Syntax `version {1|2}`

`no version`

For a more detailed description of this command, see: the version command on page 34.51.

Part 4: Multicast Applications

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Chapter 47: Multicast Introduction and Commands

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Introduction

Multicasting is a technique developed to send packets from one location in a network to many other locations without any unnecessary packet duplication. In multicasting, one packet is sent from a source and is replicated as needed in the network to reach as many end-users as necessary.

Multicasting is different from broadcasting; while broadcast packets are sent to every possible receiver, multicast packets need only be forwarded to receivers that want them. The benefit of this technique is bandwidth conservation - it is the most economical technique for sending a packet stream to many locations simultaneously.

The IP addressing for multicast packets works differently from unicast and broadcast packets. A multicast stream sends packets out with a destination IP address that identifies a specific multicast group. It does not at all specify an end host, like unicast; or a whole subnet, like broadcast.

This makes multicasting a connectionless process. The server simply sends out its multicast UDP packets, with no idea who will receive them, or whether they are successfully received. It is the hosts that tell the network that they wish to receive a multicast stream, using the Internet Group Management Protocol (IGMP). This is a Layer 3 protocol; however Layer 2 switches can also conserve bandwidth within their LAN by using IGMP snooping to track which hosts require the data stream. For more information about IGMP and IGMP snooping, see Chapter 48, IGMP and IGMP Snooping Introduction.

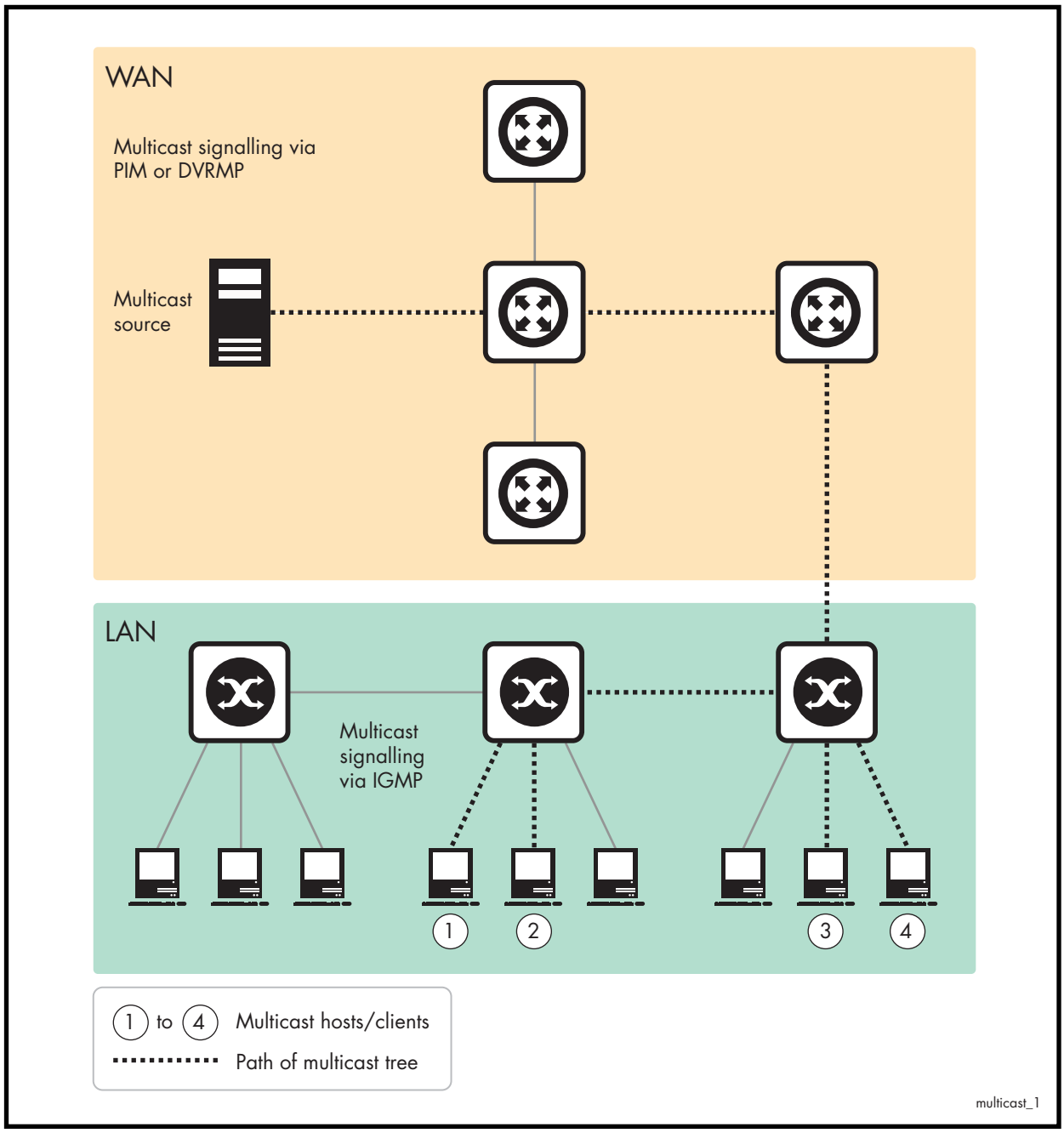
Multicast groups

The concept of a group is crucial to multicasting. A group is the set of hosts that wish to receive a particular multicast stream, and is identified by a multicast IP address and matching multicast MAC address. The multicast sender transmits the stream to the group address, and only members of the group can receive the multicast data.

Components in a multicast network

There are several protocols and roles required in a multicast network, as shown in Figure 47-1 on page 47.3. This section describes the end-to-end process of transporting multicast data through a network.

Figure 47-1: Components in a multicast network



At the two ends of a multicast data transmission are:

- the source
  This is typically a server or video encoder. It sends the stream of multicast data out through its network interface. It is unaware of where the recipients of the stream are, or if there are any recipients.
- the recipients
  These are storage or display devices, such as PCs, set-top boxes, or security video archivers. The recipients signal their desire to receive a particular multicast stream by sending out IGMP messages requesting the stream.

The role of the network in-between is to deliver the multicast stream to the recipients as efficiently as possible. The devices achieve this by exchanging signalling information between themselves in order to establish a forwarding path along which the multicast stream will flow. Each node informs the next node up the chain that it needs to receive the multicast stream. Once this series of requests reaches the router nearest the multicast source, then that router will start to forward the stream. All the nodes between the source and the recipients are ready to forward the stream, due to their having received the signalled requests. In this way, the stream is efficiently forwarded right through to the recipients.

The type of signalling that the network uses falls into two categories:

- in the local area network where the recipients are located, the signalling consists of the exchange of IGMP packets.
- as soon as the signalling needs to leave the VLAN containing the recipients and cross into other VLANs and subnets, then a Layer 3 multicasting protocol like PIM is used between the routers in the Layer 3 network.

In every Layer 2 multicast network, there needs to be a device that is sending IGMP queries into the network. This is essential to maintain multicast flows once they have been established (see "Staying in the multicast group (Query message)" on page 48.3 for more information). Typically, the device that is configured to send the queries is the router that is the gateway from the local network into a Layer 3 network.

Command List

This chapter provides an alphabetical reference of multicast commands common to PIM Sparse Mode and PIM Dense Mode. See also Chapter 54, MLD Snooping Introduction and Commands, Chapter 53, PIM-DM Commands, Chapter 51, PIM-SM Commands and Chapter 49, IGMP and IGMP Snooping Commands.

clear ip mroute

Use this command to delete entries from the IP multicast routing table.

Note If you use this command, you should also use the clear ip igmp group command to clear IGMP group membership records.

Syntax

```
clear ip mroute {*|<group-addr> [<source-addr>]} [pim sparse-mode]
```

Parameter	Description
*	Deletes all multicast routes.
<group-addr>	Group IP address, in dotted decimal notation in the format A.B.C.D.
<source-addr>	Source IP address, in dotted decimal notation in the format A.B.C.D.
pim sparse-mode	Clear specified multicast route(s) for PIM Sparse Mode only.

Mode Privileged Exec

Usage When this command is used, the Multicast Routing Information Base (MRIB) clears the multicast route entries in its multicast route table, and removes the entries from the multicast forwarder. The MRIB sends a “clear” message to the multicast protocols. Each multicast protocol has its own “clear” multicast route command. The protocol-specific “clear” command clears multicast routes from PIM Sparse Mode, and also clears the routes from the MRIB.

Example

```
awplus# clear ip mroute 225.1.1.1 192.168.3.3
```

clear ip mroute statistics

Use this command to delete multicast route statistics entries from the IP multicast routing table.

Syntax `clear ip mroute statistics {*|<group-addr> [<source-addr>]}`

Parameter	Description
*	All multicast route entries.
<group-addr>	Group IP address, in dotted decimal notation in the format `A.B.C.D`.
<source-addr>	Source IP address, in dotted decimal notation in the format `A.B.C.D`.

Mode Privileged Exec

Example

```
awplus# clear ip mroute statistics 225.1.1.2 192.168.4.4
```

debug nsm mcast

Use this command to debug events in the Multicast Routing Information Base (MRIB).

Syntax

```
debug nsm mcast
   {all|fib-msg|mrt|mtrace|mtrace-detail|register|stats|vif}
```

Parameter	Description
`all`	All IPv4 multicast debugging.
`fib-msg`	Forwarding Information Base (FIB) messages.
`mrt`	Multicast routes.
`mtrace`	Multicast traceroute.
`mtrace-detail`	Multicast traceroute detailed debugging.
`register`	Multicast PIM register messages.
`stats`	Multicast statistics.
`vif`	Multicast interface.

Mode Privileged Exec and Global Configuration

Example

```
awplus# configure terminal
awplus(config)# debug nsm mcast register
```

ip mroute

Use this command to inform multicast of the RPF (Reverse Path Forwarding) route to a given multicast source.

Use the no variant of this command to delete a route to a multicast source.

Syntax

```
ip mroute <source-address/mask-length>
    [bgp|ospf|rip|static] <rpf-address> [<admin-distance>]

no ip mroute <source-address/mask-length>
    [bgp|ospf|rip|static]
```

Parameter	Description
`vrf`	Applies the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.
<source-address/mask-length>	A multicast source IP address and mask length, in dotted decimal notation in the format `A.B.C.D/M`.
`bgp`	BGP unicast routing protocol.
`ospf`	OSPF unicast routing protocol.
`rip`	RIP unicast routing protocol.
`static`	Specifies a static route.
<rpf-address>	`A.B.C.D` The closest known address on the multicast route back to the specified source. This host IP address can be within a directly connected subnet or within a remote subnet. In the case that the address is in a remote subnet, a lookup is done from the unicast route table to find the nexthop address on the path to this host.
<admin-distance>	The administrative distance. Use this to determine whether the RPF lookup selects the unicast or multicast route. Lower distances have preference. If the multicast static route has the same distance as the other RPF sources, the multicast static route takes precedence. The default is `0` and the range available is `0-255`.

Mode Global Configuration

Usage Typically, when a Layer 3 multicast routing protocol is determining the RPF (Reverse Path Forwarding) interface for the path to a multicast source, it uses the unicast route table to find the best path to the source. However, in some networks a deliberate choice is made to send multicast via different paths to those used for unicast. In this case, the interface via which a multicast stream from a given source enters a router may not be the same as the interface that connects to the best unicast route to that source.

This command enables the user to statically configure the switch with “multicast routes” back to given sources. When performing the RPF check on a stream from a given source, the multicast routing protocol will look at these static entries as well as looking into the unicast routing table. The route with the lowest administrative distance - whether a static “multicast route” or a route from the unicast route table - will be chosen as the RPF route to the source.

Note that in this context the term “multicast route” does not imply a route via which the current router will forward multicast; instead it refers to the route the multicast will have traversed in order to arrive at the current router.

Examples

The following example creates a static multicast route back to the sources in the `10.10.3.0/24` subnet. The multicast route is via the host `192.168.2.3`, and has an administrative distance of `2`:

```
awplus# configure terminal
awplus(config)# ip mroute 10.10.3.0/24 static 2 192.168.2.3 2
```

The following example creates a static multicast route back to the sources in the `192.168.3.0/24` subnet. The multicast route is via the host `10.10.10.50`. The administrative distance on this route has the default value of `0`:

```
awplus# configure terminal
awplus(config)# ip mroute 192.168.3.0/24 10.10.10.50
```

Validation Commands

show ip rpf

ip multicast forward-first-packet

Use this command to enable multicast to forward the first multicast packets coming to the device.

Use the no variant of this command to disable this feature.

Syntax

```
ip multicast forward-first-packet
no ip multicast forward-first-packet
```

Default By default, this feature is disabled.

Mode Global Configuration

Usage If this command is enabled, the device will forward the first packets in a multicast stream that create the multicast route, possibly causing degradation in the quality of the multicast stream, such as the pixilation of video and audio data.

Note If you use this command, ensure that the ip igmp snooping command is enabled, the default setting, otherwise the device will not process the first packets of the multicast stream correctly.

Example To enable the forwarding of the first multicast packets, use the following commands:

```
awplus# configure terminal
awplus(config)# ip multicast forward-first-packet
```

To disable the forwarding of the first multicast packets, use the following commands:

```
awplus# configure terminal
awplus(config)# no ip multicast forward-first-packet
```

ip multicast route

Use this command to add a static multicast route for a specific multicast source and group address to the multicast Routing Information Base (RIB). This multicast route is used to forward multicast traffic from a specific source and group ingressing on an upstream VLAN to a single or range of downstream VLANs.

Use the no variant of this command to either remove a static multicast route set with this command or to remove a specific downstream VLAN interface from a static multicast route for a specific multicast source and group address.

Syntax

```
ip multicast route <source-addr> <group-addr> <upstream-vlan-id>
    [<downstream-vlan-id>]

no ip multicast route <source-addr> <group-addr> [<upstream-vlan-id>
    <downstream-vlan-id>]
```

Parameter	Description
<source-addr>	Source IP address, in dotted decimal notation in the format A.B.C.D.
<group-addr>	Group IP address, in dotted decimal notation in the format A.B.C.D.
<upstream-vlan-id>	Upstream VLAN interface on which the multicast packets ingress.
<downstream-vlan-id>	Downstream VLAN interface or range of VLAN interfaces to which the multicast packets are sent.

Default By default, this feature is disabled.

Mode Global Configuration

Usage Only one multicast route entry per IP address and multicast group can be specified. Therefore, if one entry for a static multicast route is configured, PIM will not be able to update this multicast route in any way.

If a dynamic multicast route exists you cannot create a static multicast route with same source IP address, group IP address, upstream VLAN and downstream VLANs. An error message is displayed and logged. To add a new static multicast route, either wait for the dynamic multicast route to timeout or clear the dynamic multicast route with the clear ip mroute * command.

To update an existing static multicast route entry with more or a new set of downstream VLANs, you must firstly remove the existing static multicast route and then add the new static multicast route with all downstream VLANs specified. If you attempt to update an existing static multicast route entry with an additional VLAN or VLANs an error message is displayed and logged.

To create a blackhole or null route where packets from a specified source and group address coming from an upstream VLAN are dropped rather than forwarded, do not specify the optional *<downstream-vlan-id>* parameter when entering this command.

To remove a specific downstream VLAN from an existing static multicast route entry, specify the VLAN you want to remove with the <*downstream-vlan-id*> parameter when entering the no variant of this command.

Example To create a static multicast route for the multicast source IP address `2.2.2.2` and group IP address `224.9.10.11`, specifying the upstream VLAN interface as `vlan10` and the downstream VLAN interface as `vlan20`, use the following commands:

```
awplus# configure terminal
awplus(config)# ip multicast route 2.2.2.2 224.9.10.11 vlan10
vlan20
```

To create a blackhole route for the multicast source IP address `2.2.2.2` and group IP address `224.9.10.11`, specifying the upstream VLAN interface as `vlan10`, use the following commands:

```
awplus# configure terminal
awplus(config)# ip multicast route 2.2.2.2 224.9.10.11 vlan10
```

To create a static multicast route for the multicast source IP address `2.2.2.2` and group IP address `224.9.10.11`, specifying the upstream VLAN interface as `vlan10` and the downstream VLAN range as `vlan20-25`, use the following commands:

```
awplus# configure terminal
awplus(config)# ip multicast route 2.2.2.2 224.9.10.11 vlan10
vlan20-25
```

To remove the downstream VLAN `23` from the static multicast route created with the above command, use the following commands:

```
awplus# configure terminal
awplus(config)# no ip multicast route 2.2.2.2 224.9.10.11
vlan10 vlan23
```

To delete a static multicast route for the multicast source IP address `2.2.2.2` and group IP address `224.9.10.11`, use the following commands:

```
awplus# configure terminal
awplus(config)# no ip multicast route 2.2.2.2 224.9.10.11
```

Related Commands show ip mroute

ip multicast route-limit

Use this command to limit the number of multicast routes that can be added to a multicast routing table.

Use the no variant of this command to return the limit to the default.

Syntax

```
ip multicast route-limit <limit> [<threshold>]
no ip multicast route-limit
```

Parameter	Description
<limit>	*<1-2147483647>* Number of routes.
<threshold>	*<1-2147483647>* Threshold above which to generate a warning message. The mroute warning threshold must not exceed the mroute limit.

Default The default limit and threshold value is 2147483647.

Mode Global Configuration

Usage This command limits the number of multicast routes (mroutes) that can be added to a router, and generates an error message when the limit is exceeded. If the threshold parameter is set, a threshold warning message is generated when this threshold is exceeded, and the message continues to occur until the number of mroutes reaches the limit set by the limit argument.

Example

```
awplus# configure terminal
awplus(config)# ip multicast route-limit 34 24
```

ip multicast wrong-vif-suppression

Use this command to prevent unwanted multicast packets received on an unexpected VLAN being trapped to the CPU.

Use the no variant of this command to disable wrong VIF suppression.

Syntax

```
ip ip multicast wrong-vif-suppression
no ip multicast wrong-vif-suppression
```

Default By default, this feature is disabled.

Mode Global Configuration

Usage Use this command if there is excessive CPU load and multicast traffic is enabled. To confirm that VIF messages are being sent to the CPU use the debug nsm mcast command.

Example To enable the suppression of wrong VIF packets, use the following commands:

```
awplus# configure terminal
awplus(config)# ip multicast wrong-vif-suppression
```

To disable the suppression of wrong VIF packets, use the following commands:

```
awplus# configure terminal
awplus(config)# no ip multicast wrong-vif-suppression
```

ip multicast-routing

Use this command to turn on/off multicast routing on the router; when turned off the device does not perform multicast functions.

Use the no variant of this command to disable multicast routing after enabling it. Note the default stated below.

Syntax

```
ip multicast-routing
no ip multicast-routing
```

Default By default, multicast routing is off.

Mode Global Configuration

Usage When the no variant of this command is used, the Multicast Routing Information Base (MRIB) cleans up Multicast Routing Tables (MRT), stops IGMP operation, and stops relaying multicast forwarder events to multicast protocols.

When multicast routing is enabled, the MRIB starts processing any MRT addition/deletion requests, and any multicast forwarding events.

You must enable multicast routing before issuing other multicast commands.

Example

```
awplus# configure terminal
awplus(config)# ip multicast-routing
```

Validation Commands show running-config

multicast

Use this command to enable a switch port to route multicast packets that ingress the port.

Use the no variant of this command to stop the switch port from routing multicast packets that ingress the port. Note that this does not affect Layer 2 forwarding of multicast packets. If you enter no multicast on a port, multicast packets received on that port will not be forwarded to other VLANs, but ports in the same VLANs as the receiving port will still receive the multicast packets.

Syntax

```
multicast
no multicast
```

Default By default, all switch ports route multicast packets.

Mode Interface mode

Examples

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# multicast
```

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# no multicast
```

Validation Commands show running-config

show ip mroute

Use this command to display the contents of the IP multicast routing (mroute) table.

Syntax

```
show ip mroute [<group-addr>] [<source-addr>] [{dense|sparse}]
   [{count|summary}]
```

Parameter	Description
<group-addr>	Group IP address.
<source-addr>	Source IP address.
dense	Display dense multicast routes.
sparse	Display sparse multicast routes.
count	Display the route and packet count from the IP multicast routing (mroute) table.
summary	Display the contents of the IP multicast routing (mroute) table in an abbreviated form.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ip mroute 10.10.3.34 224.1.4.3
```

```
awplus# show ip mroute 10.10.5.24 225.2.2.2 count
```

```
awplus# show ip mroute 10.10.1.34 summary
```

Output The following is a sample output of this command displaying the IP multicast routing table, with and without specifying the group and source IP address:

Figure 47-2: Example output from the **show ip mroute** command

```
awplus# show ip mroute
IP Multicast Routing Table
Flags: I - Immediate Stat, T - Timed Stat, F - Forwarder
installed
Timers: Uptime/Stat Expiry
Interface State: Interface (TTL)

(10.10.1.52, 224.0.1.3), uptime 00:00:31, stat expires 00:02:59
Owner PIM-SM, Flags: TF
  Incoming interface: vlan2
  Outgoing interface list:
   vlan3 (1)
```

Figure 47-3: Example output from the **show ip mroute** command with the source and group IP address specified

```
awplus# show ip mroute 10.10.1.52 224.0.1.3

IP Multicast Routing Table
Flags: I - Immediate Stat, T - Timed Stat, F - Forwarder
installed
Timers: Uptime/Stat Expiry
Interface State: Interface (TTL)

(10.10.1.52, 224.0.1.3), uptime 00:03:24, stat expires 00:01:28
Owner PIM-SM, Flags: TF
  Incoming interface: vlan2
  Outgoing interface list:
    vlan3 (1)
```

The following is a sample output of this command displaying the packet count from the IP multicast routing table:

Figure 47-4: Example output from the **show ip mroute count** command

```
awplus# show ip mroute count
IP Multicast Statistics
Total 1 routes using 132 bytes memory
Route limit/Route threshold: 2147483647/2147483647
Total NOCACHE/WRONGVIF/WHOLEPKT recv from fwd: 1/0/0
Total NOCACHE/WRONGVIF/WHOLEPKT sent to clients: 1/0/0
Immediate/Timed stat updates sent to clients: 0/0
Reg ACK recv/Reg NACK recv/Reg pkt sent: 0/0/0
Next stats poll: 00:01:10

Forwarding Counts: Pkt count/Byte count, Other Counts: Wrong If
pkts
Fwd msg counts: WRONGVIF/WHOLEPKT recv
Client msg counts: WRONGVIF/WHOLEPKT/Imm Stat/Timed Stat sent
Reg pkt counts: Reg ACK recv/Reg NACK recv/Reg pkt sent

(10.10.1.52, 224.0.1.3), Forwarding: 2/19456, Other: 0
  Fwd msg: 0/0, Client msg: 0/0/0/0,  Reg: 0/0/0
```

The following is a sample output for this command displaying the IP multicast routing table in an abbreviated form:

Figure 47-5: Example output from the **show ip mroute summary** command

```
awplus# show ip mroute summary

IP Multicast Routing Table
Flags: I - Immediate Stat, T - Timed Stat, F - Forwarder
installed
Timers: Uptime/Stat Expiry
Interface State: Interface (TTL)

(10.10.1.52, 224.0.1.3), 00:01:32/00:03:20, PIM-SM, Flags: TF
```

show ip mvif

Use this command to display the contents of the Multicast Routing Information Base (MRIB) VIF table.

Syntax `show ip mvif [<interface>]`

Parameter	Description
<interface>	The interface to display information about.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip mvif vlan2
```

Output Figure 47-6: Example output from the **show ip mvif** command

```
Interface     Vif   Owner     TTL  Local             Remote          Uptime
              Idx   Module         Address           Address
vlan2         0     PIM-SM    1    192.168.1.53      0.0.0.0         00:04:26
Register      1               1    192.168.1.53      0.0.0.0         00:04:26
vlan3         2     PIM-SM    1    192.168.10.53     0.0.0.0         00:04:25
```

Figure 47-7: Example output from the **show ip mvif** command with the interface parameter **vlan2** specified

```
Interface    Vif   Owner     TTL  Local             Remote            Uptime
             Idx   Module         Address           Address
vlan2        0     PIM-SM    1    192.168.1.53      0.0.0.0           00:05:17
```

show ip rpf

Use this command to display Reverse Path Forwarding (RPF) information for the specified source address.

Syntax

```
show ip rpf <source-addr>
```

Parameter	Description
<source-addr>	Source IP address, in dotted decimal notation in the format A.B.C.D.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip rpf 10.10.10.50
```

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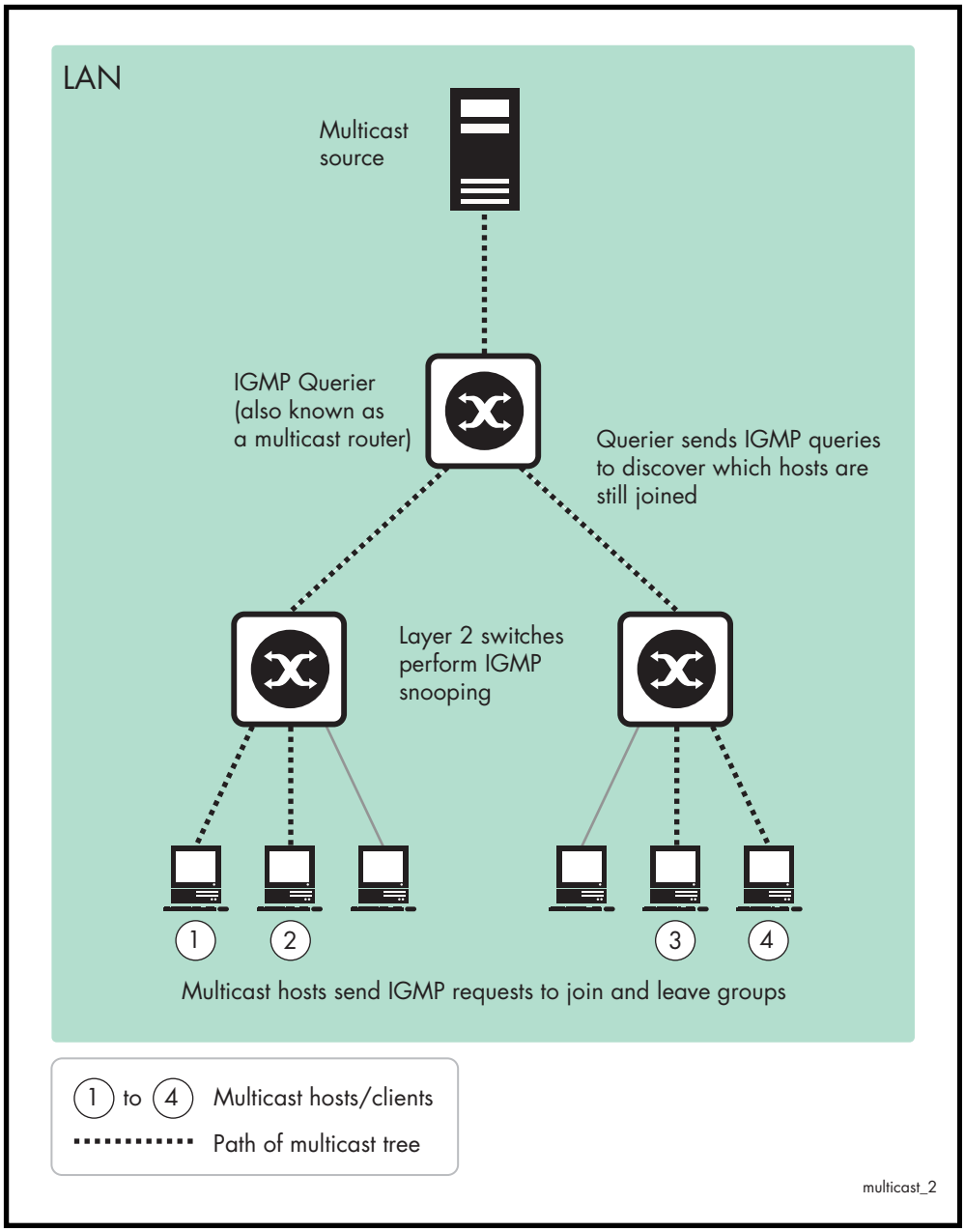
Introduction

This chapter provides information about Internet Group Management Protocol (IGMP), IGMP Snooping, and an introduction to the Query Solicitation feature when used with IGMP Snooping. To see details on the commands used in this example, or to see the outputs of the validation commands, refer to Chapter 49, IGMP and IGMP Snooping Commands. For a general overview of multicasting, see Chapter 47, Multicast Introduction and Commands.

IGMP

Internet Group Management Protocol (IGMP) is the protocol that hosts use to indicate that they are interested in receiving a particular multicast stream. An example of a multicast system within a single Layer 2 LAN is shown in Figure 48-1.

Figure 48-1: Multicast system within a single LAN



Joining a multicast group (Membership report)

When a host wants to receive a stream, referred to as “joining a group”, it sends out an IGMP packet containing the address of the group it wants to join. This packet is called an IGMP Membership report, often referred to as a “join packet”. This packet is forwarded through the LAN to the local IGMP querier, which is typically a router. Once the querier has received an IGMP join message, it knows to forward the multicast stream to the host. If it is not already receiving the stream, it must tell the devices between itself and the multicast source, which may be some hops away from the querier, that it wishes to receive the stream. This might involve a process of using Layer 3 multicast protocols to signal across a WAN, or it might be as simple as receiving a stream from a locally connected multicast server.

Staying in the multicast group (Query message)

The Query message is used by a querier to determine whether hosts are still interested in an IGMP group. At certain time intervals (the default is 125 seconds), the querier sends an IGMP query message onto the local LAN. The destination address of the query message is a special “all multicast groups” address. The purpose of this query is to ask “Are there any hosts on the LAN that wish to remain members of multicast groups?” After receiving an IGMP query, any host that wants to remain in a multicast group must send a new join packet for that group. If a host is a member of more than one group, then it sends a join message for each group it wants to remain a member of. The querier looks at the responses it receives to its query, and compares these to the list of multicast streams that it is currently registered to forward. If there are any items in that list for which it has not received query responses, it will stop forwarding those streams. Additionally, if it is receiving those streams through a Layer 3 network, it will send a Layer 3 routing protocol message upstream, asking to no longer receive that stream.

Leaving the multicast group (Leave message)

How a host leaves a group depends on the IGMP version that it is using. Under IGMP version 1, when a host has finished with a data stream, the local querier continues to send the stream to the host until it sends out the next query message and receives no reply back from the host. IGMP version 2 introduced the Leave message. This allows a host to explicitly inform its querier that it wants to leave a particular multicast group. When the querier receives the Leave message, it sends out a group specific query asking whether any hosts still want to remain members of that specific group. If no hosts respond with join messages for that group, then the querier knows that there are no hosts on its LAN that are still members of that group. This means that for that specific group, it can ask to be pruned from the multicast tree. IGMP version 3 removed the Leave message. Instead a host leaves a group by sending a join message with no source specified.

IGMP Snooping

IGMP Snooping is a way for Layer 2 switches to reduce the amount of multicast traffic on a LAN. The AlliedWare Plus implementation of IGMP Snooping is compatible with networks running all IGMP versions.

Without IGMP Snooping, Layer 2 switches handle IP multicast traffic in the same manner as broadcast traffic and forward multicast frames received on one port to all other ports in the same VLAN. IGMP Snooping allows switches to monitor network traffic, and determine hosts to receive multicast traffic, by looking into IGMP packets to learn which attached hosts need to receive which multicast groups. This allows the switch to forward multicast traffic only out the appropriate ports. If it sees multiple reports sent for one group, it will forward only one of them.

How IGMP Snooping operates

IGMP Snooping operates similarly to the multicast protocols. When a switch hears an IGMP report from a host for a given multicast group, the switch adds the host's port number to the list of ports that are listening to the multicast group. When the switch hears an IGMP leave, it removes the host's port from the list, after the completion of the leave process as described in "Leaving the multicast group (Leave message)" on page 48.3. When there are no hosts listening to a group, the switch informs the local querier to stop sending that group's multicast stream.

IGMP Snooping allows query messages to be forwarded to all ports. The hosts that still require the stream respond to the queries by sending reports. The switch intercepts these. Depending on configuration settings, the switch may just forward the reports directly on to the querier, or it may proxy report on behalf of the group, only forwarding on one consolidated report for each group.

By default, IGMP Snooping is enabled both globally and on all VLANs.

Note

IGMP Snooping cannot be disabled on an interface if IGMP Snooping has already been disabled globally. IGMP Snooping can be disabled on both an interface and globally if disabled on the interface first and then disabled globally.

To disable IGMP Snooping either		
1.	`awplus#`	
	`configure terminal`	Enter Global Configuration mode.
2.	`awplus(config)#`	
	`no ip igmp snooping`	Disable IGMP Snooping globally.
or		
1.	`awplus#`	
	`configure terminal`	Enter Global Configuration mode.
2.	`awplus(config)#`	
	`interface <vlan-name>`	Enter Interface Configuration mode for a specific VLAN.
3.	`awplus(config-if)#`	
	`no ip igmp snooping`	Disable IGMP Snooping for a specific VLAN.

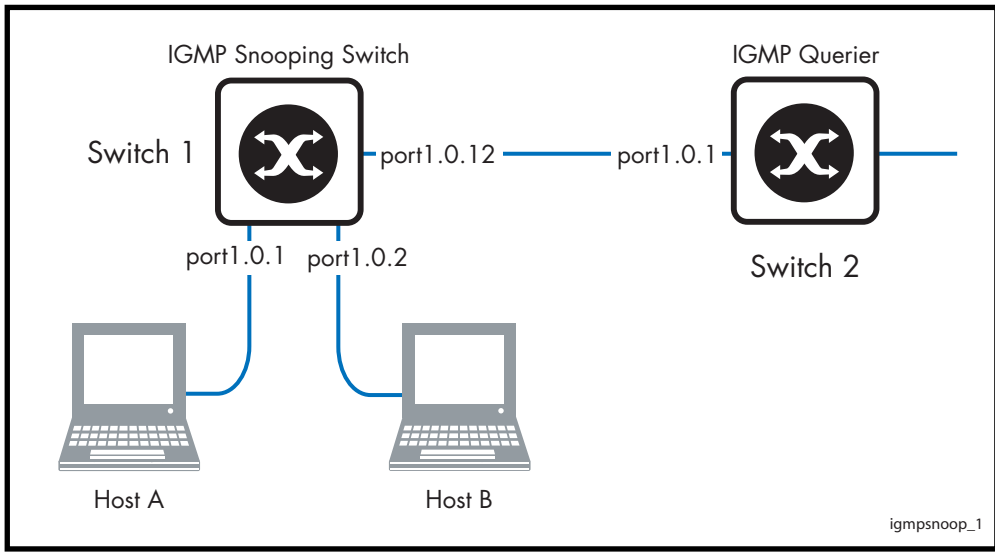
IGMP Snooping and Querier configuration example

This example describes the configuration of IGMP Snooping on an Allied Telesis managed Layer 3 switch (Switch 1) and the configuration of IGMP Querier (Switch 2). The interface port1.0.12 is configured as a multicast router port. Host A and Host B are both members of the same multicast group.

To enable IGMP Snooping on an interface:

- Enable IGMP Snooping globally, if necessary. IGMP Snooping is enabled by default.
- Statically configure ports that are connected to routers if necessary.

Figure 48-2: IGMP Snooping configuration example



As a result of this configuration:

- Membership reports are generated by hosts. The IGMP Snooping switch will forward the membership reports to its router port. Queries received by the IGMP Snooping switch from the IGMP Querier on port1.0.12 are forwarded by the IGMP Snooping switch.
- Because Host A and Host B are members of the same multicast group, the switch does not notify the IP IGMP routing device (IGMP Querier) when Host A leaves the group, because the group still has another member Host B remaining. When Host B also leaves the group, the switch forwards the leave message to the IP IGMP Querier.
- The addition of a static mrouter port is only required when there is no upstream IGMP querier or an upstream router does not send topology discovery or maintenance messages (like IGMP General Queries or OSPF Hello packets).
- In this example, the configuration of a static mrouter port on port1.0.12 is provided to illustrate the ip igmp snooping mrouter command. However, this command would probably not be necessary, since the switch should dynamically set port1.0.12 to be an mrouter port as it receives IGMP Queries arriving from the IGMP Querier attached to port1.0.12.
- In this example, it is not necessary to explicitly configure the switch to work with IGMPv2 or IGMPv3. When the IGMP version is not configured then the switch will work with both versions of IGMP.

Table 48-1: Configuring IGMP Snooping on Switch 1 and IGMP Querier on Switch 2

Configure IGMP Snooping (Switch 1)		
1.	`awplus#`	
	`configure terminal`	Enter Global Configuration mode.
2.	`awplus(config)#`	
	`ip igmp snooping`	IGMP Snooping is enabled by default. Use this command only if you have previously disabled it.
3.	`awplus(config)#`	
	`interface vlan1`	Enter Interface Configuration mode for VLAN 1.
4.	`awplus(config-if)#`	
	`ip igmp snooping mrouter interface port1.0.12`	Configure port1.0.12 as a multicast router port to the IGMP Querier.
5.	`awplus(config-if)#`	
	`exit`	Return to Global Configuration mode.
Validate the configuration		
6.	`awplus#`	
	`exit`	Return to Privileged Exec mode.
7.	`awplus#`	
	`show ip igmp interface vlan1`	Display the state of IGMP Snooping for VLAN 1.
8.	`awplus#`	
	`show ip igmp groups`	Display the multicast groups with receivers directly connected to the router.
9.	`awplus#`	
	`show ip igmp snooping mrouter interface vlan1`	Display the multicast router ports, both static and dynamic, in VLAN 1.
Configure IGMP Querier (Switch 2)		
1.	`awplus#`	
	`configure terminal`	Enter Global Configuration mode.
2.	`awplus(config)#`	
	`interface vlan1`	Enter Interface Configuration mode for VLAN 1.
3.	`awplus(config-if)#`	
	`ip igmp`	Enable IGMP on VLAN 1 and configure the switch as an IGMP Querier.
Validate the configuration		
4.	`awplus#`	
	`exit`	Return to Privileged Exec mode.
5.	`awplus#`	
	`show ip igmp interface vlan1`	Display the state of IGMP Querier for VLAN 1.
6.	`awplus#`	
	`show running-config`	Display the current dynamic configuration of Switch 2.

Query Solicitation

Query Solicitation minimizes the loss of multicast data after a topology change on networks that use EPSR or spanning tree (STP, RSTP, or MSTP) for loop protection. Without Query Solicitation, when the underlying link layer topology changes, multicast data flow can stop for up to several minutes, depending on which port goes down and how much of the IGMP query interval remained at the time of the topology change. Query Solicitation greatly reduces this disruption.

Query Solicitation operates without configuration in AlliedWare Plus™ switches running STP, RSTP, MSTP or EPSR. However, you may find it useful to manually enable Query Solicitation in loop-free networks running IGMP (see Speeding up IGMP convergence in a non-looped topology) and networks where not all switches support Query Solicitation (see Enabling Query Solicitation on multiple switches in a looped topology).

How Query Solicitation Works

Query Solicitation monitors STP, RSTP, MSTP and EPSR messages for topology changes. When it detects a change, it generates a special IGMP Leave message called a Query Solicit. The switch floods the Query Solicit message to all ports in every VLAN that Query Solicitation is enabled on. When the Querier receives the Query Solicit message, it sends out a General Query and waits for clients to respond with Membership Reports. These Reports update the snooping information throughout the network.

Query Solicit messages have a group address of 0.0.0.0.

Query Solicitation works by default (without you enabling it) on all VLANs on the root bridge in an STP instance and on all data VLANs on the master node in an EPSR instance. By default, the root bridge or master node always sends a Query Solicit message when any of the following events occur:

- an STP BPDU packet with the Topology Change (TC) flag arrives at the root bridge
- an STP port on a switch goes from a Discarding to Forwarding state
- the FDB gets flushed by EPSR

If necessary, you can make clients respond more quickly to the General Query by tuning the IGMP timers, especially the maximum response time advertised in IGMP queries using the ip igmp query-max-response-time command.

Query Solicitation Operation

When IGMP Snooping is enabled and EPSR or Spanning Tree changes the underlying link layer topology, this can interrupt multicast data flow for a significant length of time. This is because there is no way for switches in a network with interested clients to know where the traffic is available, due to the change in network topology. This change in network topology may take up to two IGMP Query intervals from the IGMP Querier, until the switches will know where to forward membership reports received by client hosts. During this time, those hosts will not receive multicast traffic.

Query solicitation prevents this by monitoring for any topology changes. When it detects a change, it generates a special IGMP Leave message known as a Query Solicit, and floods the Query Solicit message to all ports in every VLAN that query solicitation is enabled on. When the IGMP Querier receives the message, it responds by sending a General Query, which all IGMP listeners respond to. This refreshes snooped group membership information in the network.

Query solicitation reduces downtime to a negligible amount by triggering on topology changes. The generation of query solicitation messages in the network causes the IGMP Querier to send an IGMP Query immediately following a topology change resulting in the switches knowing where to look for the traffic and thus sending reports to the correct switch upstream, and thus allow the multicast data traffic to be recovered instantly.

Query solicitation functions by default (without you enabling it) on all VLANs on the root bridge in an STP instance and on all data VLANs on the master node in an EPSR instance. By default, the root bridge or master node always sends a Query Solicit message when the topology changes.

If you have multiple STP or EPSR instances, query solicitation only sends Query Solicit messages on VLANs in the instance that experienced a topology change.

In switches other than the STP root bridge or EPSR master node, query solicitation is disabled by default, but you can enable it by using the ip igmp snooping tcn query solicit command.

If you enable query solicitation on a switch other than the STP root bridge or EPSR master node, both that switch and the root or master send a Query Solicit message.

Once the Querier receives the Query Solicit message, it sends out a General Query and waits for responses, which update the snooping information throughout the network.

The ip igmp query-holdtime command can be configured on the IGMP Querier. This command introduces a brief delay between when the IGMP Querier receives the query solicit, and when it sends out the general query. Although this slightly reduces the speed with which the network recovers from the topology change, its does guard against a DoS (Denial of Service) attack. Without this delay, a malign host sending a stream of query solicits could cause the IGMP Querier to flood the network with IGMP Queries.

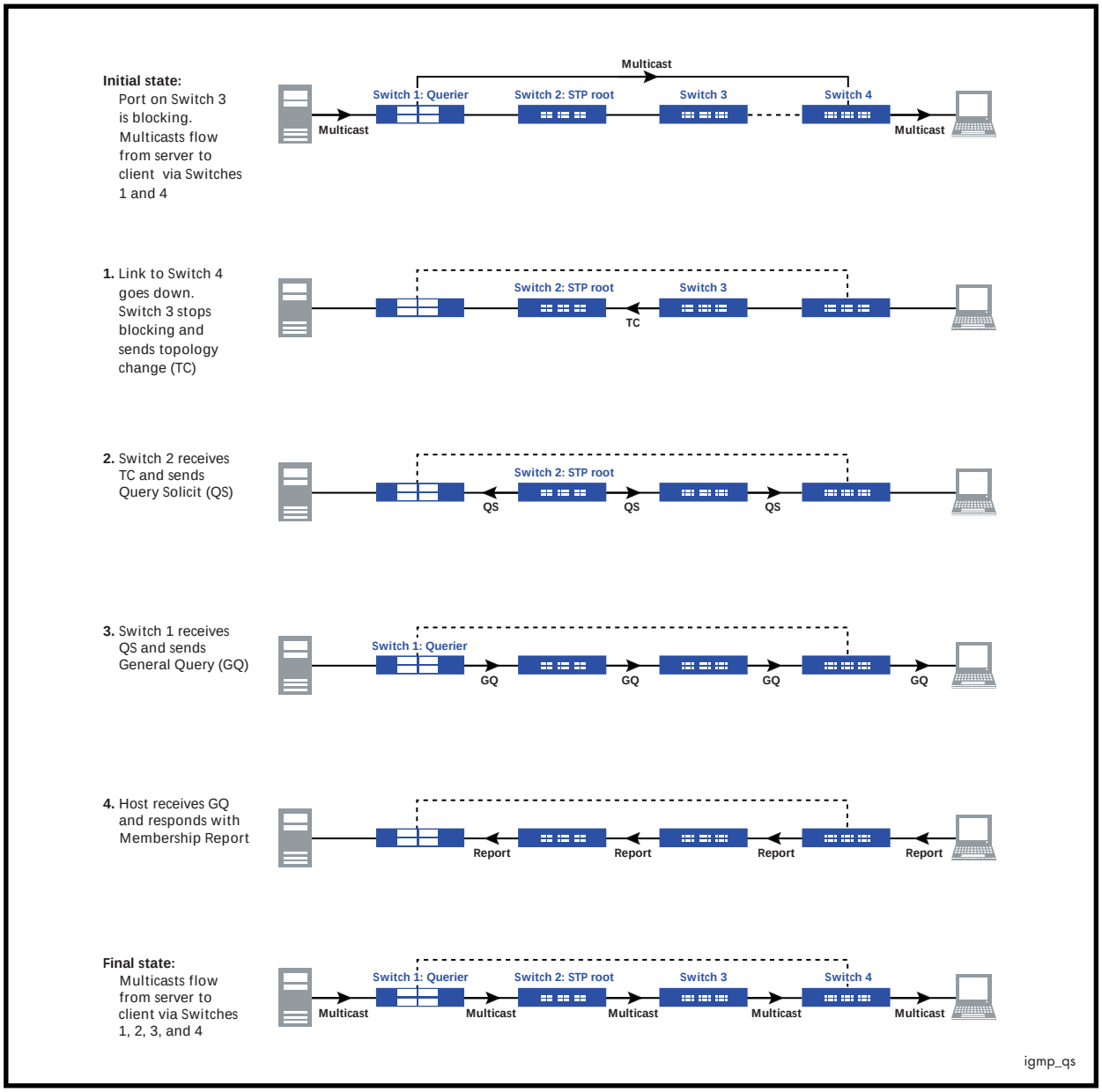
To get the network to converge faster, use the ip igmp query-max-response-time command and set a low response time value, such as one or two seconds, so that the clients will respond immediately with a report as a response to the IGMP Queries

On switches other than the STP root bridge or the EPSR master node, you can disable query solicitation by using the no variant of the ip igmp snooping tcn query solicit command. In addition, on all switches, you can disable query solicitation on a per-vlan basis using the no variant of the ip igmp snooping tcn query solicit command in Interface Configuration mode, after specifying a VLAN first in Interface Configuration mode.

To see whether query solicitation is on or off, check the Query Solicitation field in output of the show ip igmp interface command. You can view running and startup configurations with show running-config and show startup-config commands to see if Query Solicitation is enabled.

The following figure shows how Query Solicitation works when a port goes down.

Figure 48-3: Query Solicitation when a port goes down



Speeding up IGMP convergence in a non-looped topology

For loop-free networks running IGMP, where it may take up to two minutes for multicasting to recover in a non-looped topology after a port comes back up, you can speed up convergence by enabling RSTP using the spanning-tree mode and spanning-tree enable commands.

RSTP enables the network to use Query Solicitation by default, and means that multicasting should resume within seconds, not minutes, of the link coming up.

Enabling Query Solicitation on multiple switches in a looped topology

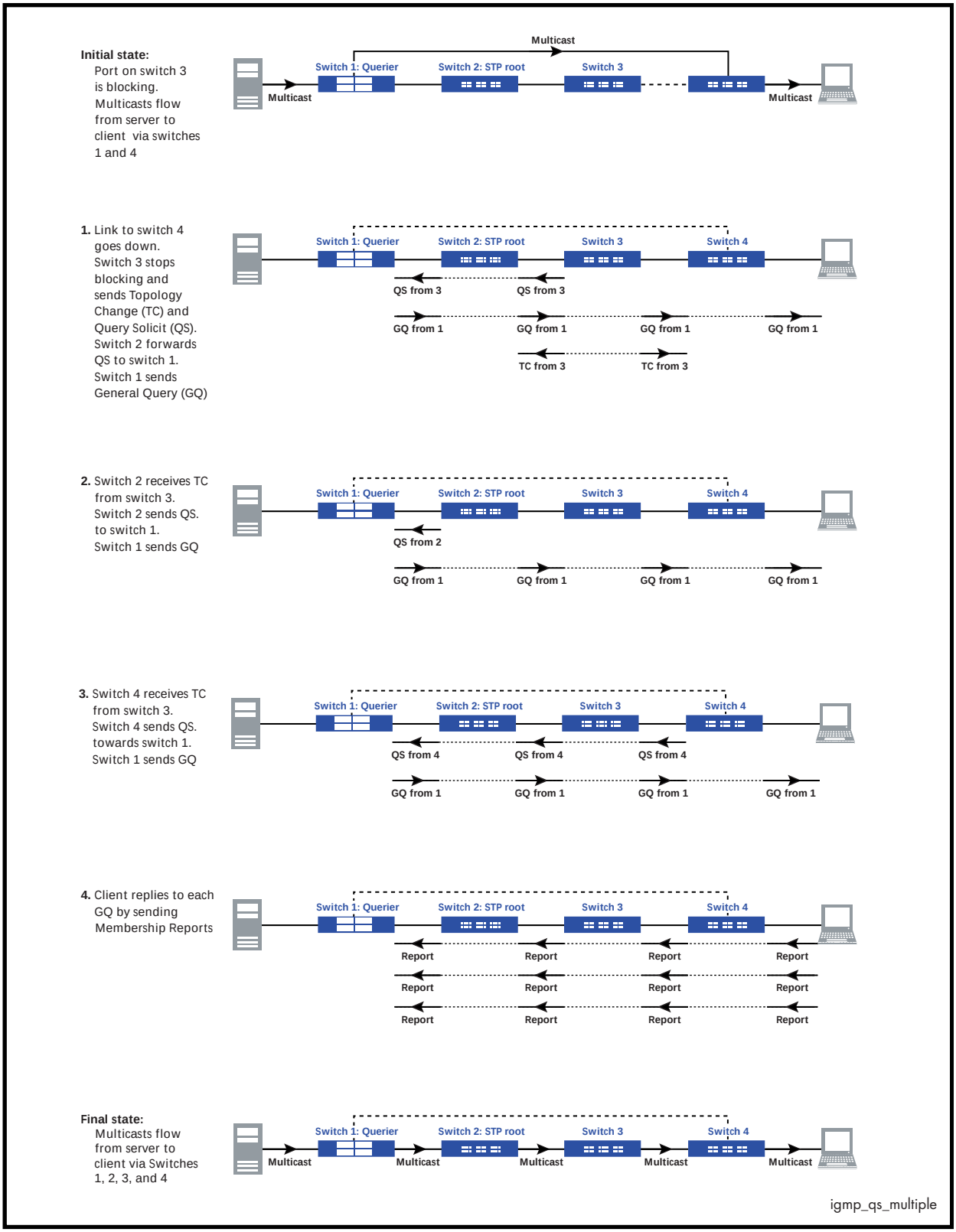
On networks that use spanning tree or EPSR, Query Solicitation is not normally required on switches other than the STP root bridge or EPSR master node. Therefore, it is only enabled by default on the root bridge and the master node.

However, in some networks you may need to turn on Query Solicitation on all switches - for example, if the network includes other switches that do not support Query Solicitation and therefore the STP root bridge may be a switch that does not send Query Solicit messages. To enable Query Solicitation, use the ip igmp snooping tcn query solicit command.

Every switch that has Query Solicitation enabled sends a Query Solicit message when it detects a topology change. Enabling it on multiple switches means you get multiple messages, but has no other disadvantage.

The following figure shows the packet flow for a four-switch network with Query Solicitation enabled on all the switches.

Figure 48-4: Packet flow for a four switch network with Query Solicitation enabled



Chapter 49: IGMP and IGMP Snooping Commands

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Introduction

The Internet Group Management Protocol (IGMP) module includes the IGMP Proxy service and IGMP Snooping functionality. Some of the following commands may have commonalities and restrictions. These are described under the Usage section for each command.

Command List

This chapter provides an alphabetical reference of configure, clear, and show commands related to Internet Group Management Protocol (IGMP).

clear ip igmp

Use this command to clear all IGMP group membership records on all VLAN interfaces.

Syntax `clear ip igmp`

Mode Privileged Exec

Usage This command applies to VLAN interfaces configured for IGMP, IGMP Snooping, or IGMP Proxy.

Example

```
awplus# clear ip igmp
```

Validation Commands show ip igmp interface
show running-config

Related Commands clear ip igmp group
clear ip igmp interface

clear ip igmp group

Use this command to clear IGMP group membership records for a specific group on either all VLAN interfaces, a single VLAN interface, or for a range of VLAN interfaces.

Syntax

```
clear ip igmp group *
clear ip igmp group <ip-address> <interface>
```

Parameter	Description
*	Clears all groups on all VLAN interfaces. This is an alias to the clear ip igmp command.
<ip-address>	Specifies the group whose membership records will be cleared from all VLAN interfaces, entered in the form A.B.C.D.
<interface>	Specifies the name of the VLAN interface; all groups learned on this VLAN interface are deleted.

Mode Privileged Exec

Usage This command applies to groups learned by IGMP, IGMP Snooping, or IGMP Proxy.

In addition to the group a VLAN interface can be specified. Specifying this will mean that only entries with the group learnt on the interface will be deleted.

Examples

```
awplus# clear ip igmp group *
awplus# clear ip igmp group 224.1.1.1 vlan1
```

Validation Commands show ip igmp interface
show running-config

Related Commands clear ip igmp
clear ip igmp interface

clear ip igmp interface

Use this command to clear IGMP group membership records on a particular VLAN interface.

Syntax

```
clear ip igmp interface <interface>
```

Parameter	Description
<interface>	Specifies the name of the VLAN interface. All groups learned on this VLAN interface are deleted.

Mode Privileged Exec

Usage This command applies to interfaces configured for IGMP, IGMP Snooping, or IGMP Proxy.

Example

```
awplus# clear ip igmp interface vlan1
```

Validation Commands show ip igmp interface
show running-config

Related Commands clear ip igmp
clear ip igmp group

debug igmp

Use this command to enable debugging of either all IGMP or a specific component of IGMP.

Use the no variant of this command to disable all IGMP debugging, or debugging of a specific component of IGMP.

Syntax

```
debug igmp {all|decode|encode|events|fsm|tib}
no debug igmp {all|decode|encode|events|fsm|tib}
```

Parameter	Description
`all`	Enable or disable all debug options for IGMP
`decode`	Debug of IGMP packets that have been received
`encode`	Debug of IGMP packets that have been sent
`events`	Debug IGMP events
`fsm`	Debug IGMP Finite State Machine (FSM)
`tib`	Debug IGMP Tree Information Base (TIB)

Modes

Privileged Exec and Global Configuration

Usage

This command applies to interfaces configured for IGMP, IGMP Snooping, or IGMP Proxy.

Example

```
awplus# configure terminal
awplus(config)# debug igmp all
```

Related Commands

show debugging igmp
undebug igmp

ip igmp

Use this command to enable IGMP on an interface. The command configures the device as an IGMP querier.

Use the no variant of this command to return all IGMP related configuration to the default on this interface.

Syntax

```
ip igmp
no ip igmp
```

Default Disabled

Mode Interface Configuration for a VLAN interface.

Usage This command can only be configured on VLAN interfaces, and will have no effect on IGMP Proxy or IGMP Snooping configuration.

Example

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip igmp
```

Validation Commands show ip igmp interface
show running-config

ip igmp access-group

This command adds an access control list to a VLAN interface configured for IGMP, IGMP Snooping, or IGMP Proxy. The access control list is used to control and filter the multicast groups learnt on the VLAN interface.

The no variant of this command disables the access control filtering on the interface.

Syntax

```
ip igmp access-group {<access-list-number>|<access-list-name>}
no ip igmp access-group
```

Parameter	Description
<access-list-number>	Standard IP access-list number, in the range <1-99>.
<access-list-name>	Standard IP access-list name.

Default By default there are no access lists configured on any interface.

Mode Interface Configuration for a VLAN interface.

Usage This command applies to VLAN interfaces configured for IGMP, IGMP Snooping, or IGMP Proxy.

Example In the following example, hosts serviced by VLAN 1 can only join the group `225.2.2.2`:

```
awplus# configure terminal
awplus(config)# access-list 1 permit 225.2.2.2 0.0.0.0
awplus(config)# interface vlan1
awplus(config-if)# ip igmp access-group 1
```

ip igmp immediate-leave

In IGMP version 2, use this command to minimize the leave latency of IGMP memberships for specified multicast groups. The specified access list number or name defines the multicast groups in which the immediate leave feature is enabled.

Use the no variant of this command to disable this feature.

Syntax

```
ip igmp immediate-leave group-list {<access-list-number>|<access-
    list-number-expanded>|<access-list-name>}

no ip igmp immediate-leave
```

Parameter	Description
<access-list-number>	Access-list number, in the range <1-99>.
<access-list-number-expanded>	Access-list number (expanded range), in the range <1300-1999>.
<access-list-name>	Standard IP access-list name.

Default Disabled by default.

Mode Interface Configuration for a VLAN interface.

Usage This command applies to interfaces configured for IGMP, IGMP Snooping, or IGMP Proxy.

Example The following example shows how to enable the immediate-leave feature on an interface for a specific range of multicast groups

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip igmp immediate-leave group-list 34
awplus(config-if)# exit
awplus(config)# access-list 34 permit 225.192.20.0 0.0.0.255
```

Related Commands ip igmp last-member-query-interval

ip igmp last-member-query-count

Use this command to set the last-member query-count value for an interface.

Use the no variant of this command to return to the default on an interface.

Syntax

```
ip igmp last-member-query-count <2-7>
no ip igmp last-member-query-count
```

Parameter	Description
<2-7>	Last member query count value.

Default The default last member query count value is 2.

Mode Interface Configuration for a VLAN interface.

Usage This command applies to interfaces configured for IGMP, IGMP Snooping, or IGMP Proxy.

Example

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip igmp last-member-query-count 3
```

Validation Commands show ip igmp interface
show running-config

Related Commands ip igmp last-member-query-interval
ip igmp startup-query-count

ip igmp last-member-query-interval

Use this command to configure the frequency at which the router sends IGMP group specific host query messages.

Use the no variant of this command to set this frequency to the default.

Syntax

```
ip igmp last-member-query-interval <interval>
no ip igmp last-member-query-interval
```

Parameter	Description
<interval>	The frequency in milliseconds, in the range <1000-25500>, at which IGMP group-specific host query messages are sent.

Default 1000 milliseconds

Mode Interface Configuration for a VLAN interface.

Usage This command applies to interfaces configured for IGMP, IGMP Snooping, or IGMP Proxy.

Example The following example changes the IGMP group-specific host query message interval to 2 seconds (2000 milliseconds):

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip igmp last-member-query-interval 2000
```

Validation Commands
show ip igmp interface
show running-config

Related Commands
ip igmp immediate-leave
ip igmp last-member-query-count

ip igmp limit

Use this command to configure the limit on the maximum number of group membership entries for the device as a whole or for the specified interface (if in interface mode). Once the specified number of group memberships is reached, all further membership reports will be ignored. Optionally, you can configure an access-list to stop certain address(es) from being subject to the limit.

The limit is dependent on the MTU (Maximum Transmission Unit) of the interface, which is the size in bytes of the largest packet that a network protocol can transmit. Typically for an ethernet channel with an MTU of 1500 the igmp group membership limit will be 183 groups, because each igmp group membership is 8 bytes.

Use the no variant of this command to unset the limit and any specified exception access-list.

Syntax

```
ip igmp limit <limitvalue> [except {<access-list-number>|<access-
    list-number-expanded>|<access-list-name>}]

no ip igmp limit
```

Parameter	Description
<limitvalue>	<2-2097152> Maximum number of group membership entries.
<access-list-number>	Access-list number, in the range <1-99>.
<access-list-number-expanded>	Access-list number (expanded range), in the range <1300-1999>.
<access-list-name>	Standard IP access-list name.

Default The default limit, which is reset by the no variant of this command, is the same as maximum number of group membership entries that can be learned with the ip igmp limit command.

The default limit of group membership entries that can be learned is 2095152 entries.

Mode Global Configuration and Interface Configuration for a VLAN interface.

Usage This command applies to interfaces configured for IGMP, IGMP Snooping, or IGMP Proxy.

Examples The following example configures an IGMP limit of `100` group membership entries across all interfaces on which IGMP is enabled, and excludes group `224.1.1.1` from this limitation:

```
awplus# configure terminal
awplus(config)# access-list 1 permit 224.1.1.1 0.0.0.0
awplus(config)# ip igmp limit 100 except 1
```

The following example configures an IGMP limit of 100 group membership entries on vlan1:

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip igmp limit 100
```

ip igmp mroute-proxy

Use this command to enable IGMP mroute proxy on this downstream interface and associate it with the upstream proxy service interface.

Use the no variant of this command to remove the association with the proxy-service interface.

Syntax

```
ip igmp mroute-proxy <interface>
no ip igmp mroute-proxy
```

Parameter	Description
<interface>	The name of the VLAN interface.

Mode Interface Configuration for a VLAN interface.

Usage You must also enable the IGMP proxy service on the upstream interface, using the ip igmp proxy-service command. You can associate one or more downstream mroute proxy interfaces on the device with a single upstream proxy service interface. This downstream mroute proxy interface listens for IGMP reports, and forwards them to the upstream IGMP proxy service interface.

IGMP Proxy does not work with other multicast routing protocols, such as PIM-SM or PIM-DM. This command applies to interfaces configured for IGMP Proxy.

Example The following example configures the `vlan1` interface as the upstream proxy-service interface for the downstream interface, `vlan2`.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip igmp mroute-proxy vlan1
```

Related Commands ip igmp proxy-service

ip igmp proxy-service

Use this command to enable the VLAN interface to be the upstream IGMP proxy-service interface for the device. All associated downstream IGMP mroute proxy interfaces on this device will have their memberships consolidated on this proxy service interface, according to IGMP host-side functionality.

Use the no variant of this command to remove the designation of the VLAN interface as an upstream proxy-service interface.

Syntax

```
ip igmp proxy-service
no ip igmp proxy-service
```

Mode Interface Configuration for a VLAN interface.

Usage This command is used with the ip igmp mroute-proxy command to enable forwarding of IGMP reports to a proxy service interface for all forwarding entries for this interface. You must also enable the downstream IGMP mroute proxy interfaces on this device using the command ip igmp mroute-proxy.

IGMP Proxy does not work with other multicast routing protocols, such as PIM-SM or PIM-DM.

Example The following example designates the `vlan1` interface as the upstream proxy-service interface.

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip igmp proxy-service
```

Related Commands ip igmp mroute-proxy

ip igmp querier-timeout

Use this command to configure the timeout period before the device takes over as the querier for the VLAN interface after the previous querier has stopped querying.

Use the no variant of this command to restore the default.

Syntax

```
ip igmp querier-timeout <timeout>
no ip igmp querier-timeout
```

Parameter	Description
<timeout>	IGMP querier timeout interval value in seconds, in the range <1-65535>.

Default The default timeout interval is 255 seconds.

Mode Interface Configuration for a VLAN interface.

Usage This command applies to VLAN interfaces configured for IGMP. The timeout value should not be less than the current active querier's general query interval.

Example The following example configures the device to wait `130` seconds from the time it received the last query before it takes over as the querier for the interface:

```
awplus# configure terminal
awplus(config)# interface vlan20
awplus(config-if)# ip igmp querier-timeout 130
```

Validation Commands show ip igmp interface
show running-config

Related Commands ip igmp query-interval

ip igmp query-holdtime

This command sets the time that an IGMP Querier waits after receiving a query solicitation before it sends an IGMP Query. IGMP General Query messages will not be sent during the hold time interval.

Use the no variant of this command to return to the default query hold time period.

Syntax

```
ip igmp query-holdtime <interval>
no ip igmp query-holdtime
```

Parameter	Description
<interval>	Query interval value in milliseconds, in the range <100-5000>.

Default By default the delay before sending IGMP General Query messages is 500 milliseconds.

Mode Interface Configuration for a VLAN interface.

Usage Use this command to configure a value for the IGMP query hold time in the current network. IGMP Queries can be generated after receiving Query Solicitation (QS) packets and there is a possibility of a DoS (Denial of Service) attack if a stream of Query Solicitation (QS) packets are sent to the IGMP Querier, eliciting a rapid stream of IGMP Queries. This command applies to interfaces on which the switch is acting as an IGMP Querier.

Use the ip igmp query-interval command when a delay for IGMP general query messages is required and IGMP general query messages are required. The ip igmp query-holdtime command stops IGMP query messages during the configured holdtime interval, so the rate of IGMP Queries that can be sent out of an interface can be restricted.

See "Query Solicitation" on page 48.7 for introductory information about the Query Solicitation feature.

Examples To set the IGMP query holdtime to `900` ms for `vlan20`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan20
awplus(config-if)# ip igmp query-holdtime 900
```

To reset the IGMP query holdtime to the default (500 ms) for `vlan10`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan10
awplus(config-if)# no ip igmp query-holdtime
```

Validation Commands show ip igmp interface
show running-config

Related Commands ip igmp query-interval
ip igmp snooping tcn query solicit

ip igmp query-interval

Use this command to configure the period for sending IGMP General Query messages. The IGMP query interval specifies the time between IGMP General Query messages being sent.

Use the no variant of this command to return to the default query interval period.

Note The IGMP query interval must be greater than IGMP query maximum response time.

Syntax

```
ip igmp query-interval <interval>
no ip igmp query-interval
```

Parameter	Description
<interval>	Query interval value in seconds, in the range <2-18000>.

Default The default IGMP query interval is 125 seconds.

Mode Interface Configuration for a VLAN interface.

Usage This command applies to interfaces configured for IGMP. Note that the IGMP query interval is automatically set to a greater value than the IGMP query max response time.

For example, if you set the IGMP query max response time to 2 seconds using the ip igmp query-max-response-time command, and the IGMP query interval is currently less than 3 seconds, then the IGMP query interval period will be automatically reconfigured to be 3 seconds, so it is greater than the IGMP query maximum response time.

Use the ip igmp query-interval command when a non-default interval for IGMP General Query messages is required.

The ip igmp query-holdtime command can occasionally delay the sending of IGMP Queries.

Examples The following example changes the period between IGMP host-query messages to 3 minutes (180 seconds):

```
awplus# configure terminal
awplus(config)# interface vlan20
awplus(config-if)# ip igmp query-interval 180
```

The following example resets the period between sending IGMP host-query messages to the default (125 seconds):

```
awplus# configure terminal
awplus(config)# interface vlan20
awplus(config-if)# no ip igmp query-interval
```

Validation Commands
show ip igmp interface
show running-config

Related Commands
ip igmp query-holdtime
ip igmp query-max-response-time
ip igmp startup-query-interval

ip igmp query-max-response-time

Use this command to configure the maximum response time advertised in IGMP Queries.

Use the no variant of this command to restore the default.

Note The IGMP query maximum response time must be less than the IGMP query interval.

Syntax

```
ip igmp query-max-response-time <response-time>
no ip igmp query-max-response-time
```

Parameter	Description
<response-time>	Response time value in seconds, in the range <1-3180>.

Default The default IGMP query maximum response time is 10 seconds.

Mode Interface Configuration for a VLAN interface.

Usage This command applies to interfaces configured for IGMP. Note that the IGMP query interval is automatically set to a greater value than the IGMP query maximum response time.

For example, if you set the IGMP query interval to 3 seconds using the ip igmp query-interval command, and the current IGMP query interval is less than 3 seconds, then the IGMP query maximum response time will be automatically reconfigured to be 2 seconds, so it is less than the IGMP query interval time.

To get the network to converge faster, use the ip igmp query-max-response-time command and set a low response time value, such as one or two seconds, so that the clients will respond immediately with a report as a response to the IGMP Queries

Examples The following example configures a maximum response time of 8 seconds:

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip igmp query-max-response-time 8
```

The following example restores the default maximum response time of 10 seconds:

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# no ip igmp query-max-response-time
```

Validation Commands show ip igmp interface
show running-config

Related Commands ip igmp query-interval

ip igmp ra-option (Router Alert)

Use this command to enable strict Router Alert (RA) option validation. With strict RA option enabled, IGMP packets without RA options are ignored.

Use the no variant of this command to disable strict RA option validation.

Syntax

```
ip igmp ra-option
no ip igmp ra-option
```

Default The default state of RA validation is unset.

Mode Interface Configuration for a VLAN interface.

Usage This command applies to interfaces configured for IGMP and IGMP Snooping.

Example

```
awplus# configure terminal
awplus(config)# interface vlan20
awplus(config-if)# ip igmp ra-option
```

ip igmp robustness-variable

Use this command to change the robustness variable value on a VLAN interface.

Use the no variant of this command to return to the default on an interface.

Syntax

```
ip igmp robustness-variable <1-7>
no ip igmp robustness-variable
```

Parameter	Description
<1-7>	The robustness variable value.

Default The default robustness variable value is 2.

Mode Interface Configuration for a VLAN interface.

Usage This command applies to interfaces configured for IGMP and IGMP Snooping.

Examples

```
awplus# configure terminal
awplus(config)# interface vlan20
awplus(config-if)# ip igmp robustness-variable 3

awplus# configure terminal
awplus(config)# interface vlan20
awplus(config-if)# no ip igmp robustness-variable
```

Validation Commands show ip igmp interface
show running-config

ip igmp snooping

Use this command to enable IGMP Snooping. When this command is used in the Global Configuration mode, IGMP Snooping is enabled at the switch level. When this command is used in Interface Configuration mode, IGMP Snooping is enabled for the specified VLANs.

Use the no variant of this command to either globally disable IGMP Snooping, or disable IGMP Snooping on a specified interface.

Note

IGMP snooping cannot be disabled on an interface if IGMP snooping has already been disabled globally. IGMP snooping can be disabled on both an interface and globally if disabled on the interface first and then disabled globally.

Syntax

```
ip igmp snooping
no ip igmp snooping
```

Default By default, IGMP Snooping is enabled both globally and on all VLANs.

Mode Global Configuration and Interface Configuration for a VLAN interface.

Usage For IGMP snooping to operate on particular VLAN interfaces, it must be enabled both globally by using this command in Global Configuration mode, and on individual VLAN interfaces by using this command in Interface Configuration mode (both are enabled by default.)

Examples

```
awplus# configure terminal
awplus(config)# ip igmp snooping
awplus(config)# interface vlan1
awplus(config-if)# ip igmp snooping
```

Related Commands show ip igmp interface
show running-config

ip igmp snooping fast-leave

Use this command to enable IGMP Snooping fast-leave processing. Fast-leave processing is analogous to immediate-leave processing. The IGMP group-membership entry is removed as soon as an IGMP leave group message is received, without sending out a group-specific query.

Use the no variant of this command to disable fast-leave processing.

Syntax

```
ip igmp snooping fast-leave
no ip igmp snooping fast-leave
```

Default IGMP Snooping fast-leave processing is disabled.

Mode Interface Configuration for a VLAN interface.

Usage This IGMP Snooping command can only be configured on VLAN interfaces.

Example This example shows how to enable fast-leave processing on a VLAN.

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip igmp snooping fast-leave
```

Validation Commands

show ip igmp interface
show running-config

ip igmp snooping mrouter

Use this command to statically configure the specified port in the VLAN as a multicast router port for IGMP Snooping in that VLAN. This command applies to interfaces configured for IGMP Snooping.

Use the no variant of this command to remove the static configuration of the port as a multicast router port.

Syntax

```
ip igmp snooping mrouter interface <port>
no ip igmp snooping mrouter interface <port>
```

Parameter	Description
<port>	The port may be a switch port (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).

Mode Interface Configuration for a VLAN interface.

Usage This IGMP Snooping command can only be configured on VLAN interfaces.

Example This example shows `port1.0.2` statically configured to be a multicast router interface.

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip igmp snooping mrouter interface port1.0.2
```

Related Commands show ip igmp snooping mrouter

ip igmp snooping querier

Use this command to enable IGMP querier operation on a VLAN when no multicast routing protocol is configured in the VLAN. When enabled, the IGMP Snooping querier sends out periodic IGMP queries for all interfaces on that VLAN. This command applies to interfaces configured for IGMP Snooping.

Use the no variant of this command to disable IGMP querier configuration.

Syntax

```
ip igmp snooping querier
no ip igmp snooping querier
```

Mode Interface Configuration for a VLAN interface.

Usage This command can only be configured on VLAN interfaces.

The IGMP Snooping querier uses the `0.0.0.0` Source IP address because it only masquerades as a proxy IGMP querier for faster network convergence.

It does not start, or automatically cease, the IGMP Querier operation if it detects query message(s) from a multicast router.

If an IP address is assigned to a VLAN, which has IGMP querier enabled on it, then the IGMP Snooping querier uses the VLAN's IP address as the Source IP Address in IGMP queries.

The IGMP Snooping Querier will not stop sending IGMP Queries if there is another IGMP Snooping Querier in the network with a lower Source IP Address.

Note Do not enable the IGMP Snooping Querier feature on a Layer 2 switch when there is an operational IGMP Querier in the network.

Example

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip igmp snooping querier
```

Validation Commands show ip igmp interface
show running-config

ip igmp snooping report-suppression

Use this command to enable report suppression for IGMP versions 1 and 2. This command applies to interfaces configured for IGMP Snooping.

Report suppression stops reports being sent to an upstream multicast router port when there are already downstream ports for this group on this interface.

Use the no variant of this command to disable report suppression.

Syntax

```
ip igmp snooping report-suppression
no ip igmp snooping report-suppression
```

Default Report suppression does not apply to IGMPv3, and is turned on by default for IGMPv1 and IGMPv2 reports.

Mode Interface Configuration for a VLAN interface.

Usage This command can only be configured on VLAN interfaces.

Example This example shows how to enable report suppression for IGMPv2 reports.

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip igmp version 2
awplus(config-if)# ip igmp snooping report-suppression
```

Validation Commands show ip igmp interface
show running-config

ip igmp snooping routermode

Use this command to set the destination IP addresses as a router multicast address, according to the routermode (all multicast addresses, default multicast addresses, specified multicast addresses).

Use the no variant of this command to the default. You can also remove a specified IP address from a custom list of multicast addresses.

Syntax

```
ip igmp snooping routermode {all|default|ip|multicastrouter|address
   <ip-address>}

no ip igmp snooping routermode [address <ip-address>]
```

Parameter	Description
`all`	All reserved multicast addresses (224.0.0.x). Packets from all possible addresses in range 224.0.0.x are set as routers.
`default`	Default set of reserved multicast addresses. Packets from 224.0.0.1, 224.0.0.2, 224.0.0.4, 224.0.0.5, 224.0.0.6, 224.0.0.9, 224.0.0.13, 224.0.0.15 and 224.0.0.24 are set as routers.
`ip`	Custom reserved multicast addresses. Custom IP address in the 224.0.0.x range are set as router multicast addresses using the ip igmp snooping routermode address command.
`multicastrouter`	DVMRP (224.0.0.4) and PIM (224.0.0.13) multicast addresses are set as routers.
`address`	Specify the multicast address in the 224.0.0.x range for use after issuing an ip igmp snooping routermode ip command
`<ip-address>`	IPv4 multicast address (224.0.0.x)

Default The default routermode is default not all and shows the below reserved multicast addresses:

```
Router mode.............Def
Reserved multicast address
          224.0.0.1
          224.0.0.2
          224.0.0.4
          224.0.0.5
          224.0.0.6
          224.0.0.9
          224.0.0.13
          224.0.0.15
           224.0.0.24
```

Mode Global Configuration

Examples To set ip igmp snooping routermode for all default reserved addresses enter:.

```
awplus(config)# ip igmp snooping routermode default
```

To remove the multicast address 224.0.0.5 from the custom list of multicast addresses enter:.

```
awplus(config)# no ip igmp snooping routermode address
                224.0.0.5
```

Related commands show ip igmp snooping routermode

ip igmp snooping tcn query solicit

Use this command to enable IGMP (Internet Group Management Protocol) Snooping TCN (Topology Change Notification) Query Solicitation feature. When this command is used in the Global Configuration mode, Query Solicitation is enabled for the specified VLANs.

Use the no variant of this command to disable IGMP Snooping TCN Query Solicitation. When the no variant of this command is used in Interface Configuration mode, this overrides the Global Configuration mode setting and Query Soliciitation is disabled for the specified VLANs.

Syntax

```
ip igmp snooping tcn query solicit

no ip igmp snooping tcn query solicit
```

Default IGMP Snooping TCN Query Solicitation is disabled by default on the switch, unless the switch is the Master Node in an EPSR ring, or is the Root Bridge in a Spanning Tree.

When the switch is the Master Node in an EPSR ring, or the switch is the Root Bridge in a Spanning Tree, then IGMP Snooping TCN Query Solicitation is enabled by default and cannot be disabled using the Global Configuration mode command. However, Query Solicitation can be disabled for specified VLANs using this command from the Interface Configuration mode. Select the VLAN you want to disable in Interface Configuration mode then issue the no variant of this command to disable the specified VLAN without disabling this feature for other VLANs.

Mode Global Configuration and Interface Configuration for a VLAN interface.

Usage Once enabled, if the switch is not an IGMP Querier, on detecting a topology change, the switch generates IGMP Query Solicit messages that are sent to all the ports of the vlan configured for IGMP Snooping on the switch.

On a switch that is not the Master Node in an EPSR ring or the Root Bridge in a Spanning Tree, Query Solicitation can be disabled using the no variant of this command after being enabled.

If the switch that detects a topology change is an IGMP Querier then the switch will generate an IGMP Query message.

Note that the no variant of this command when issued in Global Configuration mode has no effect on a switch that is the Master Node in an EPSR ring or on a switch that is a Root Bridge in a Spanning Tree. Query Solicitiation is not disabled for the switch these instances. However, Query Solicitation can be disabled on a per-vlan basis from the Interface Configuration mode.

See the below state table that shows when Query Solicit messages are sent in these instances:

Command issued from Global Configuration	Switch is STP Root Bridge or the EPSR Master Node	Command issued from Interface Configuaration	IGMP Query Solicit message sent on VLAN
No	Yes	Yes	Yes
Yes	Yes	No	No
Yes	Yes	Yes	Yes

See "Query Solicitation" on page 48.7 for introductory information about the Query Solicitation feature.

Examples This example shows how to enable IGMP Snooping TCN Query Solicitation on a switch:

```
awplus# configure terminal
awplus(config)# ip igmp snoopig tcn query solicit
```

This example shows how to disable IGMP Snooping TCN Query Solicitation on a switch:

```
awplus# configure terminal
awplus(config)# no ip igmp snooping tcn query solicit
```

This example shows how to enable IGMP Snooping TCN Query Solicitation for interface vlan2:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip igmp snoopig tcn query solicit
```

This example shows how to disable IGMP Snooping TCN Query Solicitation for interface vlan2:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip igmp snooping tcn query solicit
```

Validation Commands show ip igmp interface
show running-config

Related Commands ip igmp query-holdtime

ip igmp source-address-check

This command enables the checking of the Source Address for an IGMP Report, rejecting any IGMP Reports originating on devices outside of the local subnet.

Use the no variant of this command to disable the checking of the Source Address for an IGMP Report, which allows IGMP Reports from devices outside of the local subnet.

Syntax

```
ip igmp source-address-check
no ip igmp source-address-check
```

Default Source address checking for IGMP Reports is enabled by default.

Mode Interface Configuration for a VLAN interface.

Usage This is a security feature, and should be enabled unless IGMP Reports from outside the local subnet are expected, for example, if Multicast VLAN Registration is active in the network.

The no variant of this command is required to disable the IGMP Report source address checking feature in networks that use Multicast VLAN Registration to allow IGMP Reports from devices outside of the local subnet.

Examples To deny IGMP Reports from outside the current subnet, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip igmp source-address-check
```

To allow IGMP Reports from outside the current subnet, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip igmp source-address-check
```

Validation Commands show ip igmp interface
show running-config

ip igmp ssm

Use this command to define a non-default Source Specific Multicast (SSM) range of IP multicast addresses in IGMP. Incoming IGMPv1 and IGMPv2 join requests are ignored if the multicast IP address is in the SSM range and no SSM mapping is configured for these addresses. By default, the SSM range is 232/8. To define the SSM range to be other than the default, use one of the access-list parameter options.

Use the no variant of this command to change the SSM range in IGMP back to the default.

Syntax

```
ip igmp ssm range {<access-list-number>|<access-list-name>}
no ip igmp ssm
```

Parameter	Description
<access-list-number>	Access-list number, in the range <1-99>.
<access-list-name>	Standard IP access-list name.

Default By default the SSM range is 232/8.

Mode Global Configuration

Examples To configure a non-default SSM range to be use in IGMP enter the commands:

```
awplus# configure terminal
awplus(config)# access-list 10 permit 224.1.1.0 0.0.0.255
awplus(config)# ip igmp ssm range 10
```

To return to the default configuration enter the commands:

```
awplus# configure terminal
awplus(config)# no ip igmp ssm
```

Related Commands access-list (standard numbered)
ip pim ssm

ip igmp ssm-map enable

Use this command to enable Source Specific Multicast (SSM) mapping on the device.

Use the no variant of this command to disable SSM mapping.

Syntax

```
ip igmp ssm-map enable
no ip igmp ssm-map enable
```

Mode Global Configuration

Usage This command applies to VLAN interfaces configured for IGMP.

Example To enable SSM on the switch enter the commands:

```
awplus# configure terminal
awplus(config)# ip igmp ssm-map enable
```

Related Commands ip igmp ssm-map static

ip igmp ssm-map static

Use this command to specify the static mode of defining Source Specific Multicast (SSM) mapping. SSM statically assigns sources to IGMPv1 and IGMPv2 groups to translate such (*,G) groups' memberships to (S,G) memberships for use with PIM-SSM.

Use the no variant of this command to remove the SSM map association.

Syntax

```
ip igmp ssm-map static {<access-list-number>|<access-list-number-expanded>|<access-list-name>} <ip-address>

no ip igmp ssm-map static {<access-list-number>|<access-list-number-expanded>|<access-list-name>} <ip-address>
```

Parameter	Description
<access-list-number>	Access-list number, in the range <1-99>.
<access-list-number-expanded>	Access-list number (expanded range), in the range <1300-1999>.
<access-list-name>	Standard IP access-list name.
<ip-address>	Source address to use for static map group, entered in the form A.B.C.D.

Mode Global Configuration

Usage This command applies to VLAN interfaces configured for IGMP. You can use Standard numbered and Standard named ACLs plus Expanded Numbered ACLs.

Examples This example shows how to configure an SSM static mapping for group-address `224.1.1.1`, using a standard numbered ACL shown as `10`:

```
awplus# configure terminal
awplus(config)# access-list 10 permit 224.1.1.1 0.0.0.0
awplus(config)# ip igmp ssm-map static 10 1.2.3.4
```

This example shows how to configure an SSM static mapping for group-address `224.1.1.1`, using an expanded numbered ACL shown as `1301`:

```
awplus# configure terminal
awplus(config)# access-list 1301 permit 224.1.1.1 0.0.0.0
awplus(config)# ip igmp ssm-map static 1301 1.2.3.4
```

This example shows how to configure an SSM static mapping for group-address `224.1.1.1`, using a standard named ACL shown as `sales`:

```
awplus# configure terminal
awplus(config)# access-list sales permit 224.1.1.1 0.0.0.0
awplus(config)# ip igmp ssm-map static sales 1.2.3.4
```

Related Commands ip igmp ssm-map enable

ip igmp static-group

Use this command to statically configure multicast group membership entries on a VLAN interface, or to statically forward a multicast channel out a particular port or port range.

To statically add only a group membership, do not specify any parameters.

To statically add a (*,g) entry to forward a channel out of a port specify only the multicast group address and the switch port range.

To statically add a (s,g) entry to forward a channel out of a port specify the multicast group address, the source IP address, and the switch port range. To use Source Specific Multicast mapping to determine the source IP address of the multicast server use the ssm-map parameter instead of specifying the source IP address.

Use the no variant of this command to delete static group membership entries.

Syntax

```
ip igmp static-group <ip-address> [source {<ip-source-addr>|ssm-map}]
    [interface <port>]

no ip igmp static-group <ip-address> [source {<ip-source-addr>|
    ssm-map}] [interface <port>]
```

Parameter	Description
<ip-address>	Standard IP Multicast group address, entered in the form A.B.C.D, to be configured as a static group member.
source	Optional.
<ip-source-addr>	Standard IP source address, entered in the form A.B.C.D, to be configured as a static source from where multicast packets originate.
ssm-map	This parameter uses Source Specific Multicast (SSM) Mapping to determine the source IP address associated with the specified IP Multicast group address. SSM mappings are configured using the ip igmp ssm-map static command.
interface	Use this parameter to specify a specific switch port or switch port range to statically forward the multicast group out of. If not used, static configuration is applied on all ports in the VLAN.
<port>	The port or port range to statically forward the group out of. The port may be a switch port (e.g. port1.0.4), a static channel group (e.g. sa3), or a dynamic (LACP) channel group (e.g. po4).

Mode Interface Configuration for a VLAN interface.

Usage This command applies to IGMP operation on a specific interface to statically add group and/or source records; or to IGMP Snooping on a VLAN interface to statically add group and/or source records.

Example The following example show how to statically add group and source records for IGMP:

```
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# ip igmp static-group 226.1.2.4 source
10.2.3.4
```

ip igmp startup-query-count

Use this command to configure the IGMP startup query count for a VLAN interface in Interface Configuration mode. The IGMP startup query count is the number of IGMP General Query messages sent by a querier at startup. The default IGMP startup query count is 2.

Use the no variant of this command to remove the configured IGMP startup query count for a VLAN interface in Interface Configuration mode.

Syntax

```
ip igmp startup-query-count <startup-query-count>
no ip igmp startup-query-count
```

Parameter	Description
<startup-query-count>	Specify the IGMP startup query count for a VLAN interface in the range <2-10> where 2 is the default IGMP query count.

Default The default IGMP startup query count is 2.

Mode Interface Configuration for a VLAN interface.

Examples The following example shows how to configure the IGMP startup query count to 4 for VLAN interface vlan3:

```
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# ip igmp startup-query-count 4
```

The following example shows how to remove the IGMP startup query count for VLAN interface vlan3:

```
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# no ip igmp startup-query-count
```

Related Commands

ip igmp last-member-query-count
ip igmp startup-query-interval

ip igmp startup-query-interval

Use this command to configure the IGMP startup query interval for a VLAN interface in Interface Configuration mode. The IGMP startup query interval is the amount of time in seconds between successive IGMP General Query messages sent by a querier during startup. The default IGMP startup query interval is one quarter of the IGMP query interval value.

Use the no variant of this command to remove the configured IGMP startup query interval for a VLAN interface in Interface Configuration mode.

Syntax

```
ip igmp startup-query-interval <startup-query-interval>
no ip igmp startup-query-interval
```

Parameter	Description
<startup-query-interval>	Specify the IGMP startup query interval for a VLAN interface in Interface Configuration mode in the range of <2-1800> seconds to be one quarter of the IGMP query interval value.

Default The default IGMP startup query interval is one quarter of the IGMP query interval value.

Note The IGMP startup query interval must be one quarter of the IGMP query interval.

Mode Interface Configuration for a VLAN interface.

Examples The following example shows how to configure the IGMP startup query interval to 15 seconds for VLAN interface vlan2 to be one quarter of the IGMP query interval value of 60 seconds:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip igmp startup-query-interval 15
awplus(config-if)# ip igmp query-interval 60
```

The following example shows how to remove the IGMP startup query interval for VLAN interface vlan2:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip igmp startup-query-interval
```

Related Commands
ip igmp last-member-query-interval
ip igmp query-interval
ip igmp startup-query-count

ip igmp version

Use this command to set the current IGMP version (IGMP version 1, 2 or 3) on an interface.

Use the no variant of this command to return to the default version.

Syntax

```
ip igmp version <1-3>
no ip igmp version
```

Parameter	Description
<1-3>	IGMP protocol version number

Default The default IGMP protocol version number is 3.

Mode Interface Configuration for a VLAN interface.

Usage This command applies to VLAN interfaces configured for IGMP.

Example

```
awplus# configure terminal
awplus(config)# interface vlan5
awplus(config-if)# ip igmp version 2
```

Validation Commands show ip igmp interface

show debugging igmp

Use this command to display the IGMP debugging options set.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show debugging igmp`

Mode User Exec and Privileged Exec

Example To display the IGMP debugging options set, enter the command:

```
awplus# show debugging igmp
```

Output Figure 49-1: Example output from the **show debugging igmp** command

```
IGMP Debugging status:
  IGMP Decoder debugging is on
  IGMP Encoder debugging is on
  IGMP Events debugging is on
  IGMP FSM debugging is on
  IGMP Tree-Info-Base (TIB) debugging is on
```

Related Commands debug igmp

show ip igmp groups

Use this command to display the multicast groups with receivers directly connected to the router, and learned through IGMP.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip igmp groups [<ip-address>|<interface> detail]`

Parameter	Description
<ip-address>	Address of the multicast group, entered in the form A.B.C.D.
<interface>	Interface name for which to display local information.

Mode User Exec and Privileged Exec

Example The following command displays local-membership information for all ports in all interfaces:

```
awplus# show ip igmp groups
```

Output Figure 49-2: Example output from the **show ip igmp groups** command

```
IGMP Connected Group Membership
Group Address    Interface       Uptime    Expires   Last
Reporter
224.0.1.1        port1.0.1       00:00:09  00:04:17  10.10.0.82
224.0.1.24       port1.0.2       00:00:06  00:04:14  10.10.0.84
224.0.1.40       port1.0.3       00:00:09  00:04:15  10.10.0.91
224.0.1.60       port1.0.3       00:00:05  00:04:15  10.10.0.7
224.100.100.100  port1.0.1       00:00:11  00:04:13  10.10.0.91
228.5.16.8       port1.0.3       00:00:11  00:04:16  10.10.0.91
228.81.16.8      port1.0.7       00:00:05  00:04:15  10.10.0.91
228.249.13.8     port1.0.3       00:00:08  00:04:17  10.10.0.91
235.80.68.83     port1.0.11      00:00:12  00:04:15  10.10.0.40
239.255.255.250  port1.0.3       00:00:12  00:04:15  10.10.0.228
239.255.255.254  port1.0.12      00:00:08  00:04:13  10.10.0.84
```

Table 49-1: Parameters in the output of the **show ip igmp groups** command

Parameter	Description
`Group Address`	Address of the multicast group.
`Interface`	Port through which the group is reachable.
`Uptime`	The time in weeks, days, hours, minutes, and seconds that this multicast group has been known to the device.
`Expires`	Time (in hours, minutes, and seconds) until the entry expires.
`Last Reporter`	Last host to report being a member of the multicast group.

show ip igmp interface

Use this command to display the state of IGMP, IGMP Proxy service, and IGMP Snooping for a specified VLAN, or all VLANs. IGMP is shown as Active or Disabled in the show output.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip igmp interface [<interface>]`

Parameter	Description
<interface>	The name of the VLAN interface.

Mode User Exec and Privileged Exec

Examples The following output shows IGMP interface status for vlan2 (with IGMP Snooping enabled):

```
awplus#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
awplus(config)#interface vlan2
awplus(config-if)#ip igmp snooping
awplus(config-if)#exit
awplus(config)#exit
awplus#show ip igmp interface vlan2
Interface vlan2 (Index 202)
 IGMP Disabled, Inactive, Version 3 (default)
 IGMP interface has 0 group-record states
 IGMP activity: 0 joins, 0 leaves
 IGMP robustness variable is 2
 IGMP last member query count is 2
 IGMP query interval is 125 seconds
 IGMP query holdtime is 500 milliseconds
 IGMP querier timeout is 255 seconds
 IGMP max query response time is 10 seconds
 Last member query response interval is 1000 milliseconds
 Group Membership interval is 260 seconds
 Strict IGMPv3 ToS checking is disabled on this interface
 Source Address checking is enabled
 IGMP Snooping is globally enabled
 IGMP Snooping query solicitation is globally disabled
  Num. query-solicit packets: 57 sent, 0 recvd
 IGMP Snooping is enabled on this interface
 IGMP Snooping fast-leave is not enabled
 IGMP Snooping querier is not enabled
 IGMP Snooping report suppression is enabled
awplus#
```

The following output shows IGMP interface status for vlan2 (with IGMP Snooping disabled):

```
awplus#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
awplus(config)#interface vlan2
awplus(config-if)#no ip igmp snooping
awplus(config-if)#exit
awplus(config)#exit
awplus#show ip igmp interface vlan2
Interface vlan2 (Index 202)
 IGMP Disabled, Inactive, Version 3 (default)
 IGMP interface has 0 group-record states
 IGMP activity: 0 joins, 0 leaves
 IGMP robustness variable is 2
 IGMP last member query count is 2
 IGMP query interval is 125 seconds
 IGMP query holdtime is 500 milliseconds
 IGMP querier timeout is 255 seconds
 IGMP max query response time is 10 seconds
 Last member query response interval is 1000 milliseconds
 Group Membership interval is 260 seconds
 Strict IGMPv3 ToS checking is disabled on this interface
 Source Address checking is enabled
 IGMP Snooping is globally enabled
 IGMP Snooping query solicitation is globally disabled
  Num. query-solicit packets: 57 sent, 0 recvd
 IGMP Snooping is not enabled on this interface
 IGMP Snooping fast-leave is not enabled
 IGMP Snooping querier is not enabled
 IGMP Snooping report suppression is enabled
awplus#
```

The following command displays the IGMP interface status and Query Solicitation for vlan3:

```
awplus#show ip igmp interface vlan3
Interface vlan3 (Index 203)
 IGMP Enabled, Active, Querier, Version 3 (default)
 Internet address is 192.168.9.1
 IGMP interface has 256 group-record states
 IGMP activity: 51840 joins, 0 leaves
 IGMP robustness variable is 2
 IGMP last member query count is 2
 IGMP query interval is 125 seconds
 IGMP query holdtime is 500 milliseconds
 IGMP querier timeout is 250 seconds
 IGMP max query response time is 1 seconds
 Last member query response interval is 1000 milliseconds
 Group Membership interval is 251 seconds
 Strict IGMPv3 ToS checking is disabled on this interface
 IGMP Snooping is globally enabled
 IGMP Snooping query solicitation is globally enabled
  Num. query-solicit packets: 1 sent, 10 recvd
 IGMP Snooping is enabled on this interface
 IGMP Snooping fast-leave is not enabled
 IGMP Snooping querier is not enabled
 IGMP Snooping report suppression is enabled
awplus#
```

Note Query Solicitation status information is highlighted in bold in the above output.

Use the show ip igmp interface command to validate that Query Solicitation is enabled and to show the number of query-solicit message packets sent and received on a VLAN.

Related Commands

clear ip igmp
clear ip igmp group
clear ip igmp interface
ip igmp
ip igmp last-member-query-count
ip igmp last-member-query-interval
ip igmp querier-timeout
ip igmp query-holdtime
ip igmp query-interval
ip igmp query-max-response-time
ip igmp robustness-variable
ip igmp snooping
ip igmp snooping fast-leave
ip igmp snooping querier
ip igmp snooping report-suppression
ip igmp snooping tcn query solicit
ip igmp version

show ip igmp proxy

Use this command to display the state of IGMP Proxy services for a specified interface or for all interfaces.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip igmp proxy
show ip igmp proxy groups [detail]
show ip igmp proxy groups <multicast-group> [detail]
show ip igmp proxy groups <vlan> [detail]
show ip igmp proxy groups <vlan> <multicast-group> [detail]
```

Parameter	Description
`groups`	Specify IGMP proxy group membership information.
`detail`	Specify detailed IGMPv3 source information.
<vlan>	Specify the name of a single VLAN interface, for example vlan1.
<multicast-group>	Specify the IPv4 address in of the multicast group, in the format A.B.C.D.

Mode User Exec and Privileged Exec

Example To display the state of IGMP Proxy services for all interfaces, enter the command:

```
awplus# show ip igmp proxy
```

To display the state of IGMP Proxy services for VLAN interface vlan1, enter the command:

```
awplus# show ip igmp proxy groups vlan1
```

To display the detailed state of IGMP Proxy services for VLAN interface vlan1, enter the command:

```
awplus# show ip igmp proxy groups vlan1 detail
```

Related Commands ip igmp proxy-service

show ip igmp snooping mrouter

Use this command to display the multicast router ports, both static and dynamic, in a VLAN.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip igmp snooping mrouter [interface <interface>]`

Parameter	Description
`interface`	A specific interface.
`<interface>`	The name of the VLAN interface.

Mode User Exec and Privileged Exec

Example To show all multicast router interfaces, use the command:

```
awplus# show ip igmp snooping mrouter
```

To show the multicast router interfaces in `vlan1`, use the command:

```
awplus# show ip igmp snooping mrouter interface vlan1
```

Output Figure 49-3: Example output from the **show ip igmp snooping mrouter** command

```
VLAN    Interface   Static/Dynamic
1       port1.0.5   Statically configured
200     port1.0.2   Statically configured
```

Figure 49-4: Example output from the **show ip igmp snooping mrouter interface vlan1** command

```
VLAN    Interface   Static/Dynamic
1       port1.0.5   Statically configured
```

Related Commands ip igmp snooping mrouter

show ip igmp snooping routermode

Use this command to display the current routermode and the list of IP addresses set as router multicast addresses from the ip igmp snooping routermode command.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip igmp snooping routermode`

Mode User Exec and Privileged Exec

Example To show the routermode and the list of router multicast addresses, use the command:

```
awplus# show ip igmp snooping routermode
```

Output Figure 49-5: Example output from the **show ip igmp snooping routermode** command

```
Router mode.............Def
Reserved multicast address
          224.0.0.1
          224.0.0.2
          224.0.0.4
          224.0.0.5
          224.0.0.6
          224.0.0.9
          224.0.0.13
          224.0.0.15
           224.0.0.24
```

Related Commands ip igmp snooping routermode

show ip igmp snooping statistics

Use this command to display IGMP Snooping statistics data.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip igmp snooping statistics interface <interface-range>
   [group [<ip-address>]]
```

Parameter	Description
<ip-address>	Optionally specify the address of the multicast group, entered in the form A.B.C.D.
<interface>	Specify the name of the VLAN interface or interface range.

Mode User Exec and Privileged Exec

Example To display IGMP statistical information for vlan1 and vlan2, use the command:

```
awplus# show ip igmp snooping statistics interface
       vlan1-vlan2
```

Output Figure 49-6: Example output from the **show ip igmp snooping statistics** command

```
IGMP Snooping statistics for vlan1
Interface:      port1.0.3
Group:          224.1.1.1
Uptime:         00:00:09
Group mode:     Exclude (Expires: 00:04:10)
Last reporter:  10.4.4.5
Source list is empty
IGMP Snooping statistics for vlan2
Interface:      port1.0.4
Group:          224.1.1.2
Uptime:         00:00:19
Group mode:     Exclude (Expires: 00:05:10)
Last reporter:  10.4.4.6
Source list is empty
```

undebug igmp

This command applies the functionality of the no debug igmp command on page 49.5.

Chapter 50: PIM-SM Introduction and Configuration

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Introduction

This chapter provides information about Protocol Independent Multicast - Sparse Mode (PIM-SM) and Protocol Independent Multicast - Source Specific Multicast (PIM-SSM).

PIM-SM

Protocol Independent Multicast - Sparse Mode (PIM-SM) provides efficient communication between members of sparsely distributed groups - the type of groups that are most common in wide-area internetworks.

Note The Bootstrap Router (BSR) function will not work properly if there are PIM-SM routers using VRRP.

For details of the commands used to configure PIM-SM, see Chapter 51, PIM-SM Commands. For a general overview of multicasting, see Chapter 47, Multicast Introduction and Commands.

Characteristics of PIM-SM

PIM Sparse Mode (PIM-SM) is designed on the principle that several hosts wishing to participate in a multicast conference does not justify flooding the entire internetwork with periodic multicast traffic. PIM-SM is designed to limit multicast traffic so that only those switches interested in receiving traffic for a particular group receive the traffic.

Switches with directly attached or downstream members are required to join a Sparse Mode distribution tree by transmitting explicit join messages. If a switch does not become part of the predefined distribution tree, it does not receive multicast traffic addressed to the group. In contrast, dense mode multicast routing protocols assume downstream group membership and continue to forward multicast traffic on downstream links until explicit prune messages are received. The default forwarding action of a sparse mode multicast routing protocol is to block traffic unless it is explicitly requested, while the default action of the dense mode multicast routing protocols is to forward traffic.

PIM-SM employs the concept of a Rendezvous Point (RP) where receivers “meet” sources. The initiator of each multicast group selects a primary RP and a small ordered set of alternative RPs, known as the RP-list. For each multicast group, there is only a single active RP. Each receiver wishing to join a multicast group contacts its directly attached switch, which in turn joins the multicast distribution tree by sending an explicit join message to the group's primary RP. A source uses the RP to announce its presence and to find a path to members that have joined the group. This model requires Sparse Mode switches to maintain some state information (the RP-list) prior to the arrival of data packets. In contrast, Dense Mode multicast routing protocols are data driven, since they do not define any state for a multicast group until the first data packet arrives.

Roles in PIM-SM

A multicast sender does not need to know the addresses of the members of the group in order to send to them, and the members of the group need not know the address of the sender. Group membership can change at any time. When PIM is enabled on the switch, and before the switch can route multicast traffic, it must establish which of the PIM routers in the network are performing some key roles:

- Designated Router.
- Rendezvous Point.
- Bootstrap Router.

Designated Router

There must be one PIM Designated Router (DR) in the subnetwork to which the IP hosts are connected. Any PIM-SM interfaces on the subnetwork elect the DR with the highest DR priority. If there is more than one router with the same priority, or no priority, they choose the interface with the highest IP address number. The DR performs all the PIM functionality for the subnetwork. If the current DR becomes unavailable, the remaining switches elect a new DR on the interface by DR priority or IP address.

Rendezvous Point

Each multicast group must have a Rendezvous Point (RP). The RP forms the root of the group's distribution tree. The DR for a multicast sender sends multicast packets towards the RP. DRs with group members connected to them send join messages towards the group's RP. The RP candidate with the lowest priority is elected from all the RP candidates for a group. If the RP becomes unavailable, the remaining RP candidates elect a new RP.

Bootstrap Router

Each PIM-SM network must have at least one Bootstrap Router (BSR) candidate, unless all switches in the domain are configured statically with information about all RPs in the domain. Every switch that is a BSR candidate periodically sends a Bootstrap Candidate Advertisement message to advertise that it is available as a BSR candidate. The BSR candidates in the network elect the switches with the highest preference value to be the BSR. The elected BSR listens to PIM Candidate RP Advertisement messages specifying RP candidates for multicast groups. It maintains a list of RP candidates and sends a bootstrap message every BSM interval, specifying all the multicast groups in the PIM network, and their RP candidates. Each switch uses this information and a standardized hash mechanism to determine the RP for each group.

In summary:

- Each multicast group must have at least one RP candidate
- Each PIM-SM domain must have at least one BSR candidate, unless all routers in the domain are configured statically with information about all RPs in the domain
- Each subnetwork must have at least one DR candidate.

Note The BSR function will not work properly if there are PIM-SM routers using VRRP.

PIM hello messages

When PIM is enabled on a switch, it sends out a PIM Hello message on all its PIM enabled interfaces, and listens for Hello messages from its PIM neighbors. When a switch receives a Hello message, it records the interface, IP address, priority for becoming a DR, and the timeout for the neighbor's information. The switch sends Hello messages regularly at the Hello Time interval.

Operation of PIM-SM

Once roles are established, multicast routing follows specific phases:

1. Rendezvous Point Tree
2. Register stop
3. Shortest Path Tree

While multicast routing always begins with phase 1, the Designated Router (DR) for a receiver determines whether and when to move on to phases 2 and 3, depending on the amount of traffic from the source.

Rendezvous Point Tree

Phase 1 establishes and uses a shared tree rooted at the Rendezvous Point (RP) to forward all multicast data to group members.

When an IP host sends an IGMP join message to the local PIM DR, which is not the RP for the group, the DR sends a PIM join message towards the RP for the group ("upstream"). The DR determines which switch is the RP for the group from the most recent bootstrap message. Every switch the join message passes through records that there is a group member on the incoming interface. Eventually, the join message reaches either the RP, or another switch that already knows that it has a group member downstream. If the group has many members, the join messages converge on the RP to form a Rendezvous Point Tree (RPT). This is called a shared tree because multicast data that is sent to the group by any sender shares the tree. The multicast receiver's DR sends join messages periodically according to the upstream join timer as long as the IP host is a member of the group. When the last receiver on a subnetwork leaves the group, the join messages stop, and their entries timeout on routers that are closer to the RP.

The sender's DR encapsulates the multicast data in a unicast packet in a process called registering, and sends these register packets to the group's RP. When the RP receives the data, it decapsulates them, and forwards them onto the shared tree.

Register stop

Phase 2 improves efficiency and performance by using register stop. In this phase the RP joins the shortest path tree between the source and receiver. This allows the original (unencapsulated) packets to be forwarded from the sender, instead of encapsulated packets. It also allows shorter paths to receivers that are close to the sender, making it more efficient in some circumstances.

When the RP for a group receives the first encapsulated data packet from a source, it joins the shortest path tree towards the sender. Once data is able to flow along the shortest path from the sender to the RP, packets do not need to be registered. The RP sends a register stop message in reply to the next encapsulated message. When the sender's DR receives the register stop message, it stops registering. The DR sends a null register message to the RP to find whether the RP still does not need to receive registered packets. If it receives another register stop message, the DR continues to forward only the native data packets. If the DR does not receive another register stop message within the register probe time, it resumes registering the data packets and sending them to the RP.

When the RP starts receiving native data packets from the source, it starts to discard the encapsulated packets, and starts forwarding native packets on the shared tree to all the group members. If the path from the source to the RP intersects the shared RP tree for the group, then the packets also take a short-cut onto the shared tree for delivery to the group members down its branches.

Shortest Path Tree

This phase further optimizes routing by using Shortest Path Trees (SPT). In phase 3 the receiver joins the shortest path tree between the source and receiver. This allows a multicast group member to receive multicast data by the shortest path from the sender, instead of from the shared RP tree. When the receiver's DR receives multicast data from a particular sender, it sends a join message towards the sender. When this message reaches the sender's DR, the DR starts forwarding the multicast data directly towards the receiver. As several receivers all initiate shortest paths to the sender, these paths converge, creating a SPT.

When the multicast packets start arriving from the SPT at the receiver's DR or an upstream router common to the SPT and the RPT, it starts discarding the packets from the RPT, and sends a prune message towards the RP. The prune message travels up the RPT until it reaches the RP or a switch that still needs to forward multicast packets from this sender to other receivers. Every time a switch receives a prune message, it waits a short time so that other switches on the LAN have the opportunity to override the prune message.

Multi-Access LANs

If the PIM-SM network includes multi-access LAN links for transit, as well as point-to-point links, then a mechanism is needed to prevent multiple trees forwarding the same data to the same group member. Two or more switches on a LAN may have different information about how to reach the RP or the multicast sender. They could each send a join message to two different switches closer to the RP for an RPT or the sender for an SPT. This could potentially cause two copies of all the multicast traffic towards the receiver.

When PIM switches notice duplicate data packets on the LAN, they elect a single switch to forward the data packets, by each sending PIM Assert messages. If one of the upstream switches is on an SPT and the other is on an RPT, the switch on the SPT has the shortest path to the sender, and wins the Assert election. If both switches are on RPTs the switch with the shortest path to the RP (the lowest sum of metrics to the RP) wins the Assert. If both switches are on an SPT, then the switch with the shortest path to the sender (the lowest sum of metrics to the sender's DR) wins the Assert.

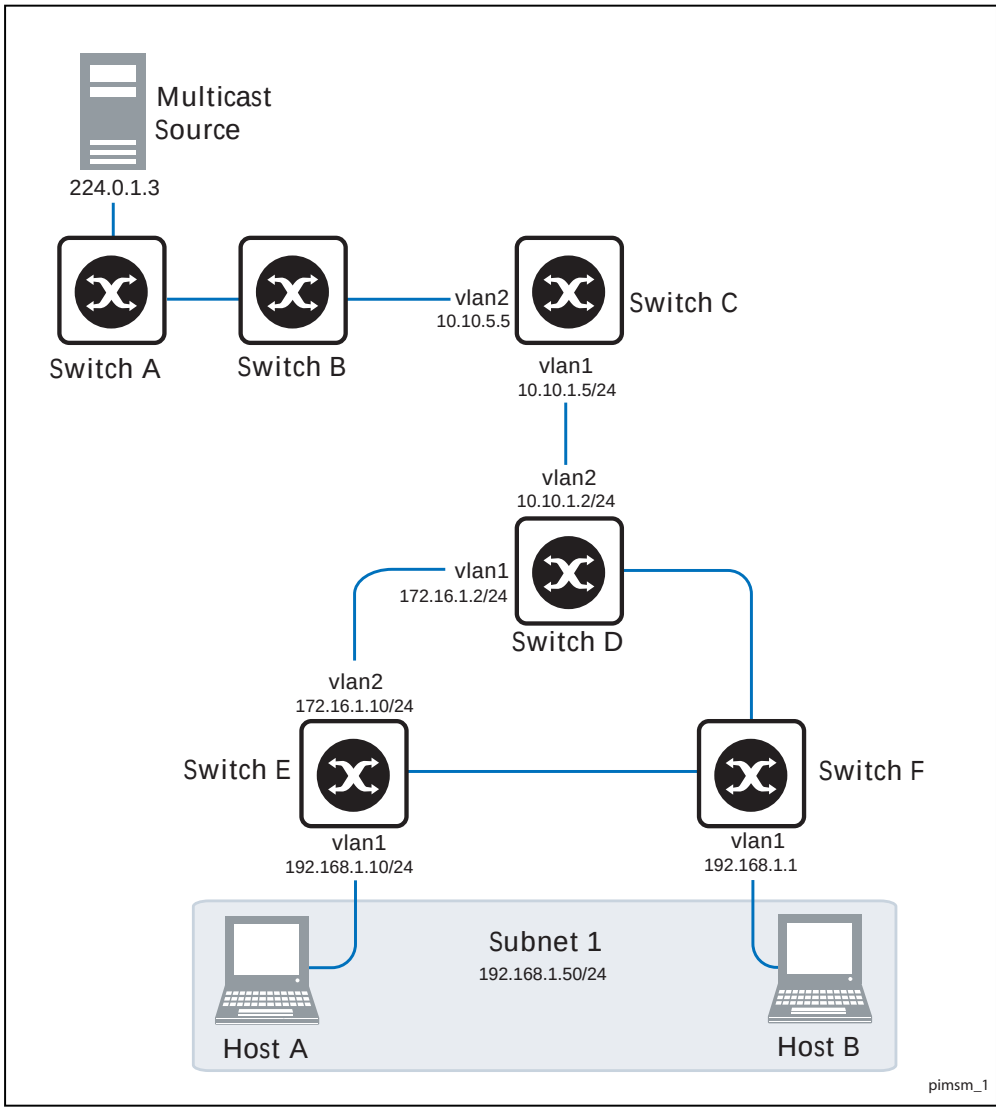
The switch that won the Assert election forwards these data packets, and acts as the local Designated Router for any IGMP members on the LAN. The downstream switches on the LAN also receive the Assert messages, and send all their join messages to the Assert winner. The result of an Assert election will timeout after the Assert Time. As long as the situation causing the duplication remains unchanged, the Assert winner sends an Assert message at a the Assert time interval, before the previous Assert messages time out. When the last downstream switch leaves the SPT, the Assert winner sends an Assert Cancel message saying that it is about to stop forwarding data on the SPT. Any RPT downstream switches then switch back to the RP tree.

PIM-SM Configuration

This section provides three PIM-SM configuration examples:

- Static Rendezvous Point configuration
- Dynamic Rendezvous Point configuration
- Bootstrap Router configuration

Both Rendezvous Point (RP) configuration examples refer to the network topology in the following graphic and use Allied Telesis managed Layer 3 Switches as the PIM routers. For details on the commands used in the following examples, refer to Chapter 51, PIM-SM Commands.



Static Rendezvous Point configuration

In this example using the above network topology, Switch C is the Rendezvous Point (RP) and all switches are statically configured with RP information. Host A and Host B join group `224.0.1.3` for all the sources. They send the IGMP membership report to Subnet 1. Two switches are attached to Subnet 1, Switch E and Switch F. Both of these switches have default Designated Router (DR) priority on `vlan1`. Because Switch E has a higher IP address on `vlan1`, Switch E becomes the DR and is responsible for sending Join messages to the RP (Switch C).

While configuring the RP, ensure that:

- Every switch includes the ip pim rp-address 10.10.1.5 statement, even if it does not have any source or group member attached to it.
- There is only one RP address for the whole multicast group.
- All interfaces running PIM-SM must have sparse-mode enabled. In the configuration sample output below, both vlan1 and vlan2 are pim sparse-mode enabled.

See the following configuration output for Switch D:

```
hostname Switch D
!!
interface vlan1
 ip pim sparse-mode
!
interface vlan2
 ip pim sparse-mode
!
interface lo
!
!
ip multicast-routing
ip pim rp-address 10.10.1.5
!
```

Configure all the switches with the same ip pim rp-address 10.10.1.5 statement as shown above.

Verifying configuration

Use the following commands to verify the RP configuration, interface details, and the multicast routing table.

RP details

For Switch D, the show ip pim sparse-mode rp mapping command shows that `10.10.1.5` is the RP for all multicast groups `224.0.0.0/4`, and is statically configured. All other switches will have a similar output.

```
awplus#show ip pim sparse-mode rp mapping
PIM Group-to-RP Mappings
Group(s): 224.0.0.0/4, Static
    RP: 10.10.1.5
         Uptime: 5d02h15m
```

For Switch D, the show ip pim sparse-mode rp-hash command displays the selected RP for the specified group, in this example `224.0.1.3`.

```
awplus#show ip pim sparse-mode rp-hash 224.0.1.3
    RP: 10.10.1.5
```

Interface details

For Switch E, the show ip pim sparse-mode interface command displays the interface details and shows that Switch E is the DR on Subnet 1.

```
awplus#show ip pim sparse-mode interface
Total configured interfaces: 16   Maximum allowed: 31
Total active interfaces:     12

Address      Interface VIFindex Ver/   Nbr       DR    DR
                                       Mode    Count   Prior
192.168.1.10    vlan2  0       v2/S    1         1     192.168.1.10
172.16.1.10     vlan3  2       v2/S    1         1     172.16.1.10
```

In this example Switch E has a base license. With the base license, the maximum number of PIM-SM interfaces that can be configured is 31. With a feature license a maximum of 100 PIM-SM interfaces are available.

IP multicast routing table

Note that the multicast routing table displayed for an RP switch is different to that displayed for other switches. For Switch C, because this switch is the RP and the root of this multicast tree, the show ip pim sparse-mode mroute command shows RPF nbr (next-hop to reach RP) as 0.0.0.0 and RPF idx (incoming interface for this (*, G) state) as None.

```
awplus#show ip pim sparse-mode mroute
IP Multicast Routing Table

(*,*,RP) Entries: 0
(*,G) Entries: 1
(S,G) Entries: 0
(S,G,rpt) Entries: 0
(*, 224.0.1.3)
RP: 10.10.1.5
RPF nbr: 0.0.0.0
RPF idx: None
Upstream State: JOINED
 Local     ..............................
 Joined    j..............................
 Asserted  ..............................
 Outgoing  o..............................
```

For Switch E, the show ip pim sparse-mode mroute command displays the IP multicast routing table.

```
awplus#show ip pim sparse-mode mroute
IP Multicast Routing Table

(*,*,RP) Entries: 0
(*,G) Entries: 1
(S,G) Entries: 0
(S,G,rpt) Entries: 0
(*, 224.0.1.3)
RP: 10.10.1.5
RPF nbr: 172.16.1.2
RPF idx: port1.0.2
Upstream State: JOINED
 Local      ..............................
 Joined     j..............................
 Asserted   ..............................
 Outgoing   o..............................
```

On Switch E, `port1.0.2` is the incoming interface of the (*, G) entry, and `port1.0.1` is on the outgoing interface list of the (*, G) entry. This means that there is a group member through `port1.0.1`, and RP is reachable through `port1.0.2`.

Dynamic Rendezvous Point configuration

A static RP configuration works for a small, stable PIM domain. However, it is not practical for a large and not so stable internetwork. In such a network, if the RP fails, the network administrator may have to change the static configurations on all PIM switches. An additional reason for choosing dynamic configuration high routing traffic leading to a change in the RP.

The Bootstrap Router (BSR) mechanism is used to dynamically maintain the RP information. To configure the RP dynamically in the above network topology, Switch C on `port1.0.1` and Switch D on `vlan1` are configured as RP candidates using the ip pim rp-candidate command. Switch D on `vlan1` is also configured as the BSR candidate. Since no other device has been configured as a BSR candidate, Switch D becomes the BSR router and is responsible for sending group-to-RP mapping information to all other PIM switches in this PIM domain.

The following output displays the complete configuration at Switch C.

```
awplus#show run
!
interface vlan1
 ip pim sparse-mode
!
interface vlan2
 ip pim sparse-mode
!
interface lo
!
ip multicast-routing
ip pim rp-candidate vlan1
```

The following output displays the complete configuration at Switch D.

```
awplus#show run
!
interface vlan1
 ip pim sparse-mode
!
interface vlan2
 ip pim sparse-mode
!
interface lo
!
ip multicast-routing
ip pim bsr-candidate vlan1
ip pim rp-candidate vlan1 priority 2
!
```

The highest priority switch is chosen as the RP. If two or more switches have the same priority, a hash function in the BSR mechanism is used to choose the RP to make sure that all devices in the PIM domain have the same RP for the same multicast group.

Use the `<interface> [priority <priority>]` parameters of the ip pim rp-candidate command to change the default priority of any RP candidate.

PIM group-to-RP mappings

The show ip pim sparse-mode rp mapping command displays the group-to-RP mapping details. The output shows information about RP candidates. There are two RP candidates for the group range `224.0.0.0/4`. RP candidate `10.10.1.5` has a default priority of `192`, whereas RP candidate `172.16.1.2` has been configured to have a priority of `2`. Since RP candidate `172.16.1.2` has a higher priority, it is selected as the RP for the multicast group `224.0.0.0/4`.

See the following configuration output for Switch D.

```
awplus#show ip pim sparse-mode rp mapping
This system is the Bootstrap Router (v2)
Group(s): 224.0.0.0/4
  RP: 10.10.1.5
    Info source: 172.16.1.2, via bootstrap, priority 192
         Uptime: 00:00:13, expires: 00:02:29
  RP: 172.16.1.2
    Info source: 172.16.1.2, via bootstrap, priority 2
         Uptime: 00:34:42, expires: 00:01:49
```

RP details

The show ip pim sparse-mode rp-hash command displays information about the RP router for a particular group. See the following configuration output for Switch D. This output shows that `172.16.1.2` has been chosen as the RP for the multicast group `224.0.1.3`.

```
awplus#show ip pim sparse-mode rp-hash 224.0.1.3
Group(s): 224.0.0.0/4
    RP: 172.16.1.2
    Info source: 172.16.1.2, via bootstrap
```

After RP information reaches all PIM switches in the domain, various state machines maintain all routing states as the result of Join/Prune messages from members of the multicast group.

Bootstrap Router configuration

Every PIM multicast group needs to be associated with the IP address of a Rendezvous Point (RP). This address is used as the root of a group-specific distribution tree, whose branches extend to all nodes in the domain that want to receive traffic sent to the group. For all senders to reach all receivers, all devices in the domain use the same mappings of group addresses to RP addresses. In order to determine the RP for a multicast group, a PIM device maintains a collection of group-to-RP mappings, called the RP-Set.

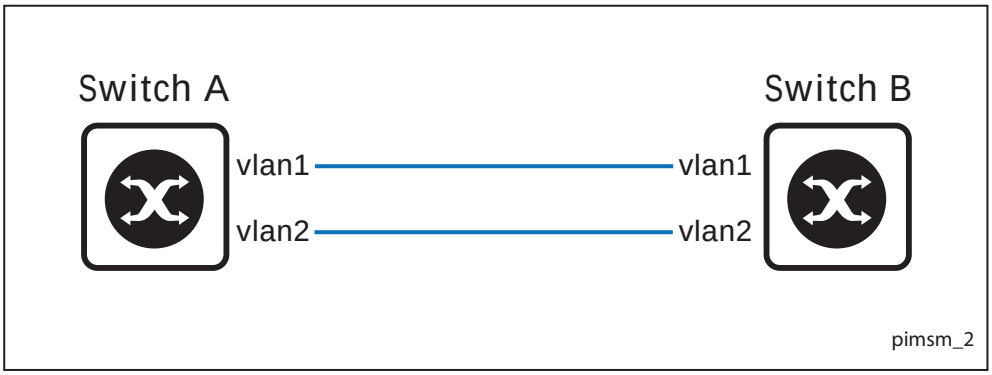
The Bootstrap Router (BSR) mechanism for the class of multicast routing protocols in the PIM domain uses the concept of an RP as a means for receivers to discover the sources that send to a particular multicast group. The BSR mechanism is one way that a multicast router can learn the set of group-to-RP mappings required in order to function.

Some of the PIM devices within a PIM domain are configured as RP candidates. A subset of the RP candidates will eventually be used as the actual RPs for the domain. An RP configured with a lower value in the priority field has higher a priority.

Some of the PIM devices in the domain are configured to be BSR candidates. One of these BSR candidates is elected to be the BSR for the domain, and all PIM devices in the domain learn the result of this election through Bootstrap messages (BSM). The BSR candidate with highest value in the priority field is the elected BSR.

The RP candidates then report their candidacy to the elected BSR, which chooses a subset of the RP candidates, and distributes corresponding group-to-RP mappings to all the devices in the domain through Bootstrap messages.

Note The BSR function will not work properly if there are PIM routers using VRRP.



Switch A Enter the following commands to configure `vlan1` on Switch A as the BSR candidate. The default priority is 64.

```
awplus# configure terminal
awplus(config)# ip pim bsr-candidate vlan1
awplus(config)# exit
```

Switch B Enter the following commands to configure `vlan1` on Switch B as the BSR candidate with a hash mask length of 10 and a priority of 25 and to configure `vlan1` as the RP candidate with a priority of 0.

```
awplus# configure terminal
awplus(config)# ip pim bsr-candidate vlan1 10 25
awplus(config)# ip pim rp-candidate vlan1 priority 0
awplus(config)# exit
```

Validation Commands

Use the show ip pim sparse-mode bsr-router command to verify the BSR candidate state on Switch A.

```
awplus#show ip pim sparse-mode bsr-router
PIMv2 Bootstrap information
This system is the Bootstrap Router (BSR)
  BSR address: 20.0.1.21
  Uptime:      00:37:12, BSR Priority: 64, Hash mask length: 10
  Expires:     00:01:32
  Role: Candidate BSR
  State: Elected BSR
```

Use the show ip pim sparse-mode bsr-router command to verify the BSR candidate state on Switch B. The initial state of the BSR candidate is pending before transitioning to BSR candidate.

```
awplus#show ip pim sparse-mode bsr-router
PIMv2 Bootstrap information
  BSR address: 20.0.1.21
  Uptime:      00:02:39, BSR Priority: 64, Hash mask length: 10
  Expires:     00:00:03
  Role: Candidate BSR
  State: Pending BSR

awplus#show ip pim sparse-mode bsr-router
PIMv2 Bootstrap information
 BSR address: 20.0.1.21
 Uptime:      00:40:20, BSR Priority: 64, Hash mask length: 10
 Expires:     00:02:07
 Role: Candidate BSR
 State: Candidate BSR
```

Use the show ip pim sparse-mode rp mapping command to verify RP-set information on Switch A.

```
awplus#show ip pim sparse-mode rp mapping
PIM Group-to-RP Mappings
This system is the Bootstrap Router (v2)
Group(s): 224.0.0.0/4
 RP: 20.0.1.11
 Info source: 20.0.1.11, via bootstrap, priority 0
 Uptime: 00:00:30, expires: 00:02:04
```

Use the show ip pim sparse-mode rp mapping command to verify RP-set information on Switch B.

```
awplus#show ip pim sparse-mode rp mapping
PIM Group-to-RP Mappings
Group(s): 224.0.0.0/4
 RP: 20.0.1.11
 Info source: 20.0.1.21, via bootstrap, priority 0
 Uptime: 00:00:12, expires: 00:02:18
```

PIM-SSM

Protocol Independent Multicast - Source Specific Multicast (PIM-SSM) is derived from Protocol Independent Multicast - Sparse Mode (PIM-SM) and is a simplified version of PIM-SM.

For details of the commands used to configure PIM-SSM, see Chapter 51, PIM-SM Commands and Chapter 49, IGMP and IGMP Snooping Commands.

Characteristics of PIM-SSM

While PIM-SM supports both a “many-to-many” and a “one-to-many” model, PIM-SSM only supports the “one-to-many” model, also known as a “broadcast application”. It is possible for devices in a network to support both PIM-SM and PIM-SSM at the same time, even on the same interfaces.

Instead of multicast groups being initially sent to a Rendezvous Point (RP), PIM-SSM builds shortest path trees (SPT) that are directly rooted at the source. This is because PIM-SSM relies on the multicast client informing the closest multicast router of the source IP address of the multicast server, as well as the multicast group IP address for the group it wants to join.

This approach removes some of the complexity in the multicast routing process and also improves security. Because a multicast client sends a join that includes the specific source IP address of the server it is no longer possible for an attacker to broadcast to the same group IP address from a different source IP address and cause a Denial of Service (DoS) attack. With PIM-SSM the attacker's traffic is discarded at the edge of the PIM domain.

PIM-SSM IP Address Range

The Internet Assigned Numbers Authority (IANA) has reserved the address range 232.0.0.0 through 232.255.255.255 for SSM applications. Although PIM-SSM can technically be configured to use the entire 224/4 multicast address range, PIM-SSM operation is guaranteed only in the 232/8 range (232.0.0/24 is reserved).

IGMPv3 and SSM-Mapping

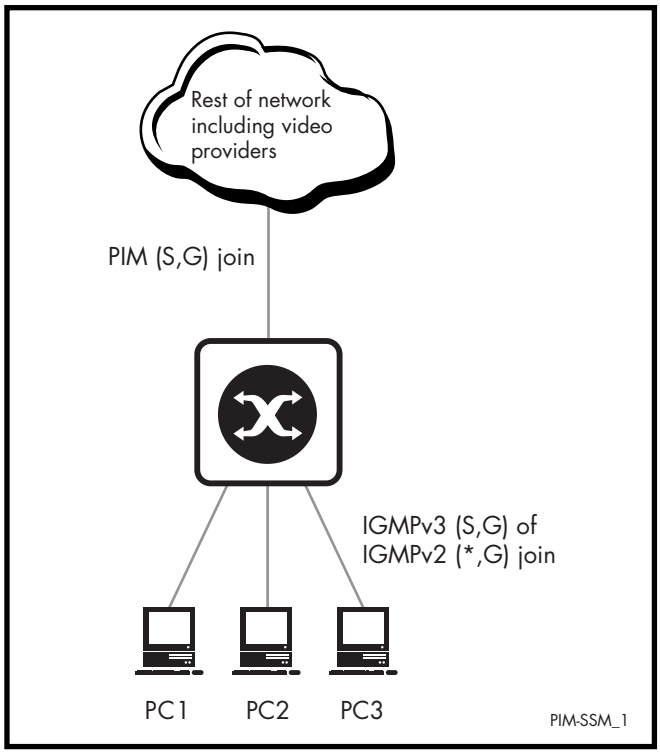
A restriction of PIM-SSM is that it requires a “Source, Group” (S,G) join and only IGMPv3 supports this. Source Specific Multicast Mapping is required to use PIM-SSM when you have older multicast client devices that do not support IGMPv3. This additional feature allows you to statically map IGMPv1/v2 (*,G) joins into PIM (S,G) joins, which in turn allows the device to talk to an upstream PIM-SSM network.

Note that IGMPv3 (*,G) joins cannot be mapped by SSM-Mapping.

How PIM-SSM Works

To join multicast group `232.1.1.1` each PC must send an IGMPv3 join with the source IP address specified. The join will be a (S,G) join, for example (`85.1.1.1,232.1.1.1`). The router will receive the IGMP join and check if the group address is in the SSM range. Then:

- If the group address is in the SSM range, the router will verify that a specific source or sources have been included in the IGMP join.
- If a specific source or sources has been included in the IGMP join, then the router will forward a PIM (S,G) join towards the source IP address.
- If the source IP address is not specified, then the router will discard the IGMP join and the PC will not join the group.
- If an IGMPv2 join is received for the SSM range then by default the join is discarded because no source IP address is specified. IGMP joins for group addresses that are not in the SSM range do not need to specify a specific source IP address.



How IGMP SSM-Mapping Works

In the example above ("How PIM-SSM Works"), if an IGMPv2 join is sent it is discarded because IGMPv2 only supports (*,G) joins. To resolve this issue, IGMP SSM-Mapping allows the router to be statically configured with source IP addresses for each group address or range of group addresses. This allows the router to receive a (*,G) join, match the group address via a software ACL, and based on this, insert the matching source IP address. The router then treats the join as a normal (S,G) join. If no match is found then the (*,G) is used. If the group address is in the SSM range then the join is discarded.

Configure PIM-SSM

Table 50-1: General configuration procedure for PIM-SSM

To enable SSM on the device	
`awplus#` `configure terminal`	Enter Global Configuration mode.
`awplus(config)#` `ip igmp ssm-map enable`	This command applies to VLAN interfaces configured for IGMP.
To specify the static mode of defining SSM	
`awplus#` `configure terminal`	Enter Global Configuration mode.

`awplus(config)#`
`access-list {<1-99>|<1300-1999>} permit <source>`
OR
`access-list standard <standard-access-list-name> permit <source>`
	Configure either a Standard Numbered ACL, Expanded Numbered ACL, or Standard Named ACL. Specify a multicast group address range and wildcard mask with the *source* parameter.

`awplus(config)#` `ip igmp ssm-map static {<access-list-number>|<access-list-number-expanded>|<access-list-name>} <ip-address>`	This command applies to VLAN interfaces configured for IGMP. SSM statically assigns sources to IGMPv1 and IGMPv2 groups to translate such (*,G) groups' memberships to (S,G) memberships for use with PIM-SSM.
To define a non-default SSM range of IP multicast addresses in IGMP	
`awplus#` `configure terminal`	Enter Global Configuration mode.

`awplus(config)#`
`access-list {<1-99>} permit <source>`
OR
`access-list standard <standard-access-list-name> permit <source>`
	Configure either a Standard Numbered ACL or Standard Named ACL.

Table 50-1: General configuration procedure for PIM-SSM(cont.)

`awplus(config)#`	
`ip igmp ssm range {<access-list-number>|<access-list-name>}`	Incoming IGMPv1 and IGMPv2 join requests are ignored if the multicast IP address is in the SSM range and no SSM mapping is configured for these addresses. By default, the SSM range is 232/8. To define the SSM range to be other than the default, specify either an access-list name or and access-list number.
To define the Source Specific Multicast (SSM) range of IP multicast addresses	
`awplus#`	
	Enter Global Configuration mode.
`awplus(config)#`	
`ip pim ssm default`	The default keyword defines the SSM range as 232/8. OR
`awplus(config)#`	
`ip pim ssm range {<access-list>|<named-access-list>}`	To define the SSM range to be other than the default, use the access-list parameter option.

Chapter 51: PIM-SM Commands

Command List 51.2
clear ip pim sparse-mode bsr rp-set * 51.2
debug pim sparse-mode 51.3
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Command List

This chapter provides an alphabetical reference of PIM-SM commands. For commands common to PIM-SM and PIM-DM, see Chapter 47, Multicast Introduction and Commands.

Note The Bootstrap Router (BSR) function will not work properly if there are PIM-SM routers using VRRP.

clear ip pim sparse-mode bsr rp-set *

Use this command to clear all Rendezvous Point (RP) sets learned through the PIMv2 Bootstrap Router (BSR).

Syntax

```
clear ip pim sparse-mode bsr rp-set *
```

Parameter	Description
*	Clears all RP sets.

Mode Privileged Exec

Usage For multicast clients, note that one router will be automatically or statically designated as the RP, and all routers must explicitly join through the RP. A Designated Router (DR) sends periodic Join/Prune messages toward a group-specific RP for each group that it has active members.

For multicast sources, note that the Designated Router (DR) unicasts Register messages to the RP encapsulated with data packets from the multicast source. The RP forwards decapsulated data packets from the source toward group members.

Example

```
awplus# clear ip pim sparse-mode bsr rp-set *
```

debug pim sparse-mode

Use this command to activate/de-activate all PIM-SM debugging.

Syntax

```
debug pim sparse-mode [all] [events] [mfc] [mib] [nexthop] [nsm]
    [packet] [state] [mtrace]

no debug pim sparse-mode [all] [events] [mfc] [mib] [nexthop] [nsm]
    [packet] [state] [mtrace]
```

Parameter	Description
`all`	Activates/deactivates all PIM-SM debugging.
`events`	Activates debug printing of events.
`mfc`	Activates debug printing of MFC (Multicast Forwarding Cache in kernel) add/delete/updates.
`mib`	Activates debug printing of PIM-SM MIBs.
`nexthop`	Activates debug printing of PIM-SM nexthop communications.
`nsm`	Activates debugging of PIM-SM Network Services Module communications.
`packet`	Activates debug printing of incoming and/or outgoing packets.
`state`	Activates debug printing of state transition on all PIM-SM FSMs.
`mtrace`	Activates debug printing of multicast traceroute.

Mode Privileged Exec and Global Configuration

Example

```
awplus# configure terminal
awplus(config)# debug pim sparse-mode all
```

Related Commands show debugging pim sparse-mode
undebug all pim sparse-mode

debug pim sparse-mode timer

Use this command to enable debugging for the specified PIM-SM timers.

Use the no variants of this command to disable debugging for the specified PIM-SM timers.

Syntax

```
debug pim sparse-mode timer assert [at]
no debug pim sparse-mode timer assert [at]
debug pim sparse-mode timer bsr [bst|crp]
no debug pim sparse-mode timer bsr [bst|crp]
debug pim sparse-mode timer hello [ht|nlt|tht]
no debug pim sparse-mode timer hello [ht|nlt|tht]
debug pim sparse-mode timer joinprune [jt|et|ppt|kat|ot]
no debug pim sparse-mode timer joinprune [jt|et|ppt|kat|ot]
debug pim sparse-mode timer register [rst]
no debug pim sparse-mode timer register [rst]
```

Parameter	Description
`assert`	Enable or disable debugging for the Assert timers.
`at`	Enable or disable debugging for the Assert Timer.
`bsr`	Enable or disable debugging for the specified Bootstrap Router timer, or all Bootstrap Router timers.
`bst`	Enable or disable debugging for the Bootstrap Router: Bootstrap Timer.
`crp`	Enable or disable debugging for the Bootstrap Router: Candidate-RP Timer.
`hello`	Enable or disable debugging for the specified Hello timer, or all Hello timers.
`ht`	Enable or disable debugging for the Hello timer: Hello Timer.
`nlt`	Enable or disable debugging for the Hello timer: Neighbor Liveness Timer.
`tht`	Enable or disable debugging for the Hello timer: Triggered Hello Timer.
`joinprune`	Enable or disable debugging for the specified JoinPrune timer, or all JoinPrune timers.
`jt`	Enable or disable debugging for the JoinPrune timer: upstream Join Timer.
`et`	Enable or disable debugging for the JoinPrune timer: Expiry Timer.
`ppt`	Enable or disable debugging for the JoinPrune timer: PrunePending Timer.
`kat`	Enable or disable debugging for the JoinPrune timer: KeepAlive Timer.
`ot`	Enable or disable debugging for the JoinPrune timer: Upstream Override Timer.
`register`	Enable or disable debugging for the Register timers.
`rst`	Enable or disable debugging for the Register timer: Register Stop Timer.

Default By default, all debugging is disabled.

Mode Privileged Exec and Global Configuration

Examples To enable debugging for the PIM-SM Bootstrap Router bootstrap timer, use the commands:

```
awplus(config)# debug pim sparse-mode timer bsr bst
```

To enable debugging for the PIM-SM Hello: neighbor liveness timer, use the command:

```
awplus(config)# debug pim sparse-mode timer hello ht
```

To enable debugging for the PIM-SM Joinprune expiry timer, use the command:

```
awplus# debug pim sparse-mode timer joinprune et
```

To disable debugging for the PIM-SM Register timer, use the command:

```
awplus# no debug pim sparse-mode timer register
```

Related Commands show debugging pim sparse-mode

ip pim accept-register list

Use this command to configure the ability to filter out multicast sources specified by the given access-list at the Rendezvous Point (RP), so that the RP will accept/refuse to perform the register mechanism for the packets sent by the specified sources. By default, the RP accepts register packets from all multicast sources.

Use the no variant of this command to revert to default.

Syntax

```
ip pim accept-register list{<simplerange>|<exprange>|<access-list>}
no ip pim accept-register
```

Parameter	Description
<simplerange>	<100-199> IP extended access-list.
<exprange>	<2000-2699> IP extended access list (expanded range).
<access-list>	IP Named Standard Access list.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# ip pim accept-register list 121
awplus(config)# access-list 121 permit ip 100.1.1.1 0.0.0.0 any
```

ip pim anycast-rp

Use this command to configure Anycast RP (Rendezvous Point) in a RP set.

Use the no variant of this command to remove the configuration.

Syntax

```
ip pim anycast-rp <anycast-rp-address> <member-rp-address>
no ip pim anycast-rp <anycast-rp-address> [<member-rp-address>]
```

Parameter	Description
<anycast-rp-address>	<A.B.C.D> Specify an anycast IP address to configure an Anycast RP (Rendezvous Point) in a RP set.
<member-rp-address>	<A.B.C.D> Specify an Anycast RP (Rendezvous Point) address to configure an Anycast RP in a RP set.

Mode Global Configuration

Usage Anycast is a network addressing and routing scheme where data is routed to the nearest or best destination as viewed by the routing topology. Compared to unicast with a one-to-one association between network address and network endpoint, and multicast with a one-to-many association between network address and network endpoint; anycast has a one-to-many association between network address and network endpoint. For anycast, each destination address identifies a set of receiver endpoints, from which only one receiver endpoint is chosen.

Anycast is often implemented using BGP to simultaneously advertise the same destination IP address range from many sources, resulting in packets address to destination addresses in this range being routed to the nearest source announcing the given destination IP address.

Use this command to specify the Anycast RP configuration in the Anycast RP set. Use the no variant of this command to remove the Anycast RP configuration. Note that the member RP address is optional when using the no parameter to remove the Anycast RP configuration. removing the anycast RP address also removes the member RP address.

Examples The following example shows how to configure the Anycast RP address with ip pim anycast-rp:

```
awplus# configure terminal
awplus(config)# ip pim anycast-rp 1.1.1.1 10.10.10.10
```

The following example shows how to remove the Anycast RP in the RP set specifying only the anycast RP address with no ip pim anycast-rp, but not specifying the member RP address:

```
awplus# configure terminal
awplus(config)# no ip pim anycast-rp 1.1.1.1
```

ip pim bsr-border

Use the ip pim bsr-border command to prevent Bootstrap Router (BSR) messages from being sent or received through a VLAN interface. The BSR border is the border of the PIM domain.

Use the no variant of this command to disable the configuration set with ip pim bsr-border.

Syntax

```
ip pim bsr-border
no ip pim bsr-border
```

Mode Interface Configuration for a VLAN interface.

Usage When this command is configured on a VLAN interface, no PIM version 2 BSR messages will be sent or received through the interface. Configure an interface bordering another PIM domain with this command to avoid BSR messages from being exchanged between the two PIM domains.

BSR messages should not be exchanged between different domains, because devices in one domain may elect Rendezvous Points (RPs) in the other domain, resulting in loss of isolation between the two PIM domains that would stop the PIM protocol from working as intended.

Examples The following example configures the interface specified to be the PIM domain border:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim bsr-border
```

The following example removes the interface specified from the PIM domain border:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip pim bsr-border
```

ip pim bsr-candidate

Use this command to give the device the candidate BSR (Bootstrap Router) status using the specified IP address mask of the interface.

Use the no variant of this command to disable this function to remove the BSR candidate.

Syntax

```
ip pim bsr-candidate <interface> [<hash>] [<priority>]
no ip pim bsr-candidate [<interface>]
```

Parameter	Description
<interface>	The interface. For instance, `vlan2`.
<hash>	`<0-32>` configure hash mask length for RP selection.
<priority>	`<0-255>` configure priority for a BSR candidate. Note that you must also specify the *<hash>* (mask length) when specifying the *<priority>*.

Mode Global Configuration

Examples To set the BSR candidate to a specified interface enter the command shown below:

```
awplus# configure terminal
awplus(config)# ip pim bsr-candidate vlan2 20 30
```

To disable this function and remove the BSR candidate from a specified interface enter:

```
awplus# configure terminal
awplus(config)# no ip pim bsr-candidate vlan2
```

ip pim cisco-register-checksum

Use this command to configure the option to calculate the Register checksum over the whole packet. This command is used to inter-operate with older Cisco IOS versions.

Use the no variant of this command to disable this option.

Syntax

```
ip pim cisco-register-checksum
no ip pim cisco-register-checksum
```

Default This command is disabled by default. By default, Register Checksum is calculated only over the header.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# ip pim cisco-register-checksum
```

ip pim cisco-register-checksum group-list

Use this command to configure the option to calculate the Register checksum over the whole packet on multicast groups specified by the access-list. This command is used to inter-operate with older Cisco IOS versions.

Use the no variant of this command to revert to default settings.

Syntax

```
ip pim cisco-register-checksum group-list
   [<simplerange>|<exprange>|<access-list>]

no ip pim cisco-register-checksum group-list
   [<simplerange>|<exprange>|<access-list>]
```

Parameter	Description
<simplerange>	<1-99> Simple access-list.
<exprange>	<1300-1999> Simple access-list (expanded range).
<access-list>	IP Named Standard Access list.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# ip pim cisco-register-checksum group-list 34
awplus(config)# access-list 34 permit 224.0.1.3
```

ip pim crp-cisco-prefix

Use this command to interoperate with Cisco devices that conform to an earlier draft standard. Some Cisco devices might not accept candidate RPs with a group prefix number of zero. Note that the latest BSR specification prohibits sending RP advertisements with prefix 0. RP advertisements for the default IPv4 multicast group range 224/4 are sent with a prefix of 1.

Use the no variant of this command to revert to the default settings.

Syntax

```
ip pim crp-cisco-prefix
no ip pim crp-cisco-prefix
```

Mode Global Configuration

Usage Cisco's BSR code does not conform to the latest BSR draft, it does not accept candidate RPs with a group prefix number of zero. To make the candidate RP work with a Cisco BSR, use the ip pim crp-cisco-prefix command when interoperating with older versions of Cisco IOS.

Example

```
awplus# configure terminal
awplus(config)# ip pim crp-cisco-prefix
```

Related Commands ip pim rp-candidate

ip pim dr-priority

Use this command to set the Designated Router priority value.

Use the no variant of this command to disable this function.

Syntax

```
ip pim dr-priority  <priority>
no ip pim dr-priority [<priority>]
```

Parameter	Description
<priority>	<0-4294967294> The Designated Router priority value. A higher value has a higher preference.

Default The default is 1. The negated form of this command restores the value to the default.

Mode Interface Configuration for a VLAN interface.

Examples To set the Designated Router priority value apply the example commands as shown below:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim dr-priority 11234
```

To disable the Designated Router priority value apply the example commands as shown below:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip pim dr-priority 11234
```

Related Commands ip pim ignore-rp-set-priority

ip pim exclude-genid

Use this command to exclude the GenID option from Hello packets sent out by the PIM module on a particular interface.This command is used to inter-operate with older Cisco IOS versions.

Use the no variant of this command to revert to default settings.

Syntax

```
ip pim exclude-genid
no ip pim exclude-genid
```

Default By default, this command is disabled; the GenID option is included.

Mode Interface Configuration for a VLAN interface.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim exclude-genid
```

ip pim ext-srcs-directly-connected

Use this command to configure PIM to treat all source traffic arriving on the interface as though it was sent from a host directly connected to the interface.

Use the no variant of this command to configure PIM to treat only directly connected sources as directly connected.

Syntax

```
ip pim ext-srcs-directly-connected
no ip pim ext-srcs-directly-connected
```

Default The no variant of this command is the default behavior.

Mode Interface Configuration for a VLAN interface.

Example To configure PIM to treat all sources as directly connected, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim ext-srcs-directly-connected
```

To configure PIM to treat only directly connected sources as directly connected, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip pim ext-srcs-directly-connected
```

ip pim hello-holdtime (PIM-SM)

This command configures a hello-holdtime value. You cannot configure a hello-holdtime value that is less than the current hello-interval.

Use the no variant of this command to return it to its default of 3.5 * the current hello-interval.

Syntax

```
ip pim hello-holdtime <holdtime>
no ip pim hello-holdtime
```

Parameter	Description
<holdtime>	<1-65535> The holdtime value in seconds (no fractional seconds are accepted).

Default The default hello-holdtime value is 3.5 * the current hello-interval. The default hello-holdtime is restored using the negated form of this command.

Mode Interface Configuration for a VLAN interface.

Usage Each time the hello interval is updated, the hello holdtime is also updated, according to the following rules:

If the hello holdtime is not configured; or if the hello holdtime is configured and less than the current hello-interval value, it is modified to the (3.5 * hello interval). Otherwise, it retains the configured value.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim hello-holdtime 123
```

ip pim hello-interval (PIM-SM)

This command configures a hello-interval value.

Use the no variant of this command to reset the hello-interval to the default.

Syntax

```
ip pim hello-interval <interval>
no ip pim hello-interval
```

Parameter	Description
<interval>	<1-65535> The value in seconds (no fractional seconds accepted).

Default The default hello-interval value is 30 seconds. The default is restored using the negated form of this command.

Mode Interface Configuration for a VLAN interface.

Usage When the hello interval is configured, and the hello holdtime is not configured, or when the configured hello-holdtime value is less than the new hello-interval value; the holdtime value is modified to the (3.5 * hello interval). Otherwise, the hello-holdtime value is the configured value.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim hello-interval 123
```

ip pim ignore-rp-set-priority

Use this command to ignore the RP-SET priority value, and use only the hashing mechanism for RP selection.

This command is used to inter-operate with older Cisco IOS versions.

Use the no variant of this command to disable this setting.

Syntax

```
ip pim ignore-rp-set-priority
no ip pim ignore-rp-set-priority
```

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# ip pim ignore-rp-set-priority
```

ip pim jp-timer

Use this command to set the PIM-SM join/prune timer.

Use the no variant of this command to unset the PIM-SM join/prune timer.

Syntax

```
ip pim jp-timer <1-65535>
no ip pim jp-timer [<1-65535>]
```

Parameter	Description
<1-65535>	Specifies the Join/Prune timer value.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# ip pim jp-timer 234

awplus# configure terminal
awplus(config)# no ip pim jp-timer 234
```

ip pim neighbor-filter (PIM-SM)

This command enables filtering of neighbors on the VLAN interface. When configuring a neighbor filter, PIM-SM will either not establish adjacency with the neighbor, or terminate adjacency with the existing neighbors if denied by the filtering access list.

Use the no variant of this command to disable this function.

Syntax

```
ip pim neighbor-filter {<number>|<accesslist>}
no ip pim neighbor-filter {<number>|<accesslist>}
```

Parameter	Description
<number>	<1-99> Standard IP access-list number.
<accesslist>	IP access list name.

Default By default, there is no filtering.

Mode Interface Configuration for a VLAN interface.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim neighbor-filter 14
```

ip pim register-rate-limit

Use this command to configure the rate of register packets sent by this DR, in units of packets per second.

Use the no variant of this command to remove the limit.

Syntax

```
ip pim register-rate-limit <1-65535>
no ip pim register-rate-limit
```

Parameter	Description
<1-65535>	Specifies the maximum number of packets that can be sent per second.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# ip pim register-rate-limit 3444
```

ip pim register-rp-reachability

Use this command to enable the RP reachability check for PIM Register processing at the DR. The default setting is no checking for RP-reachability.

Use the no variant of this command to disable this processing.

Syntax

```
ip pim register-rp-reachability
no ip pim register-rp-reachability
```

Default This command is disabled; by default, there is no checking for RP-reachability.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# ip pim register-rp-reachability
```

ip pim register-source

Use this command to configure the source address of register packets sent by this DR, overriding the default source address, which is the address of the RPF interface toward the source host.

Use the no variant of this command to un-configure the source address of Register packets sent by this DR, reverting back to use the default source address that is the address of the RPF interface toward the source host.

Syntax

```
ip pim register-source [<sourceaddress>|<interface>]
no ip pim register-source
```

Parameter	Description
<sourceaddress>	The IP address, entered in the form `A.B.C.D`, to be used as the source of the register packets.
<interface>	The name of the interface to be used as the source of the register packets.

Usage The configured address must be a reachable address to be used by the RP to send corresponding Register-Stop messages in response. It is normally the local loopback interface address, but can also be a physical address. This address must be advertised by unicast routing protocols on the DR. The configured interface does not have to be PIM enabled.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# ip pim register-source 10.10.1.3
```

ip pim register-suppression

Use this command to configure the register-suppression time, in seconds, overriding the default of 60 seconds. Configuring this value modifies register-suppression time at the DR. Configuring this value at the RP modifies the RP-keepalive-period value if the ip pim rp-register-kat command on page 51.28 is not used.

Use the no variant of this command to reset the value to its default of 60 seconds.

Syntax

```
ip pim register-suppression <1-65535>
no ip pim register-suppression
```

Parameter	Description
<1-65535>	Register suppression on time in seconds.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# ip pim register-suppression 192
```

ip pim rp-address

Use this command to statically configure RP (Rendezvous Point) address for multicast groups.

Use the no variant of this command to remove a statically configured RP (Rendezvous Point) address for multicast groups.

Syntax

```
ip pim rp-address <ip-address>
    [<simplerange>|<expandedrange> |<accesslist>] [<override>]

no ip pim rp-address <ip-address>
    [<simplerange>|<expandedrange>| <accesslist>] [override>]
```

Parameter	Description
<ip-address>	IP address of Rendezvous Point, entered in the form `A.B.C.D`.
<simplerange>	`<1-99>` IP Standard Access-list.
<expandedrange>	`<1300-1999>` IP Standard Access-list (expanded range).
<accesslist>	IP extended Access-list name.
<override>	Enables statically defined RPs to override dynamically learned RPs.

Mode Global Configuration

Usage The AlliedWare Plus™ PIM-SM implementation supports multiple static RPs. It also supports usage of static-RP and BSR mechanism simultaneously. The ip pim rp-address command is used to statically configure the RP address for multicast groups.

You need to understand the following information before using this command.

If the RP-address that is configured by the BSR, and the RP-address that is configured statically, are both available for a group range, then the RP-address configured through BSR is chosen over the statically configured RP-address.

A single static-RP can be configured for multiple group ranges using Access Lists. However, configuring multiple static RPs (using ip pim rp-address command) with the same RP address is not allowed. The static-RP can either be configured for the whole multicast group range `224.0.0.0/4` (without ACL) or for specific group ranges (using ACL).

For example, configuring ip pim rp-address 192.168.3.4 will configure static-RP 192.168.3.4 for the default group range 224.0.0.0/4. Configuring ip pim rp-address 192.168.7.8 grp-list will configure static-RP 192.168.7.8 for all the group ranges represented by permit filters in grp-list ACL.

If multiple static-RPs are available for a group range, then one with the highest IP address is chosen.

Only `Permit` filters in ACL are considered as valid group ranges. The default `Permit` filter `0.0.0.0/0` is converted to the default multicast filter `224.0.0.0/4`.

After configuration, the RP-address is inserted into a static-RP group tree based on the configured group ranges. For each group range, multiple static-RPs are maintained in a linked list. This list is sorted in a descending order of IP addresses. When selecting static-RPs for a group range, the first element (which is the static-RP with highest IP address) is chosen.

RP-address deletion is handled by removing the static-RP from all the existing group ranges and recalculating the RPs for existing TIB states if required.

Group mode and RP address mappings learned through BSR take precedence over mappings statistically defined by the ip pim rp-address command. Commands with the override keyword take precedence over dynamically learned mappings.

Example

```
awplus# configure terminal
awplus(config)# ip pim rp-address 192.168.3.4 4
```

Related Commands

ip pim rp-candidate
ip pim rp-register-kat

ip pim rp-candidate

Use this command to give the router the candidate RP (Rendezvous Point) status using the IP address of the specified interface.

Use the no variant of this command to remove the RP status set using the ip pim rp-candidate command.

Syntax

```
ip pim rp-candidate <interface>
   [priority <priority>|interval <interval>| grouplist <grouplist>]

no ip pim rp-candidate [<interface>]
```

Parameter	Description
<interface>	Interface name
<priority>	<0-255> configure priority for an RP candidate.
<interval>	advertisement interval specified in the range <1-16383> (in seconds).
<grouplist>	IP access list specifier for standard, expanded or named access lists in their respective ranges: [<1-99>|*WORD*]

Default The priority value for a candidate RP is 0 by default until specified using the priority parameter.

Mode Global Configuration

Usage Note that issuing the command ip pim rp-candidate <*interface*> without optional priority, interval, or grouplist parameters will configure the candidate RP with a priority value of 0.

Examples

```
awplus# configure terminal
awplus(config)# ip pim rp-candidate vlan2 priority 3
```

```
awplus# configure terminal
awplus(config)# ip pim rp-candidate vlan2 priority 3
               group-list 3
```

```
awplus# configure terminal
awplus(config)# no ip pim rp-candidate vlan2
```

Related Commands ip pim rp-address
ip pim rp-register-kat

ip pim rp-register-kat

Use this command to configure the Keep Alive Time (KAT) for (S,G) states at the RP (Rendezvous Point) to monitor PIM Register packets.

Use the no variant of this command to remove a previously configured KAT time with ip pim rp-register-kat.

Syntax

```
ip pim rp-register-kat <1-65535>
no ip pim rp-register-kat
```

Parameter	Description
<1-65536>	KAT time in seconds.

Mode Global Configuration

Examples

```
awplus# configure terminal
awplus(config)# ip pim rp-register-kat 3454

awplus# configure terminal
awplus(config)# no ip pim rp-register-kat
```

Related Commands ip pim rp-address
ip pim rp-candidate

ip pim sparse-mode

Use this command to enable PIM-SM on the VLAN interface.

Use the no variant of this command to disable PIM-SM on the VLAN interface.

Syntax

```
ip pim sparse-mode
no ip pim sparse-mode
```

Mode Interface Configuration for a VLAN interface.

Examples

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim sparse-mode

awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip pim sparse-mode
```

ip pim sparse-mode passive

Use this command to enable and disable passive mode operation for local members on the VLAN interface.

Use the no variant of this command to disable passive mode operation for local members on the VLAN interface.

Syntax

```
ip pim sparse-mode passive
no ip pim sparse-mode passive
```

Mode

Interface Configuration for a VLAN interface.

Usage

Passive mode essentially stops PIM transactions on the interface, allowing only IGMP mechanism to be active. To turn off passive mode, use the no ip pim sparse-mode passive or the ip pim sparse-mode command. To turn off PIM activities on the VLAN interface, use the no ip pim sparse-mode command.

Examples

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim sparse-mode passive

awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip pim sparse-mode passive
```

ip pim spt-threshold

This command turns on the ability for the last-hop PIM router to switch to SPT.

The no variant of this command turns off the ability for the last-hop PIM router to switch to SPT.

Note The switching to SPT happens either at the receiving of the first data packet, or not at all; it is not rate-based.

Syntax

```
ip pim spt-threshold
no ip pim spt-threshold
```

Mode Global Configuration

Examples

```
awplus# configure terminal
awplus(config)# ip pim spt-threshold

awplus# configure terminal
awplus(config)# no ip pim spt-threshold
```

ip pim spt-threshold group-list

Use this command to turn on/off the ability for the last-hop PIM router to switch to SPT for multicast group addresses specified by the given access-list.

The switching to SPT happens either at the receiving of the first data packet, or not at all; it is not rate-based.

Use the no variant of this command to turn off switching to the SPT.

Syntax

```
ip pim spt-threshold group-list {<simplerange>|<expandedrange>|
   <named-accesslist>}
no ip pim spt-threshold group-list [<simplerange>|<expandedrange>|
   <named-accesslist>]
```

Parameter	Description
<simplerange>	<1-99> IP Standard Access-list.
<expandedrange>	<1300-1999> IP Standard Access-list (expanded range).
<named-accesslist>	IP Access-list name.

Mode Global Configuration

Usage Turn on/off the ability for the last-hop PIM router to switch to SPT for multicast group addresses specified by the given access-list.

Example

```
awplus# configure terminal
awplus(config)# ip pim spt-threshold group-list 1
awplus(config)# access-list 1 permit 224.0.1.3
```

ip pim ssm

Use this command to define the Source Specific Multicast (SSM) range of IP multicast addresses. The default keyword defines the SSM range as 232/8. To define the SSM range to be other than the default, use the access-list parameter option.

Use the no variant of this command to disable the SSM range.

Syntax

```
ip pim ssm default
ip pim ssm range {<access-list>|<named-access-list>}
no ip pim ssm
```

Parameter	Description
<access-list>	<1-99> Simple access-list.
<named-access-list>	Named Standard Access List.

Default By default, the command is disabled.

Mode Global Configuration

Usage When an SSM range of IP multicast addresses is defined by the ip pim ssm command, the no (*,G) or (S,G,rpt) state will be initiated for groups in the SSM range.

The messages corresponding to these states will not be accepted or originated in the SSM range.

Examples The following commands show how to configure SSM service for the IP address range defined by access list 10:

```
awplus# configure terminal
awplus(config)# access-list 10 permit 225.1.1.1
awplus(config)# ip pim ssm range 4
```

The following commands show how to disable PIM-SSM:

```
awplus# configure terminal
awplus(config)# no ip pim ssm
```

show debugging pim sparse-mode

This command displays the status of the debugging of the system.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show debugging pim sparse-mode`

Mode User Exec and Privileged Exec

Example To display PIM-SM debugging settings, use the command:

```
awplus# show debugging pim sparse-mode
```

Figure 51-1: output from the **show debugging pim sparse-mode** command

```
Debugging status:
  PIM event debugging is on
  PIM Hello THT timer debugging is on
  PIM event debugging is on
  PIM MFC debugging is on
  PIM state debugging is on
  PIM packet debugging is on
  PIM incoming packet debugging is on
  PIM outgoing packet debugging is on
```

Related Commands debug pim sparse-mode

show ip pim sparse-mode bsr-router

Use this command to show the Bootstrap Router (BSR) (v2) address.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip pim sparse-mode bsr-router`

Mode User Exec and Privileged Exec

Output Figure 51-2: output from the **show ip pim sparse-mode bsr-router** command

```
PIMv2 Bootstrap information
  BSR address: 10.10.11.35 (?)
  Uptime:      00:00:38, BSR Priority: 0, Hash mask length: 10
  Expires:     00:01:32
  Role: Non-candidate BSR
  State: Accept Preferred
```

Related Commands show ip pim sparse-mode rp mapping
show ip pim sparse-mode neighbor

show ip pim sparse-mode interface

Use this command to show PIM-SM interface information.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip pim sparse-mode interface`

Mode User Exec and Privileged Exec

Example To display information about PIM-SM interfaces, use the command:

```
awplus# show ip pim sparse-mode interface
```

Figure 51-3: Example output from the **show ip pim sparse-mode interface** command

```
Total configured interfaces: 100   Maximum allowed: 100
Total active interfaces:     100

Address          Interface VIFindex Ver/   Nbr    DR         DR
                                    Mode   Count  Prior
10.1.100.4       vlan100   4        v2/S   2      1     10.1.100.6
10.2.101.10      vlan1001  5        v2/S   0      1     10.2.101.10
10.2.102.10      vlan1002  6        v2/S   0      1     10.2.102.10
10.2.103.10      vlan1003  7        v2/S   0      1     10.2.103.10
10.2.104.10      vlan1004  8        v2/S   0      1     10.2.104.10
10.2.105.10      vlan1005  9        v2/S   0      1     10.2.105.10
10.2.106.10      vlan1006  10       v2/S   0      1     10.2.106.10
10.2.107.10      vlan1007  11       v2/S   0      1     10.2.107.10
```

1. Only the top entries output by this command are shown in this example.

Table 51-1: Parameters in the output from the **show ip pim sparse-mode interface** command

Parameters	Description
`Total configured interfaces`	The number of configured PIM Sparse Mode interfaces.
`Maximum allowed`	The maximum number of PIM Sparse Mode interfaces that can be configured.
`Total active interfaces`	The number of active PIM Sparse Mode interfaces.
`Address`	Primary PIM-SM address.
`Interface`	Name of the PIM-SM interface.
`VIF Index`	The Virtual Interface index of the VLAN.
`Ver/Mode`	PIM version/Sparse mode.
`Nbr Count`	Neighbor count of the PIM-SM interface.
`DR Priority`	Designated Router priority.
`DR`	The IP address of the Designated Router.

Related Commands

ip pim sparse-mode
show ip pim sparse-mode rp mapping
show ip pim sparse-mode neighbor

show ip pim sparse-mode interface detail

Use this command to show detailed information on a PIM-SM interface.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip pim sparse-mode interface detail`

Mode User Exec and Privileged Exec

Output Figure 51-4: s Example output from the **show ip pim sparse-mode interface detail** command

```
vlan3 (vif 3):
  Address 192.168.1.149, DR 192.168.1.149
  Hello period 30 seconds, Next Hello in 15 seconds
  Triggered Hello period 5 seconds
  Neighbors:
   192.168.1.22

vlan2 (vif 0):
  Address 10.10.11.149, DR 10.10.11.149
  Hello period 30 seconds, Next Hello in 18 seconds
  Triggered Hello period 5 seconds
  Neighbors:
   10.10.11.4
```

show ip pim sparse-mode mroute

This command displays the IP multicast routing table, or the IP multicast routing table based on the specified address or addresses.

Two group addresses cannot be used simultaneously; two source addresses cannot be used simultaneously.

Note that when a feature license is enabled, the output for the show ip pim sparse-mode mroute command will only show 32 interfaces because of the terminal display width limit. Use the show ip pim sparse-mode mroute detail command to display detailed entries of the IP multicast routing table.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip pim sparse-mode mroute [<group-address>] [<source-address>]
show ip pim sparse-mode mroute [<source-address> <group-address>]
```

Parameter	Description
<group-address>	Group IP address, entered in the form A.B.C.D. Based on the group and source address, the output is the selected route if present in the multicast route tree.
<source-address>	Source IP address, entered in the form A.B.C.D. Based on the source and group address, the output is the selected route if present in the multicast route tree.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ip pim sparse-mode mroute
awplus# show ip pim sparse-mode mroute 40.40.40.11
awplus# show ip pim sparse-mode mroute 235.0.0.1
awplus# show ip pim sparse-mode mroute 235.0.0.1 40.40.40.11
```

Figure 51-5: Example output from the **show ip pim sparse-mode mroute** command

```
IP Multicast Routing Table

(*,*,RP) Entries: 0
(*,G) Entries: 1
(S,G) Entries: 0
(S,G,rpt) Entries: 0
FCR Entries: 1

(*, 224.0.1.3)
RP: 10.10.5.153
RPF nbr: 192.168.1.152
RPF idx: vlan2
Upstream State: JOINED
 Local      ..............................
 Joined     ..j...........................
 Asserted   ..............................
FCR:
Source: 10.10.1.52
 Outgoing   ..o...........................
 KAT timer running, 144 seconds remaining
 Packet count 1
```

show ip pim sparse-mode mroute detail

This command displays detailed entries of the IP multicast routing table, or detailed entries of the IP multicast routing table based on the specified address or addresses.

Two group addresses cannot be used simultaneously; two source addresses cannot be used simultaneously.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip pim sparse-mode mroute [<group-address>|<source-address>]
   detail

show ip pim sparse-mode mroute [<group-address> <source-address>]
   detail

show ip pim sparse-mode mroute [<source-address> <group-address>]
   detail
```

Parameter	Description
<group-address>	Group IP address, entered in the form A.B.C.D. Output is all multicast entries belonging to that group.
<source-address>	Source IP address, entered in the form A.B.C.D. Output is all multicast entries belonging to that source.
`detail`	Show detailed information.

Usage

Based on the group and source address, the output is the selected route if present in the multicast route tree.

Mode

User Exec and Privileged Exec

Examples

```
awplus# show ip pim sparse-mode mroute detail

awplus# show ip pim sparse-mode mroute 40.40.40.11 detail

awplus# show ip pim sparse-mode mroute 224.1.1.1 detail

awplus# show ip pim sparse-mode mroute 224.1.1.1 40.40.40.11
       detail
```

Figure 51-6: Example output from the **show ip pim sparse-mode mroute detail** command

```
IP Multicast Routing Table

(*,*,RP) Entries: 0
(*,G) Entries: 4
(S,G) Entries: 0
(S,G,rpt) Entries: 0
FCR Entries: 0

(*, 224.0.1.24) Uptime: 00:06:42
  RP: 0.0.0.0, RPF nbr: None, RPF idx: None
  Upstream:
   State: JOINED, SPT Switch: Disabled, JT: off
   Macro state: Join Desired,
  Downstream:
   vlan2:
     State: NO INFO, ET: off, PPT: off
     Assert State: NO INFO, AT: off
      Winner: 0.0.0.0, Metric: 42949672951, Pref: 42949672951,
RPT bit: on
     Macro state: Could Assert, Assert Track
  Local Olist:
   vlan2
```

show ip pim sparse-mode neighbor

Use this command to show the PIM-SM neighbor information.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip pim sparse-mode neighbor [<interface>] [<ip-address>]
   [detail]
```

Parameter	Description
<interface>	Interface name (e.g. `vlan2`). Show neighbors on an interface.
<ip-address>	Show neighbors with a particular address on an interface. The IP address entered in the form A.B.C.D.
`detail`	Show detailed information.

Mode User Exec and Privileged Exec

Examples

```
awplus# show ip pim sparse-mode neighbor
```

```
awplus# show ip pim sparse-mode neighbor vlan5 detail
```

Figure 51-7: Example output from the **show ip pim sparse-mode neighbor** command

```
Neighbor         Interface   Uptime/Expires    Ver   DR
Address                                              Priority/
Mode
10.10.0.9        vlan2       00:55:33/00:01:44 v2    1 /
10.10.0.136      vlan2       00:55:20/00:01:25 v2    1 /
10.10.0.172      vlan2       00:55:33/00:01:32 v2    1 / DR
192.168.0.100    vlan3       00:55:30/00:01:20 v2    N / DR
```

Figure 51-8: Example output from the **show ip pim sparse-mode neighbor interface detail** command

```
Nbr 10.10.3.180 (vlan5), DR
 Expires in 55 seconds, uptime 00:00:15
 Holdtime: 70 secs, T-bit: off, Lan delay: 1, Override interval:
3
 DR priority: 100, Gen ID: 625159467,
 Secondary addresses:
  192.168.30.1
```

show ip pim sparse-mode nexthop

Use this command to see the nexthop information as used by PIM-SM.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip pim sparse-mode nexthop`

Mode User Exec and Privileged Exec

Example

```
awplus# show ip pim sparse-mode nexthop
```

Figure 51-9: Example output from the **show ip pim sparse-mode nexthop** command

```
Flags: N = New, R = RP, S = Source, U = Unreachable
Destination Type Nexthop Nexthop Nexthop      Nexthop    Metric Pref  Refcnt
                 Num     Addr                 Ifindex    Name
-------------------------------------------------------------------------
10.10.0.9   .RS.  1      0.0.0.0  4           0           0      1
```

Table 51-2: Parameters in output of the **show ip pim sparse-mode nexthop** command

Parameter	Description
`Destination`	The destination address for which PIM-SM requires nexthop information.
`Type`	The type of destination, as indicated by the Flags description. N = New, R= RP, S = Source, U = Unreachable.
`Nexthop Num`	The number of nexthops to the destination. PIM-SM always uses only 1 nexthop.
`Nexthop Addr`	The address of the primary nexthop gateway.
`Nexthop IfIndex`	The interface on which the nexthop gateway can be reached.
`Nexthop Name`	The name of nexthop interface.
`Metric`	The metric of the route towards the destination.
`Preference`	The preference of the route towards destination.
`Refcnt`	Only used for debugging.

show ip pim sparse-mode rp-hash

Use this command to display the Rendezvous Point (RP) to be chosen based on the group selected.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip pim sparse-mode rp-hash <group-addr>`

Parameter	Description
<group-addr>	The group address for which to find the RP, entered in the form A.B.C.D.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip pim sparse-mode rp-hash 224.0.1.3
```

Figure 51-10: output from the **show ip pim sparse-mode rp-hash** command

```
RP: 10.10.11.35
Info source: 10.10.11.35, via bootstrap
```

Related Commands show ip pim sparse-mode rp mapping

show ip pim sparse-mode rp mapping

Use this command to show group-to-RP (Rendezvous Point) mappings, and the RP set.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip pim sparse-mode rp mapping`

Mode User Exec and Privileged Exec

Example

```
awplus# show ip pim sparse-mode rp mapping
```

Figure 51-11: output from the **show ip pim sparse-mode rp mapping** command

```
PIM Group-to-RP Mappings
Group(s): 224.0.0.0/4
  RP: 10.10.0.9
    Info source: 10.10.0.9, via bootstrap, priority 0
         Uptime: 16:52:39, expires: 00:02:50
```

Related Commands show ip pim sparse-mode rp-hash

undebug all pim sparse-mode

Use this command to disable all PIM-SM debugging.

Syntax `undebug all pim sparse-mode`

Mode Privileged Exec

Example

```
awplus# undebug all pim sparse-mode
```

Related Commands debug pim sparse-mode

Chapter 52: PIM-DM Introduction and Configuration

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Introduction

Protocol Independent Multicast - Dense Mode (PIM-DM) is a data-driven multicast routing protocol, which builds source-based multicast distribution trees that operate on the Flood-and-Prune principle. It requires unicast-reachability information, but does not depend on a specific unicast routing protocol.

For details of the commands used to configure PIM-DM, see Chapter 53, PIM-DM Commands. For a general overview of multicasting, see Chapter 47, Multicast Introduction and Commands.

Characteristics of PIM-DM

PIM Dense Mode (PIM-DM) is a significantly less complex protocol than PIM Sparse Mode (PIM-SM). PIM-DM works on the principle that it is probable that any given multicast stream will have at least one downstream listener. PIM-DM is ideal where many hosts subscribe to receive multicast packets, so most of the PIM Routers receive and forward all multicast packets.

Where PIM-SM only forwards a multicast stream when requested, PIM-DM always floods any new multicast stream that arrives at the PIM Router and only stops flooding the multicast stream on a given link if it is explicitly told to, by receiving a Prune message from the downstream PIM Router.

PIM-DM does not include the concepts of Rendezvous Points, which are used in PIM-SM. PIM-SM explicitly builds unidirectional shared trees rooted at a Rendezvous Point (RP) per group. PIM-DM implicitly builds shortest-path trees by flooding multicast traffic domain wide, then Prunes back branches of the tree where no receivers are available. As with PIM-SM, so does PIM-DM also use Reverse Path Forwarding (RPF) to stop loops for packet forwarding for PIM Routers receiving multicast packets.

PIM-DM Terminology

See the below descriptions of the terms and concepts used to describe the PIM-DM protocol:

PIM Router

Any Layer 3 routing device that is running PIM, such as an Allied Telesis managed Layer 3 switch or Allied Telesis router.

Reverse Path Forwarding

Reverse Path Forwarding (RPF) is the mechanism that PIM uses to make sure it does not forward multicast streams around in loops. If a set of PIM Routers are connected in a loop, and each PIM Router is forwarding a given multicast stream, then eventually the multicast stream would be forwarded right around the loop.

To prevent this from happening, PIM makes use of the fact that the unicast routing tables in a set of PIM Routers should converge into a loop-free tree of paths to any given destination.

When a PIM Router receives a multicast stream from source address `SourceA` through an interface `IF1`, it checks whether `IF1` is the interface the PIM Router would use to reach `SourceA`. The PIM Router will only forward the multicast stream if `IF1` is the interface the PIM Router would use to reach `SourceA`.

RPF determines whether the interface is correct by consulting unicast routing tables. This ensure that the multicast stream is forwarded in a loop-free manner back up the tree of unicast paths that lead to the source.

Forwarding Multicast Packets

PIM Routers forward a given multicast stream onto all PIM enabled IP interfaces that have not received a Prune for the given multicast stream. As with unicast routing, the PIM Router decrements the TTL (Time To Live) in each packet that the PIM Router forwards. The packet is discarded if the TTL is decremented to 0.

However, unlike unicast routing, the destination MAC addresses of the packets are not altered as they are forwarded by the PIM Router. The destination MAC addresses remain set to the multicast MAC addresses that correspond to the destination group address of the multicast stream.

Upstream

Towards the Source.

Downstream

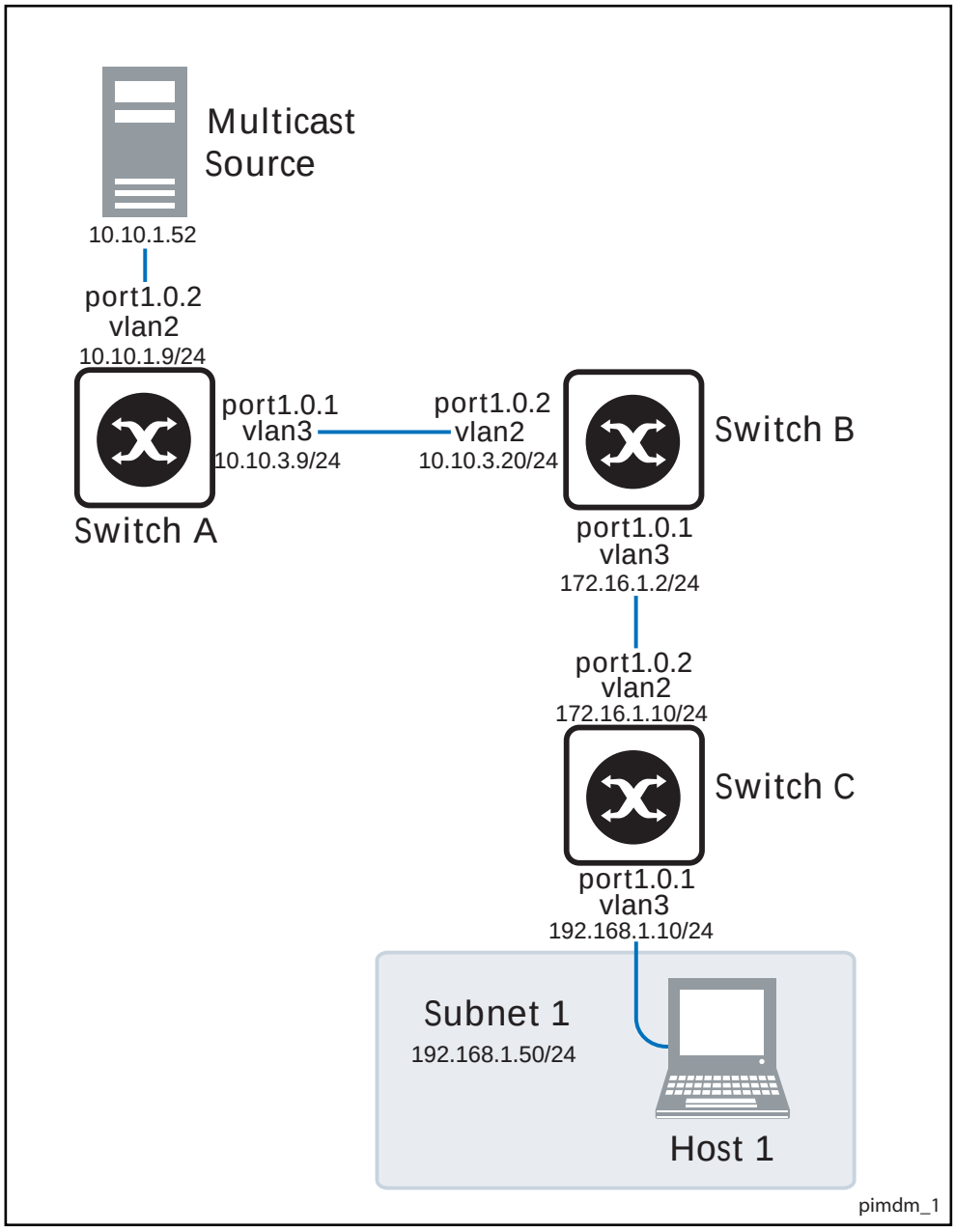
Anything other than the upstream interface for that group.

PIM-DM Configuration

The main requirement is to enable PIM-DM on the desired interfaces. This section provides a PIM-DM configuration example for a relevant scenario. The configuration uses Allied Telesis managed Layer 3 Switches as the PIM Routers. Three PIM Routers are connected in a chain, and a multicast client is attached to the third PIM Router.

Configuration Example

In this example, the address of the multicast source is 10.10.1.52. The following figure displays the network topology used in this example:



The steps involved in the forwarding of the multicast streams for this sample configuration are:

Switch A

1. When the PIM Routers start, they use the exchange of PIM Hello packets for PIM neighbor relationships with each other. Then each PIM Router becomes aware of the location of its PIM neighbors.

2. As a multicast stream arrives from the source to Switch A, it performs an RPF check on the source IP address of the multicast stream. Switch A determines the best route to the source IP address (10.10.1.52) is the receiving interface, so it forwards the multicast stream to its only PIM neighbor.

3. Switch A creates an (S, G) (Source, Group) entry in its PIM-DM forwarding table. Any further packets from the same source, which are destined to be forwarded to the same group, will be automatically forwarded without an RFP (Reverse Path Forwarding) check.

Switch B

4. When the multicast stream arrives at Switch B, it performs the same steps (2 and 3) as Switch A. This results in Switch B also having an (S, G) entry for the multicast stream in its PIM forwarding table, and the multicast stream is forwarded to Switch C.

Switch C

5. When the multicast stream arrives at Switch C, it will perform an RPF check on the multicast stream as it arrives, and accept it.

   This PIM Router does not have any downstream PIM Routers, but if Switch C has received an IGMP report from the client to request this multicast stream, Switch C will forward the multicast stream out port1.0.1, but no other ports.

   If the client leaves the group, and Switch C has no other attached clients requesting the group, then Switch C will send a Prune message upstream, resulting in Switch A and Switch B stopping forwarding the multicast stream to Switch C.

Switch A Configuration Output

See the following configuration output for Switch A:

```
hostname Switch A
vlan database
vlan 2 state enable
vlan 3 state enable
interface vlan2
ip address 10.10.1.9/24
ip igmp
ip pim dense-mode
!
interface vlan3
ip address 10.10.3.9/24
ip igmp
ip pim dense-mode
!
interface port1.0.1
switchport access vlan 3
!
interface port1.0.2
switchport access vlan 2
!
ip multicast-routing
!
```

Switch B Configuration Output

See the following configuration output for Switch B:

```
hostname Switch B
vlan database
vlan 2 state enable
vlan 3 state enable
interface vlan2
ip address 10.10.3.20/24
ip igmp
ip pim dense-mode
!
interface vlan3
ip address 172.16.1.2/24
ip igmp
ip pim dense-mode
!
interface port1.0.1
switchport access vlan 3
!
interface port1.0.2
switchport access vlan 2
!
ip multicast-routing
!
```

Switch C Configuration Output

See the following configuration output for Switch C:

```
hostname Switch C
vlan database
vlan 2 state enable
vlan 3 state enable
interface vlan2
ip address 172.16.1.10/24
ip igmp
ip pim dense-mode
!
interface vlan3
ip address 192.168.1.10/24
ip igmp
ip pim dense-mode
!
interface port1.0.1
switchport access vlan 3
!
interface port1.0.2
switchport access vlan 2
!
ip multicast-routing
!
```

Verifying Configuration

Use the following commands to verify the interface details and multicast routing table.

Interface Details

The show ip pim dense-mode interface command displays the interface details for Switch C.

```
Address          Interface VIFindex Ver/   Nbr
                                    Mode   Count
192.168.1.10     port1.0.1  0       v2/D   0
172.16.1.10      port1.0.2  2       v2/D   1
```

IP Multicast Routing Table

The show ip mroute command displays the IP multicast routing table (for Switch C).

```
IP Multicast Routing Table
Flags: I - Immediate Stat, T - Timed Stat, F - Forwarder
installed
Timers: Uptime/Stat Expiry
Interface State: Interface (TTL)

(10.10.1.52, 224.0.1.3), uptime 00:00:15
Owner PIM-DM, Flags: F
  Incoming interface: port1.0.2
  Outgoing interface list:
    port1.0.1 (1)
```

IP PIM-DM Multicast Routing Table

The show ip pim dense-mode mroute command displays the IP PIM-DM multicast routing table (for Switch C).

```
PIM-DM Multicast Routing Table
(10.10.1.52, 224.0.1.3)
  RPF Neighbor: 172.16.1.2, Nexthop: 172.16.1.2, port1.0.2
  Upstream IF: port1.0.2
    Upstream State: Forwarding
    Assert State: NoInfo
  Downstream IF List:
    port1.0.1, in 'olist':
      Downstream State: NoInfo
      Assert State: NoInfo
```

Chapter 53: PIM-DM Commands

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Command List

This chapter provides an alphabetical reference of PIM-DM commands. For commands common to PIM-SM and PIM-DM, see Chapter 47, Multicast Introduction and Commands.

debug pim dense-mode all

This command enables PIM-DM debugging.

The no variant of this command disables PIM-DM debugging.

Syntax

```
debug pim dense-mode all
no debug pim dense-mode all
```

Mode Privileged Exec and Global Configuration

Example

```
awplus# configure terminal
awplus(config)# debug pim dense-mode all
```

Output Figure 53-1: Example output from the **debug pim dense-mode all** command

```
PIM event debugging is on
PIM MFC debugging is on
PIM state debugging is on
PIM packet debugging is on
PIM incoming packet debugging is on
PIM outgoing packet debugging is on
```

Validation Commands show debugging pim dense-mode

Related Commands
debug pim dense-mode context
debug pim dense-mode decode
debug pim dense-mode encode
debug pim dense-mode fsm
debug pim dense-mode mrt
debug pim dense-mode nexthop
debug pim dense-mode nsm
debug pim dense-mode vif

debug pim dense-mode context

This command enables debugging of general configuration context.

The no variant of this command disables debugging of general configuration context.

This command enables debugging of general configuration and Virtual Routing (VR), and Virtual Routing and Forwarding (VRF) context.

The no variant of this command disables debugging of general configuration and Virtual Routing (VR), and Virtual Routing and Forwarding (VRF) context.

Syntax

```
debug pim dense-mode context
no debug pim dense-mode context
```

Mode Privileged Exec and Global Configuration

Example

```
awplus# configure terminal
awplus(config)# debug pim dense-mode context
```

Related Commands

debug pim dense-mode all
debug pim dense-mode decode
debug pim dense-mode encode
debug pim dense-mode fsm
debug pim dense-mode mrt
debug pim dense-mode nexthop
debug pim dense-mode nsm
debug pim dense-mode vif

debug pim dense-mode decode

This command enables debugging of the PIM-DM message decoder.

The no variant of this command disables debugging of the PIM-DM message decoder.

Syntax

```
debug pim dense-mode decode
no debug pim dense-mode decode
```

Mode Privileged Exec and Global Configuration

Example

```
awplus# configure terminal
awplus(config)# debug pim dense-mode decoder
```

Related Commands

debug pim dense-mode all
debug pim dense-mode context
debug pim dense-mode encode
debug pim dense-mode fsm
debug pim dense-mode mrt
debug pim dense-mode nexthop
debug pim dense-mode nsm
debug pim dense-mode vif

debug pim dense-mode encode

This command enables debugging of the PIM-DM message encoder.

The no variant of this command disables debugging of the PIM-DM message encoder.

Syntax

```
debug pim dense-mode encode
no debug pim dense-mode encode
```

Mode Privileged Exec and Global Configuration

Example

```
awplus# configure terminal
awplus(config)# debug pim dense-mode encoder
```

Related Commands

debug pim dense-mode all
debug pim dense-mode context
debug pim dense-mode decode
debug pim dense-mode fsm
debug pim dense-mode mrt
debug pim dense-mode nexthop
debug pim dense-mode nsm
debug pim dense-mode vif

debug pim dense-mode fsm

This command enables debugging of Finite-State Machine (FSM) specific information of all Multicast Routing Table (MRT) and MRT Virtual Multicast Interface (MRT-VIF) entries.

The no variant of this command disables debugging of Finite-State Machine (FSM) specific information of all Multicast Routing Table (MRT) and MRT Virtual Multicast Interface (MRT-VIF) entries.

Syntax

```
debug pim dense-mode fsm
no debug pim dense-mode fsm
```

Mode Privileged Exec and Global Configuration

Example

```
awplus# configure terminal
awplus(config)# debug pim dense-mode fsm
```

Related Commands

debug pim dense-mode all
debug pim dense-mode context
debug pim dense-mode decode
debug pim dense-mode encode
debug pim dense-mode mrt
debug pim dense-mode nexthop
debug pim dense-mode nsm
debug pim dense-mode vif

debug pim dense-mode mrt

This command enables debugging of MRT and MRT-VIF entry handling (for example, creation and deletion of).

The no variant of this command disables debugging of MRT and MRT-VIF entry handling.

Syntax

```
debug pim dense-mode mrt
no debug pim dense-mode mrt
```

Mode Privileged Exec and Global Configuration

Example

```
awplus# configure terminal
awplus(config)# debug pim dense-mode mrt
```

Related Commands

debug pim dense-mode all
debug pim dense-mode context
debug pim dense-mode decode
debug pim dense-mode encode
debug pim dense-mode fsm
debug pim dense-mode nexthop
debug pim dense-mode nsm
debug pim dense-mode vif

debug pim dense-mode nexthop

This command enables debugging of Reverse Path Forwarding (RPF) neighbor nexthop cache handling.

The no variant of this command disables debugging of Reverse Path Forwarding (RPF) neighbor nexthop cache handling.

Syntax

```
debug pim dense-mode nexthop
no debug pim dense-mode nexthop
```

Mode Privileged Exec and Global Configuration

Example

```
awplus# configure terminal
awplus(config)# debug pim dense-mode nexthop
```

Related Commands

debug pim dense-mode all
debug pim dense-mode context
debug pim dense-mode decode
debug pim dense-mode encode
debug pim dense-mode fsm
debug pim dense-mode mrt
debug pim dense-mode nsm
debug pim dense-mode vif

debug pim dense-mode nsm

This command enables debugging of PIM-DM interface with NSM.

The no variant of this command disables debugging of PIM-DM interface with NSM.

Syntax

```
debug pim dense-mode nsm
no debug pim dense-mode nsm
```

Mode Privileged Exec and Global Configuration

Example

```
awplus# configure terminal
awplus(config)# debug pim dense-mode nsm
```

Related Commands

debug pim dense-mode all
debug pim dense-mode context
debug pim dense-mode decode
debug pim dense-mode encode
debug pim dense-mode fsm
debug pim dense-mode mrt
debug pim dense-mode nexthop
debug pim dense-mode vif

debug pim dense-mode vif

This command enables debugging of VIF handling.

The no variant of this command disables debugging of VIF handling.

Syntax

```
debug pim dense-mode vif
no debug pim dense-mode vif
```

Mode Privileged Exec and Global Configuration

Example

```
awplus# configure terminal
awplus(config)# debug pim dense-mode vif
```

Related Commands

debug pim dense-mode all
debug pim dense-mode context
debug pim dense-mode decode
debug pim dense-mode encode
debug pim dense-mode fsm
debug pim dense-mode mrt
debug pim dense-mode nexthop
debug pim dense-mode nsm

ip pim dense-mode

This command enables or disables PIM-DM operation from Interface mode on the current VLAN interface. This command also disables passive mode on the VLAN interface if passive mode has been enabled using an ip pim dense-mode passive command.

The no variant of this command disables all PIM-DM activities on the interface.

Syntax

```
ip pim dense-mode
no ip pim dense-mode
```

Mode Interface Configuration for a VLAN interface.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim dense-mode
```

ip pim dense-mode passive

This command enables PIM-DM passive mode operation from Interface mode on the current VLAN interface.

The no variant of this command disables passive mode.

Syntax

```
ip pim dense-mode passive
no ip pim dense-mode passive
```

Mode Interface Configuration for a VLAN interface.

Usage Configuring a VLAN interface as a passive PIM-DM interface indicates that the VLAN interface is connected to a stub network (i.e. a network that does not contain any PIM Routers). So, multicast streams that arrive on other PIM-DM interfaces can be routed to hosts on the passive PIM-DM interface, but no PIM neighbor relationships will be formed on the passive PIM-DM interface.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim dense-mode passive
```

ip pim ext-srcs-directly-connected

Use this command to configure PIM to treat all source traffic arriving on the interface as though it was sent from a host directly connected to the interface.

For a more detailed description of this command, see: Chapter 51, PIM-SM Commands - ip pim ext-srcs-directly-connected command on page 51.15.

ip pim hello-holdtime (PIM-DM)

This command configures a hello-holdtime. The PIM hello-holdtime on a VLAN interface is the period which the router will wait to receive a hello from neighbors on that interface. If the router does not receive a hello from a given neighbor within that period, then it will decide that the neighbor is no longer an active PIM Router, and will terminate the neighbor relationship.

You cannot configure a hello-holdtime value that is less than the current hello-interval. Each time the hello-interval is updated, the hello-holdtime is also updated, according to the following rules:

- If the hello-holdtime is not configured; or if the hello holdtime is configured and less than the current hello-interval value, it is modified to 3.5 times the hello-interval value.
- Otherwise, it retains the configured value.

Use the no variant of this command to return the hello-holdtime value to its default of 3.5 times the current hello-interval value.

Syntax

```
ip pim hello-holdtime <holdtime>
no ip pim hello-holdtime
```

Parameter	Description
<holdtime>	<1-65535> The holdtime value in seconds (no fractional seconds are accepted).

Mode Interface Configuration for a VLAN interface.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim hello-holdtime 123
```

ip pim hello-interval (PIM-DM)

This command configures a PIM hello-interval value. The PIM hello-interval on a VLAN interface is the period at which the router will transmit PIM hello messages on that interface.

When the hello-interval is configured, and the hello-holdtime is not configured, or when the configured hello-holdtime value is less than the new hello-interval value; the hello-holdtime value is modified to 3.5 times the hello-interval value. Otherwise, the hello-holdtime value is the configured value. The default is 30 seconds.

Use the no variant of this command to reset the hello-interval to the default.

Syntax

```
ip pim hello-interval <interval>
no ip pim hello-interval
```

Parameter	Description
<interval>	*<1-65535>* The value in seconds (no fractional seconds accepted).

Mode Interface Configuration for a VLAN interface.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim hello-interval 123
```

ip pim max-graft-retries

This command configures PIM-DM to send a limited number of Graft message retries, after which time the device will remove all information regarding the particular (Source, Group), or until the device receives an acknowledgment, whichever occurs first.

The no variant of this command configures PIM-DM to send Graft message retries until the device receives an acknowledgment, which is the default behavior.

Syntax

```
ip pim max-graft-retries <1-65535>
no pim max-graft-retries
```

Parameter	Description
`no`	Negate a command or set its defaults.
`ip`	Internet Protocol (IP).
`pim`	PIM Interface commands.
`max-graft-retries`	PIM Graft message retries.
<1-65535>	Graft message retries before ceasing Graft message retries.

Default By default, Graft retries are sent by PIM-DM until the device receives an acknowledgement.

Mode Interface Configuration for a VLAN interface.

Usage Graft messages are used to reduce the join latency when a previously pruned branch of the source tree must be grafted back, when a member joins the group after the PIM-DM device has sent a Prune message to prune unwanted traffic. Graft messages are the only PIM-DM messages that receive an acknowledgement.

If Graft messages were not used, then the member waiting for pruned off traffic would have to wait up to 3 minutes for the periodic re-flooding to occur to begin receiving multicast traffic again. By using Grafts, the Prune can be reversed much faster than waiting for periodic re-flooding to begin receiving multicast traffic again.

Examples To configure PIM-DM to send a maximum of 10 Graft message retries, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim max-graft-retries 10
```

To configure PIM-DM to send Graft message retries forever, which is the default behavior, use the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip pim max-graft-retries
```

Validation Commands

show ip mroute
show ip pim dense-mode mroute
show running-config

ip pim neighbor-filter (PIM-DM)

Enables filtering of neighbors on the VLAN interface. When configuring a neighbor filter, PIM-DM will either not establish adjacency with the neighbor, or terminate adjacency with the existing neighbors if denied by the filtering access list.

Use the no variant of this command to disable this function.

Syntax

```
ip pim neighbor-filter [<number>|<accesslist>]
no ip pim neighbor-filter [<number>|<accesslist>]
```

Parameter	Description
<number>	*<1-99>* Standard IP access list number.
<accesslist>	IP access list name.

Default By default, there is no filtering.

Mode Interface Configuration for a VLAN interface.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim neighbor-filter 14
```

ip pim propagation-delay

This command configures the PIM propagation-delay value. The PIM propagation-delay is the expected delay in the transfer of PIM messages across the VLAN interface that it is attached to.

Use the no variant of this command to return the propagation-delay to the default (1000 milliseconds).

Syntax

```
ip pim propagation-delay <delay>
no ip pim propagation-delay
```

Parameter	Description
<delay>	*<1000-5000>* The value in milliseconds. The default is 1000 milliseconds.

Default The propagation-delay is set to 1000 milliseconds by default.

Mode Interface Configuration for a VLAN interface.

Examples

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim propagation-delay 2000

awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip pim propagation-delay
```

ip pim state-refresh origination-interval

This command configures a PIM state-refresh origination-interval value. The origination interval is the number of seconds between PIM state refresh control messages. The default is 60 seconds.

Use the no variant of this command to return the origination interval to the default.

Syntax

```
ip pim state-refresh origination-interval <interval>
no ip pim state-refresh origination-interval
```

Parameter	Description
<interval>	**<1-100>** The integer value in seconds (no fractional seconds accepted). The default state-refresh origination-interval value is 60.

Default The state-refresh origination-interval is set to 60 seconds by default, and is reset using negation.

Mode Interface Configuration for a VLAN interface.

Example

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip pim state-refresh origination-interval 65
```

show debugging pim dense-mode

This command displays the status of the debugging of the system.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show debugging pim dense-mode`

Mode User Exec and Privileged Exec

Output Figure 53-2: Example output from the **show debugging pim dense-mode** command

```
PIM-DM Debugging status:
  PIM-DM VR-VRF Context debugging is off
  PIM-DM Decoder debugging is off
  PIM-DM Encoder debugging is off
  PIM-DM FSM debugging is off
  PIM-DM MRT debugging is off
  PIM-DM NHOP debugging is off
  PIM-DM NSM debugging is off
  PIM-DM VIF debugging is off
```

Related Commands debug pim dense-mode all

show ip pim dense-mode interface

This command displays the PIM-DM interface information.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip pim dense-mode interface`

Mode User Exec and Privileged Exec

Example To display information about the PIM-DM interfaces, use the command:

```
awplus# show ip pim dense-mode interface
```

Output

Figure 53-3: Example output from the **show ip pim dense-mode interface** command

```
Total configured interfaces: 100   Maximum allowed: 100
Total active interfaces:     100

Address          Interface VIFIndex Ver/   Nbr
                                    Mode   Count
10.1.100.4       vlan100   4        v2/D   0
10.2.101.10      vlan1001  5        v2/D   0
10.2.102.10      vlan1002  6        v2/D   0
10.2.103.10      vlan1003  7        v2/D   0
10.2.104.10      vlan1004  8        v2/D   0
10.2.105.10      vlan1005  9        v2/D   0
10.2.106.10      vlan1006  10       v2/D   0
10.2.107.10      vlan1007  11       v2/D   0
```

1. Only the top entries output by this command are shown in this example.

Table 53-1: Parameters in the output of the **show ip pim dense-mode interface** command

Parameter	Description
`Total configured interfaces`	The number of configured PIM Dense Mode interfaces.
`Maximum allowed`	The maximum number of PIM Dense Mode interfaces that can be configured.
`Total active interfaces`	The number of active PIM Dense Mode interfaces.
`Address`	Primary PIM-DM address.
`Interface`	Name of the PIM-DM interface.
`VIF Index`	The Virtual Interface index of the VLAN.
`Ver/Mode`	PIM version/Dense mode.
`Nbr Count`	Neighbor count of the PIM-DM interface.

Related Commands ip pim dense-mode
show ip pim dense-mode neighbor

show ip pim dense-mode interface detail

This command displays detailed information on a PIM-DM interface.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip pim dense-mode interface detail`

Mode User Exec and Privileged Exec

Example

```
awplus# show ip pim dense-mode interface detail
```

Output Figure 53-4: Example output from the **show ip pim dense-mode interface detail** command

```
vlan2 (vif-id: 0):
  Address 192.168.1.53/24
  Hello period 30 seconds, Next Hello in 30 seconds
  Neighbors:
    192.168.1.152/32
    192.168.1.149/32
vlan3 (vif-id: 2):
  Address 192.168.10.53/24
  Hello period 30 seconds, Next Hello in 8 seconds
  Neighbors: none
```

show ip pim dense-mode mroute

This command displays the IP PIM-DM multicast routing table.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip pim dense-mode mroute`

Mode User Exec and Privileged Exec

Example

```
awplus# show ip pim dense-mode mroute
```

Output Figure 53-5: Example output from the **show ip pim dense-mode mroute** command

```
PIM-DM Multicast Routing Table
(192.168.10.52, 224.1.1.1)
  Source directly connected on vlan3
  State-Refresh Originator State: Originator
  Upstream IF: vlan3, State: Forwarding
  Downstream IF List:
    vlan2, in 'olist':
      Downstream State: NoInfo
      Assert State: NoInfo
```

show ip pim dense-mode neighbor

This command displays PIM-DM neighbor information.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip pim dense-mode neighbor`

Mode User Exec and Privileged Exec

Usage The total number of PIM-DM neighbors is restricted to 500 PIM-DM neighbors.

When the 500 PIM-DM neighbor limit is reached, as a result of receiving hello packets from new PIM-DM neighbors, a log entry will be issued to the log file in the below format:

```
<date> <time> <facility>.<severity> <program[<pid>]>: <message>
-------------------------------------------------------------------
2008 Dec 10 00:58:39 user.err x900 PIM-DM[1150]: [VIF] Nbr
Create: Cannot create more than 500 neighbours - ignoring
neighbour 100.0.1.247/32 on vlan100
```

Example

```
awplus# show ip pim dense-mode neighbor
```

Output Figure 53-6: Example output from the **show ip pim dense-mode neighbor** command

```
Total number of neighbors: 500
Neighbor-Address  Interface          Uptime/Expires    Ver
192.168.1.152     vlan2                17:15:42/00:01:28 v2
192.168.1.149     vlan2                17:15:34/00:01:34 v2
```

show ip pim dense-mode neighbor detail

This command displays detailed PIM-DM neighbor information.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip pim dense-mode neighbor detail`

Mode User Exec and Privileged Exec

Example

```
awplus# show ip pim dense-mode neighbor detail
```

Output Figure 53-7: Example output from the **show ip pim dense-mode neighbor detail** command

```
Neighbor 192.168.1.152 (vlan2)
 Up since 17:16:20, Expires in 00:01:20
Neighbor 192.168.1.149 (vlan2)
 Up since 17:16:12, Expires in 00:01:26
```

show ip pim dense-mode nexthop

This command displays the nexthop information as used by PIM-DM. In the context of PIM-DM, the term 'nexthop' refers to the nexthop router on the path back to the source address of a multicast stream.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip pim dense-mode nexthop`

Mode User Exec and Privileged Exec

Example

```
awplus# show ip pim dense-mode nexthop
```

Output Figure 53-8: Example output from the **show ip pim dense-mode neighbor nexthop** command

```
Destination      Nexthop   Nexthop         Nexthop          Metric Pref
                 Num       Addr            Interface
192.168.10.52    1         0.0.0.0         vlan2            3      1
```

Table 53-2: Parameters in the output of the **show ip pim dense-mode neighbor nexthop** command

Parameter	Description
`Destination`	Destination address for which PIM-DM requires nexthop information.
`Nexthop Num`	Number of nexthops to the destination. PIM can only use one nexthop.
`Nexthop Addr`	Address of the current nexthop gateway.
`Nexthop Interface`	Name of the nexthop interface.
`Metric`	Metric of the route towards the destination.
`Preference`	Preference of the route towards the destination.

undebug all pim dense-mode

Use this command from the Global Configuration mode to disable all PIM-DM debugging.

Syntax `undebug all pim dense-mode`

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# undebug all pim dense-mode
```

Related Commands

debug pim dense-mode all
debug pim dense-mode context
debug pim dense-mode decode
debug pim dense-mode encode
debug pim dense-mode fsm
debug pim dense-mode mrt
debug pim dense-mode nexthop
debug pim dense-mode nsm
debug pim dense-mode vif

Chapter 54: MLD Snooping Introduction and Commands

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Introduction

Multicast Listener Discovery (MLD) is used to exchange membership status information between IPv6 routers that support multicasting and members of multicast groups on a network segment. Host membership in a multicast group is reported by individual member hosts, and membership status is periodically polled by multicast routers. For a general overview of multicasting, see Chapter 47, Multicast Introduction and Commands.

MLD is defined in RFC 2710, "Multicast Listener Discovery (MLD) for IPv6."

MLD Snooping

MLD Snooping is a feature whereby a Layer 2 switch listens to or "snoops" the MLD messages passing through the switch or from member hosts and multicast routers. The purpose of MLD Snooping is to provide efficient Layer 2 multicast forwarding, by sending only to hosts that have expressed an interest in receiving the multicast data.

Hosts express an interest in receiving multicast data for a given multicast group by sending an MLD join message. Without MLD Snooping, if one host expresses an interest in getting multicast data for a given group, by sending an MLD join for the multicast group, then all hosts connected to the same VLAN will also receive the multicast data. This wastes bandwidth on the switch ports connected to the host that are not interested in receiving the multicast data. Snooping takes note of exactly which ports have received joins for a given group, and send that group only to those ports.

MLD Snooping is enabled by default globally for the switch. It can be enabled and disabled on a per-VLAN basis.

MLD Snooping makes a distinction between Member ports, which are ports connected to members hosts, and Router ports, which are ports connected to, or directed towards, a Layer 3 router or a Layer 3 switch.

Command List

This chapter provides an alphabetical reference of configuration, clear, and show commands related to MLD Snooping.

clear ipv6 mld

Use this command to clear all MLD local memberships on all interfaces.

Syntax `clear ipv6 mld`

Mode Privileged Exec

Usage This command applies to groups learned by MLD Snooping.

Example

```
awplus# clear ipv6 mld
```

Related Commands clear ipv6 mld group
clear ipv6 mld interface

clear ipv6 mld group

Use this command to clear MLD specific local-membership(s) on all interfaces, for a particular group.

Syntax `clear ipv6 mld group {*|<ipv6-address>}`

Parameter	Description
*	Clears all groups on all interfaces. This is an alias to the clear ipv6 mld command.
<ipv6-address>	Specify the group address for which MLD local-memberships are to be cleared from all interfaces. Specify the IPv6 multicast group address in the format in the format X:X::X:X.

Mode Privileged Exec

Usage This command applies to groups learned by MLD Snooping.

Example

```
awplus# clear ipv6 mld group *
```

Related Commands clear ipv6 mld
clear ipv6 mld interface

clear ipv6 mld interface

Use this command to clear MLD interface entries.

Syntax `clear ipv6 mld interface <interface>`

Parameter	Description
<interface>	Specifies name of the interface; all groups learned from this interface are deleted.

Mode Privileged Exec

Usage This command applies to interfaces configured for MLD Snooping.

Example

```
awplus# clear ipv6 mld interface vlan2
```

Related Commands clear ipv6 mld
clear ipv6 mld group

debug mld

Use this command to enable all MLD debugging modes, or a specific MLD debugging mode.

Use the no variant of this command to disable all MLD debugging modes, or a specific MLD debugging mode.

Syntax

```
debug mld {all|decode|encode|events|fsm|tib}
no debug mld {all|decode|encode|events|fsm|tib}
```

Parameter	Description
`all`	Debug all MLD.
`decode`	Debug MLD decoding.
`encode`	Debug MLD encoding.
`events`	Debug MLD events.
`fsm`	Debug MLD Finite State Machine (FSM).
`tib`	Debug MLD Tree Information Base (TIB).

Mode Privileged Exec and Global Configuration

Examples

```
awplus# configure terminal
awplus(config)# debug mld all

awplus# configure terminal
awplus(config)# debug mld decode

awplus# configure terminal
awplus(config)# debug mld encode

awplus# configure terminal
awplus(config)# debug mld events
```

ipv6 mld access-group

Use this command to control the multicast local-membership groups learned on an interface.

Use the no variant of this command to disable this access control.

Syntax

```
ipv6 mld access-group <access-list-name>
no ipv6 mld access-group
```

Parameter	Description
<access-list-name>	Standard IPv6 access-list name.

Default No access list is configured by default.

Mode Interface Configuration for a specified VLAN interface or a range of VLAN interfaces.

Usage This command applies to groups learned by MLD Snooping.

Example In the following example, `vlan2` will only accept MLD joins for groups in the range `ff1e:0db8:0001::/64`:

```
awplus# configure terminal
awplus(config)# ipv6 access-list standard group1 permit
ff1e:0db8:0001::/64
awplus(config)# interface vlan2
awplus(config-if)# ipv6 mld access-group group1
```

In the following example, `vlan2-vlan4` will only accept MLD joins for groups in the range `ff1e:0db8:0001::/64`:

```
awplus# configure terminal
awplus(config)# ipv6 access-list standard group1 permit
ff1e:0db8:0001::/64
awplus(config)# interface vlan2-vlan4
awplus(config-if)# ipv6 mld access-group group1
```

ipv6 mld limit

Use this command to configure a limit on the maximum number of group memberships that may be learned. The limit may be set for the switch as a whole, or for a specific interface.

Once the specified group membership limit is reached, all further local-memberships will be ignored.

Optionally, an exception access-list can be configured to specify the group-address(es) that are exempted from being subject to the limit.

Use the no variant of this command to unset the limit and any specified exception access-list.

Syntax

```
ipv6 mld limit <limitvalue> [except <access-list-name>]
no ipv6 mld limit
```

Parameter	Description
<limitvalue>	<2-512> Maximum number of group membership states.
<access-list-name>	Standard IPv6 access-list name that defines multicast groups which are exempted from being subject to the configured limit.

Default The default limit, which is reset by the no variant of this command, is the same as maximum number of group membership entries that can be learned with the ipv6 mld limit command.

The default limit of group membership entries that can be learned is 512 entries.

Mode Global Configuration and Interface Configuration for a specified VLAN interface or a range of VLAN interfaces.

Usage This command applies to interfaces learned by MLD Snooping.

If this command is issued on multiple VLAN interfaces, the limits apply individually to each of those interfaces.

Examples The following example configures an MLD limit of 100 group-memberships across all VLAN interfaces on which MLD is enabled, and excludes groups in the range `ff1e:0db8:0001::/64` from this limitation:

```
awplus# configure terminal
awplus(config)# ipv6 access-list standard v6grp permit
ff1e:0db8:0001::/64
awplus(config)# ipv6 mld limit 100 except v6grp
```

The following example configures an MLD limit of 100 group-membership states on `vlan2`:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 mld limit 100
```

The following example configures an MLD limit of 100 group-membership states on `vlan2-vlan4`:

```
awplus# configure terminal
awplus(config)# interface vlan2-vlan4
awplus(config-if)# ipv6 mld limit 100
```

Related Commands show ipv6 mld groups

ipv6 mld snooping

Use this command to enable MLD Snooping. When this command is issued in the Global Configuration mode, MLD Snooping is enabled globally for the switch. When this command is issued in Interface mode for a VLAN then MLD Snooping is enabled for the specified VLAN. Note that MLD Snooping is enabled on the VLAN only if it is enabled globally and on the VLAN.

Use the no variant of this command to globally disable MLD Snooping in Global Configuration mode, or for the specified VLAN interface in Interface mode.

Syntax

```
ipv6 mld snooping
no ipv6 mld snooping
```

Default By default, MLD Snooping is enabled both globally and on all VLANs.

Mode Global Configuration and Interface Configuration for a specified VLAN interface or a range of VLANs.

Usage For MLD Snooping to operate on particular VLAN interfaces, it must be enabled both globally by using this command in Global Configuration mode, and on individual VLAN interfaces by using this command in Interface Configuration mode (Both are enabled by default).

Examples To configure MLD Snooping on `vlan2`, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 mld snooping
```

To configure MLD Snooping on `vlan2-vlan4`, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2-vlan4
awplus(config-if)# ipv6 mld snooping
```

To disable MLD Snooping for `vlan2`, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config)# no ipv6 mld snooping
```

To disable MLD Snooping for `vlan2-vlan4`, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface vlan2-vlan4
awplus(config)# no ipv6 mld snooping
```

To configure MLD Snooping globally for the switch, enter the following commands:

```
awplus# configure terminal
awplus(config)# ipv6 mld snooping
```

To disable MLD Snooping globally for the switch, enter the following commands:

```
awplus# configure terminal
awplus(config)# no ipv6 mld snooping
```

ipv6 mld snooping fast-leave

Use this command to enable MLD Snooping fast-leave processing. Fast-leave processing is analogous to immediate-leave processing; the MLD group-membership is removed as soon as an MLD leave group message is received, without sending out a group-specific query.

Use the no variant of this command to disable fast-leave processing.

Syntax

```
ipv6 mld snooping fast-leave
no ipv6 mld snooping fast-leave
```

Default MLD Snooping fast-leave processing is disabled.

Mode Interface Configuration for a specified VLAN interface or a range of VLAN interfaces.

Usage This MLD Snooping command can only be configured on VLAN interfaces.

Example This example shows how to enable fast-leave processing on `vlan2`.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 mld snooping fast-leave
```

This example shows how to enable fast-leave processing on `vlan2-vlan4`.

```
awplus# configure terminal
awplus(config)# interface vlan2-vlan4
awplus(config-if)# ipv6 mld snooping fast-leave
```

ipv6 mld snooping mrouter

Use this command to statically configure the specified port as a Multicast Router interface for MLD Snooping within the specified VLAN.

Use the no variant of this command to remove the static configuration of the interface as a Multicast Router interface.

Syntax

```
ipv6 mld snooping mrouter interface <port>
no ipv6 mld snooping mrouter interface <port>
```

Parameter	Description
<port>	Specify the name of the port.

Mode Interface Configuration for a specified VLAN interface or a range of VLAN interfaces.

Usage This MLD Snooping command statically configures a switch port as a Multicast Router interface.

Example This example shows how to specify the next-hop interface to the multicast router for `vlan2`.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 mld snooping mrouter interface
port1.0.5
```

This example shows how to specify the next-hop interface to the multicast router for `vlan2-vlan4`.

```
awplus# configure terminal
awplus(config)# interface vlan2-vlan4
awplus(config-if)# ipv6 mld snooping mrouter interface
port1.0.5
```

ipv6 mld snooping report-suppression

Use this command to enable report suppression from hosts for Multicast Listener Discovery version 1 (MLDv1) on a VLAN in interface configuration mode.

Use the no variant of this command to disable report suppression on a VLAN in interface configuration mode.

Syntax

```
ipv6 mld snooping report-suppression
no ipv6 mld snooping report-suppression
```

Default Report suppression does not apply to MLDv2, and is turned on by default for MLDv1 reports.

Mode Interface Configuration for a specified VLAN interface or a range of VLAN interfaces.

Usage This MLD Snooping command can only be configured on VLAN interfaces.

MLDv1 Snooping maybe configured to suppress reports from hosts. When a querier sends a query, only the first report for particular set of group(s) from a host will be forwarded to the querier by the MLD Snooping switch. Similar reports (to the same set of groups) from other hosts, which would not change group memberships in the querier, will be suppressed by the MLD Snooping switch to prevent 'flooding' of query responses.

Examples This example shows how to enable report suppression for MLD reports on `vlan2`.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 mld snooping report-suppression
```

This example shows how to enable report suppression for MLD reports on `vlan2-vlan4`.

```
awplus# configure terminal
awplus(config)# interface vlan2-vlan4
awplus(config-if)# ipv6 mld snooping report-suppression
```

This example shows how to disable report suppression for MLD reports on `vlan2`:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ipv6 mld snooping report-suppression
```

This example shows how to disable report suppression for MLD reports on `vlan2-vlan4`:

```
awplus# configure terminal
awplus(config)# interface vlan2-vlan4
awplus(config-if)# no ipv6 mld snooping report-suppression
```

ipv6 mld static-group

Use this command to statically configure IPv6 group membership entries on an interface. To statically add only a group membership, do not specify any parameters.

Use the no variant of this command to delete static group membership entries.

Syntax

```
ipv6 mld static-group <ipv6-group-address>
   [source <ipv6-source-address>] [interface <port>]

no ipv6 mld static-group <ipv6-group-address>
   [source <ipv6-source-address>] [interface <port>]
```

Parameter	Description
<ipv6-group-address>	Specify a standard IPv6 Multicast group address to be configured as a static group member. The IPv6 address uses the format X:X::X:X.
<ipv6-source-address>	Optional. Specify a standard IPv6 source address to be configured as a static source from where multicast packets originate. The IPv6 address uses the format X:X::X:X.
<port>	Optional. Physical interface. This parameter specifies a physical port. If this parameter is used, the static configuration is applied to just to that physical interface. If this parameter is not used, the static configuration is applied on all ports in the VLAN.

Mode Interface Configuration for a specified VLAN interface.

Usage This command applies to MLD Snooping on a VLAN interface to statically add groups and/or source records.

Example The following examples show how to statically add group and/or source records for MLD Snooping on `vlan2`:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 mld static-group ff1e::10
```

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 mld static-group ff1e::10 source
fe80::2fd:6cff:fe1c:b
```

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 mld static-group ff1e::10
```

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 mld static-group ff1e::10 interface
port1.0.8
```

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 mld static-group ff1e::10 source
fe80::2fd:6cff:fe1c:b interface port1.0.8
```

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ipv6 mld static-group ff1e::10 interface
port1.0.8
```

show ipv6 mld groups

Use this command to display the multicast groups with receivers directly connected to the router, and learned through MLD.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ipv6 mld groups [<ipv6-address> |<interface> detail]
```

Parameter	Description
<ipv6-address>	Optional. Specify Address of the multicast group in format X:X::X:X.
<interface>	Optional. Specify the Interface name for which to display local information.

Mode User Exec and Privileged Exec

Example The following command displays local-membership information for all interfaces:

```
awplus# show ipv6 mld groups
```

Output Figure 54-1: Example output from the **show ipv6 mld groups** command

```
MLD Connected Group Membership
Group Address    Interface     Uptime      Expires    Last
Reporter
ff1e::10         ge10          00:03:16    00:01:09
fe80::202:b3ff:fef0:79d8
```

show ipv6 mld interface

Use this command to display the state of MLD Snooping for a specified interface, or all interfaces.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 mld interface [<interface>]`

Parameter	Description
<interface>	Interface name.

Mode User Exec and Privileged Exec

Example The following command displays MLD interface status on all interfaces enabled for MLD:

```
awplus# show ipv6 mld interface
```

Output Figure 54-2: Example output from the **show ipv6 mld interface** command

```
Interface vlan1 (Index 2)
 MLD Enabled, Active, Querier, Version 2 (default)
 Internet address is fe80::2fd:6cff:fe1c:b
 MLD interface has 0 group-record states
 MLD activity: 0 joins, 0 leaves
 MLD query interval is 125 seconds
 MLD querier timeout is 255 seconds
 MLD max query response time is 10 seconds
 Last member query response interval is 1000 milliseconds
 Group Membership interval is 260 seconds
```

show ipv6 mld snooping mrouter

Use this command to display the multicast router interfaces, both configured and learned, in a VLAN.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 mld snooping mrouter <interface>`

Parameter	Description
<interface>	The name of the VLAN interface.

Mode User Exec and Privileged Exec

Example The following command displays the multicast router interfaces in `vlan2`:

```
awplus# show ipv6 mld snooping mrouter vlan2
```

Output Figure 54-3: Example output from the **show ipv6 mld snooping mrouter** command

```
VLAN    Interface    Static/Dynamic
2       port1.0.2
2       port1.0.3
```

show ipv6 mld snooping statistics

Use this command to display MLD Snooping statistics data.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ipv6 mld snooping statistics interface <interface>`

Parameter	Description
<interface>	The name of the VLAN interface.

Mode User Exec and Privileged Exec

Example The following command displays MLDv2 statistical information for `vlan2`:

```
awplus# show ipv6 mld snooping statistics interface vlan2
```

Output Figure 54-4: Example output from the **show ipv6 mld snooping statistics** command

```
Interface:      vlan2
Group:          ff1e::10
Uptime:         00:00:13
Group mode:     Include
Last reporter:  fe80::202:b3ff:fef0:79d8
Group source list: (R - Remote, M - SSM Mapping)
  Source Address        Uptime    v2 Exp    Fwd  Flags
  7ffe::4               00:00:13  00:04:06  Yes  R
```

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Chapter 55: Access Control Lists Introduction

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Introduction

This chapter describes Access Control Lists (ACLs), and general ACL configuration information.

See Chapter 56, IPv4 Hardware Access Control List (ACL) Commands and Chapter 58, IPv6 Hardware Access Control List (ACL) Commands for detailed command information and command examples about IPv4 and IPv6 hardware ACLs that are applied directly to interfaces.

See Chapter 57, IPv4 Software Access Control List (ACL) Commands and Chapter 59, IPv6 Software Access Control List (ACL) Commands for detailed command information and command examples about IPv4 and IPv6 software ACLs as applied to Routing and Multicasting.

See all relevant Routing commands and configurations in "Layer Three, Switching and Routing" and all relevant Multicast commands and configurations in "Multicast Applications".

Overview

An Access Control List (ACL) is one filter, or a sequence of filters, that are applied to an interface to either block, pass, or when using QoS, apply priority to, packets that match the filter definitions. ACLs are used to restrict network access by hosts and devices and to limit network traffic.

An ACL contains an ordered list of filters. Each filter specifies either permit or deny and a set of conditions the packet must satisfy in order to match the filter. The meaning of permit or deny entries depends on the context in which the ACL is used - either on an inbound or an outbound interface.

When a packet is received on an interface, the switch compares fields in the packet against filters in the ACL to check whether the packet has permission to be forwarded, based on the filter properties. The first match determines whether the switch accepts or rejects the packets. If no entries match, the switch rejects the packets. If there are no restrictions, the switch forwards the packets.

Because filters in an ACL are applied sequentially and their action stops at the first match, it is very important that you apply the filters in the correct order. For example you might want to pass all traffic from VLAN 4 except for that arriving from two selected addresses A and B. Setting up a filter that first passes all traffic from VLAN 4 then denies traffic from addresses A and B will not filter out traffic from A and B if they are members VLAN 4. To ensure that the traffic from A and B is always blocked you should first apply the filter to block traffic from A and B, then apply the filter to allow all traffic from VLAN 4.

You can assign sequence numbers to filters. See "ACL Filter Sequence Numbers" on page 55.15 for more information.

ACL Rules

- The source or destination address or the protocol of each packet being filtered are tested against the filters in the ACL, one condition at a time (for a permit or a deny filter).
- If a packet does not match a filter then the packet is checked against the next filter in the ACL.
- If a packet and a filter match, the subsequent filters in the ACL are not checked and the packet is permitted or denied as specified in the matched filter.
- The first filter that the packet matches determines whether the packet is permitted or denied. After the first match, no subsequent filters are considered.
- If the ACL denies the address or protocol then the software discards the packet.
- For software ACLs, if no filters match then the packet is dropped.
- For hardware ACLs, if no filters match then the packet is forwarded.
- Checking stops after the first match, so the order of the filters in the ACL is critical. The same permit or deny filter specified in a different order could result in a packet being passed in one situation and denied in another situation.
- One ACL per interface, per protocol, per direction is allowed. However, each ACL assigned per interface, per protocol, per direction may also have multiple filters.
- For inbound ACLs, a permit filter continues to process the packet after receiving it on an inbound interface, and a deny filter discards the packet.

ACL Source and Destination Addresses

Configure source addresses in ACL filters to filter packets coming from specified networking devices or hosts. Configure destination addresses in ACL filters to filter packets going to specified networking devices or hosts.

ACL Reverse Masking

ACLs uses reverse masking, also referred to as wildcard masking, to indicate to the switch whether to check or ignore corresponding IP address bits when comparing the address bits in an ACL filter to a packet being submitted to the ACL.

Reverse masking for IP address bits specify how the switch treats the corresponding IP address bits. A reverse mask is also called an inverted mask because a 1 and 0 mean the opposite of what they mean in a subnet or a network mask.

- A reverse mask bit 0 means check the corresponding bit value.
- A reverse mask bit 1 means ignore the corresponding bit value.

Hardware and Software ACL Types

Access Control Lists (ACLs) used in AlliedWare Plus™ are separated into two different types, Software ACLs and Hardware ACLs. You can define both types as either named or numbered.

Note

The filtering principles applied to software ACLs (those in the range 1 to 2699) are different to those applied to hardware ACLs (those in the range 3000 to 4699).

Software ACLs will deny access unless explicitly permitted by an ACL action. Hardware ACLs will permit access unless explicitly denied by an ACL action.

Numbered ACLs (for Hardware and Software ACLs)

Numbered ACLs are assigned an ACL number within the range 1 to 4699. ACL numbers are grouped into ranges, where each range denotes a specific functionality. The following table shows the number ranges and functionality that your switch supports.

Table 55-1: ACL Numeric Ranges and Functionality

ACL Number Range	Function
1 to 99	IP standard ACL [1]
100 to 199	IP extended ACL [1]
1300 to 1999	IP standard expanded ACL [1]
2000 to 2699	IP extended expanded ACL [1]
3000 to 3699	Hardware IP ACL
4000 to 4699	Hardware MAC ACL

1. Software ACLs that use either the ranges 1-99, 100-199, 1300-1999, 2000-2699, or are named ACLs (that use the standard or extended keyword followed by a text string), are used in features such as SNMP, IGMP, BGP and OSPF.

Hardware ACLs

These ACL types are applied directly to an interface, or are used for QoS classifications. They use the following ranges:

- 3000-3699 for Hardware IP ACLs
- 4000-4699 for Hardware MAC ACLs
- named hardware IPv4 ACLs
- named hardware IPv6 ACLs

See Chapter 56, IPv4 Hardware Access Control List (ACL) Commands and Chapter 58, IPv6 Hardware Access Control List (ACL) Commands for detailed command information and command examples about IPv4 and IPv6 hardware ACLs that are applied directly to interfaces.

Software ACLs

These ACLs types can be either named ACLs, using the standard or extended keyword followed by a text string, or they can use the following ranges:

- 1-99 (IP standard ACL range)
- 100-199 (IP extended ACL range)
- 1300-1999 (IP standard expanded ACL range)
- 2000-2699 (IP extended expanded ACL range)
- named standard IPv4 ACLs
- named extended IPv4 ACLs
- named standard IPv6 ACLs
- named extended IPv6 ACLs

Software ACLs are used in features such as SNMP, PIM, IGMP, BGP and OSPF.

See Chapter 57, IPv4 Software Access Control List (ACL) Commands and Chapter 59, IPv6 Software Access Control List (ACL) Commands for detailed command information and command examples about IPv4 and IPv6 software ACLs as applied to Routing and Multicasting. See all relevant Routing commands and configurations in "Layer Three, Switching and Routing" and all relevant Multicast commands and configurations in "Multicast Applications".

Defining Hardware MAC ACLs

These are used to filter traffic based on specific source or destination MAC addresses contained within the data frames. They can be applied to ports in the form of access groups.

A MAC access list requires the following components:

- an ACL number in the range 4000-4699
- an action, permit, deny etc. See "Actions for Hardware ACLs" on page 55.7
- a source MAC address. You can use the format, HHHH.HHHH.HHHH to filter on a specific MAC address (where H is a hexadecimal number), or you can filter on any source MAC address by entering the word "any".
- a source MAC mask. This mask determines which portion of the source MAC address header will be compared with that found in the incoming packets. The mask is configured in the format <HHHH.HHHH.HHHH> where each H is a hexadecimal number. In practice each hex number will normally be either 0 (to represent a match) or F (to represent a don't care condition). A mask is not required if the source address is specified as "any".
- a destination MAC address. You can use the format, HHHH.HHHH.HHHH to filter on a specific MAC address (where H is a hexadecimal number), or you can filter on any destination MAC address by entering the word "any".
- a destination MAC mask. This mask determines which portion of the destination MAC address header will be compared with that found in the incoming packets. The mask is configured in the format <HHHH.HHHH.HHHH> where each H is a hexadecimal number. In practice each hex number will normally be either 0 (to represent a match) or F (to represent a don't care condition). A mask is not required if the source address is specified as "any".

Example To permit packets coming from a specific MAC address of 0030.841A.1234 and with any destination address:

```
awplus# configure terminal
awplus(config)# access-list 4000 permit 0030.841A.1234
0000.0000.0000 any
```

Defining Hardware IP ACLs

These are used to filter traffic based on specific source or destination IP addresses contained within the data frames. They can be applied to ports in the form of access groups.

An IP access list requires the following components:

- an ACL number in the range 3000-3699
- an action, see "Actions for Hardware ACLs" on page 55.7
- a packet type:
  - « IP: This matches any type of IP packet. A source and destination address must also be specified, although they can be "any".
  - « ICMP: This matches ICMP packets. A source and destination address must also be specified, although they can be "any". An ICMP type can optionally be specified after the destination address.
  - « TCP: This matches TCP packets. A source and destination address must also be specified, although they can be "any". After the source address, a source port can optionally be specified and after the destination address a destination port can optionally be specified. The port matching can be done using eq (equal to), gt (greater than), lt (less than), ne (not equal to), or range (for a range of ports, which requires a start port and an end port).
  - « UDP: This matches UDP packets and has the same options as TCP.
  - « proto: This allows any IP protocol type to be specified (e.g. 89 for OSPF). A source and destination address must be also specified, although they can be "any".

For example, to match (and permit) any type of IP packet containing a destination address of 192.168.1.1

```
awplus(config)# access-list 3000 permit ip any 192.168.1.1/32
```

To match (and permit) an ICMP packet with a source address of 192.168.x.x and an ICMP code of 4

```
awplus(config)# access-list 3001 permit icmp 192.168.0.0/16
any icmp-type 4
```

To match a TCP packet with a source address of 192.168.x.x, source port of 80 and a destination port from 100 to 150:

```
awplus(config)# access-list 3002 permit tcp 192.168.0.0/16 eq
80 any range 100 150
```

To match a UDP packet with a source address of 192.168.x.x, a destination address of 192.168.1.x, and a destination port greater than 80:

```
awplus(config)# access-list 3003 permit udp 192.168.0.0/16
                192.168.1.0/24 gt 80
```

To match to any OSPF packet:

```
awplus(config)# access-list 3004 permit proto 89 any any
```

Note that an IP address mask can be specified using either of the following notations:

- "A.B.C.D/M": This is the most common; e.g. 192.168.1.0/24
- "A.B.C.D A.B.C.D": 192.168.1.1 0.0.0.0 is the same as 192.168.1.1/32 and 192.168.1.1 255.255.255.255 is the same as "any"
- "host A.B.C.D": This is the same as A.B.C.D/32

Actions for Hardware ACLs

The following actions are available for Hardware ACLs:

- deny: Discard the packet.
- permit: Allow the packet.
- copy-to-cpu: Send a copy of the packet to the CPU and forward it as well. This is the same as copy, forward in AW hardware filters.
- send-to-cpu: Send the packet to the CPU and does not forward it. Note that specifying this action could result in EPSR healthcheck messages and other control packets being dropped.
- copy-to-mirror: Send a copy of the packet to the mirror port and forward it as well.

Attaching hardware ACLs to interfaces

A hardware ACL is attached directly to a switchport using the access-group command. For example, to permit traffic from 192.168.1.x, but discard from 192.168.x.x:

```
awplus# configure terminal
awplus(config)# access-list 3000 permit ip 192.168.1.0/24
                any
awplus(config)# access-list 3001 deny ip 192.168.0.0/24 any
awplus(config)# interface port1.0.1
awplus(config-if)# access-group 3000
awplus(config-if)# access-group 3001
```

Hardware ACLs and QoS classifications

Interface ACLs and QoS policies can both be attached to the same port. Where this is done, packets received on the port will be matched against the ACLs first.

The interface ACLs and QoS classifications are implemented by taking the first matching filter and applying the action defined for that filter. All subsequent matches in the table are then ignored. Thus, because ACLs are also matched first, if the matching ACL has a permit action, the packet is forwarded due to that rule's action and any subsequent QoS rules are bypassed.

You can also apply permit rules using QoS.

For example, you might want to permit a source IP address of 192.168.1.x, but block everything else on 192.168.x.x.

In this case you could create both the permit and deny rules using QoS.

Classifying Your Traffic

Classification is the process of filtering and marking. Filtering involves sorting your data into appropriate traffic types. Marking involves tagging the data so that downstream ports and routers can apply appropriate service policy rules.

There are two reasons to classify data:

1. To provide network security (Security ACLs)
2. To apply service quality criteria QoS.

Security ACLs

The main application of security ACLs is to block undesired traffic. Other applications include:

- copy-to-cpu
- copy-to-mirror
- send-to-cpu

For more information on these applications see “Actions for Hardware ACLs” on page 55.7

QoS ACLs

When using ACLs though QoS, the same classification and action abilities are available, but QoS has some additional fields that it can match on (see Match Commands) and also provides the ability to perform metering, marking and remarking on packets that match the filter definitions.

The action used by a QoS class-map is determined by the ACL that is attached to it. If no ACL is attached, it uses the permit action. If an ACL is not required by the class-map (for example, only matching on the VLAN) and a deny action is required, a MAC ACL should be added with `any` for source address and `any` for destination address.

The following example creates a class-map with will deny all traffic on vlan 2:

```
awplus(config)# access-list 4000 deny any any
awplus(config)# class-map cmap1
awplus(config-cmap)# match access-group 4000
awplus(config-cmap)# match vlan 2
```

The default class-map matches to all traffic and so cannot have any match or ACL commands applied to it. The action for this class-map is set via the default-action command and is `permit` by default. It can be changed to `deny` by using the following commands:

```
awplus(config)# policy-map pmap1
awplus(config-pmap)# default-action deny
```

For more information on applying QoS filtering, see "Classifying your Data" on page 60.7.

Profile Limitations

A profile is a mask that comprises 16 bytes. Each filter item that is added to the ACL set will consume a portion of the 16 bytes. Note that Hardware ACLs and QoS filters both share this single mask. However each time a mask component is defined within the mask, it can by used in many ACLs - so it is the number of different components that is important.

How many filters can you create?

The following table will help you manage your ACL mask.

Protocol Component	Bytes Used in the Mask
Protocol Type	2
Ethernet format	2
VLAN ID	2
IP protocol type (TCP, UDP, etc.)	1
source IPv4 address	4
destination IPv4 address	4
source IPv6 address[1]	0
destination IPv6 address[1]	0
TCP port number	2
UDP port number	2

Protocol Component	Bytes Used in the Mask
DSCP	1
MAC source address	6
MAC destination address	6

1. Normally any classification field, i.e. the destination MAC address, will use some of the 16 'profile bytes' that are available to classify incoming packets. For example an ACL with both source and destination MAC address fields set, will consume 12 of the 16 bytes. However the classification fields IPv6 Next Header, and IPv6 source and destination address will not consume any of these bytes, allowing greater freedom in ACL configuration options.

Hardware Filter Example

If you make a hardware filter that matches on destination IP address and source TCP port, this adds 7 bytes to the mask:

- 1 byte for the IP protocol field (to indicate TCP)
- 4 bytes for the destination IP address
- 2 bytes for the source TCP port number.

If you now create the following (additional) hardware filters:

- A hardware filter that matches on source MAC address. This adds 6 more bytes to the mask
- A QoS class map that matches on destination IP address (4 bytes) and DSCP (1 byte). This adds 1 more byte to the mask, for the DSCP. Note that it does not add 4 more bytes for the destination IP address, because the switch already matches on that field.
- A hardware filter that matches on source IP address and source TCP port. This does not change the mask, because the switch already matches on those fields.
- A hardware filter that matches on source UDP port. This does not add any length to the mask, because it shares the same 2 bytes as the source TCP port. However, if you next make a hardware filter that matches on destination TCP or UDP port, that uses another 2 bytes.

Are there now enough bytes for your set of filters?

The mask has a maximum size of 16 bytes. When it reaches the 16-byte limit, no more classifiers can be used that would cause the mask to increase in size. The switch can still accept classifiers that use fields that have already been included in the mask.

There is no particular number of hardware filters or QoS flow groups that will cause the mask to reach its 16-byte limit - it could happen after a few filters, or you might be able to create hundreds of filters without the mask reaching its limit.

So to determine whether you will have enough filter length, look at the fields you want to filter, determine the number of bytes for each field, and sum up the total number of bytes. If that number is less than 16, there is enough filter length. Don't forget to count TCP and UDP source port as a single field, and likewise to count TCP and UDP destination port as a single field.

Attaching hardware ACLs using QoS

The same functionality can be achieved using QoS, by attaching the ACL to a class-map, attaching the class-map to a policy-map and attaching the policy-map to a port:

Step 1: Enable QoS on the switch

```
awplus(config)# mls qos enable
```

Step 2: Create access lists

Create ACL `3000` to permit all packets from the 192.168.1 subnet:

```
awplus(config)# access-list 3000 permit ip 192.168.1.0/24 any
```

Create ACL `3001` to deny all packets from the 192.168.0 subnet.:

```
awplus(config)# access-list 3001 deny ip 192.168.0.0/24 any
```

Step 3: Attach access-groups to class-maps

Attach ACL `3000` to the class-map `cmap1`:

```
awplus(config)# class-map cmap1
awplus(config-cmap)# match access-group 3000
awplus(config-cmap)# exit
```

Attach ACL `3001` to the same class-map (`cmap2`):

```
awplus(config-cmap)# match access-group 3001
awplus(config-cmap)# exit
```

Step 4: Attach class-maps to policy-maps

Attach the class-map `cmap1` to policy-map `pmap1`:

```
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# exit
```

Add the class-map `cmap2` to the policy-map `pmap1`:

```
awplus(config-pmap)# class cmap2
awplus(config-pmap-c)# exit
```

Return to Global Configuration mode:

```
awplus(config-pmap)# exit
```

Step 5: Add policy-maps to ports

Add policy-map `pmap1` to `port1.0.1`:

```
awplus(config)# interface port1.0.1
awplus(config-if)# service-policy input pmap1
```

Note that multiple interface ACLs can be attached to the same port, or either type and can be interleaved. The order of matching is based on the order in which the ACLs were attached to the port. Only one ACL can be attached to a class-map, but multiple class-maps can be attached to a policy-map. Interface ACLs can be attached to the same port as a QoS policy, with the interface ACLs being matched first as described at the beginning of the Classification section.

Filtering hardware ACLs with QoS

Another reason for using QoS rather than interface ACLs is that QoS provides a lot more fields on which to match. These are accessed through the match commands in config-cmap mode.

Config-cmap mode describes the fields that can be matched on. Only one of each type can be matched, with the exception of tcp-flags (see below for classification). If multiple matches are specified, they are ANDed together.

The following example shows how you can match a packet on vlan 2, that has a source IP address of 192.168.x.x and a DSCP of 12:

Create ACL `3000` to permit all packets from the 192.168 subnet.:

```
awplus# configure terminal
awplus(config)# access-list 3000 permit ip 192.168.0.0/16 any
```

Apply ACL 3000 to the class-map cmap1 and add the matching criteria of vlan 2 and DSCP 12:

```
awplus(config)# class-map cmap1
awplus(config-cmap)# match access-group 3000
awplus(config-cmap)# match vlan 2
awplus(config-cmap)# match dscp 12
awplus(config-cmap)# exit
```

Using QoS Match Commands with TCP Flags

Usually, if multiple matches of the same type are specified, the matching process will apply to the last match that you specified. For TCP flags however, the arguments are ANDed together. For example, the following series of commands will match on a packet that has ack, syn and fin set:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match tcp-flags ack
awplus(config-cmap)# match tcp-flags syn
awplus(config-cmap)# match tcp-flags fin
awplus(config-cmap)# exit
```

The following commands will achieve the same result:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match tcp-flags ack syn fin
awplus(config-cmap)# exit
```

Note that the matching is looking to see whether “any” of the specified flags are set. There is no checking for whether any of these flags are unset. Therefore the following commands will match on a packet in any of the following combinations of syn and ack status flags as shown in the following table:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match tcp-flags syn
awplus(config-cmap)# exit
```

Syn	Ack	Match on Packet
Set	Set	Yes
Set	Unset	Yes
Unset	Set	No
Unset	Unset	No

If you want to drop packets with syn only, but not with ack and syn, the following two class-maps can be used (note that ACL 4000 is used to apply a drop action as described in “Actions for Hardware ACLs” on page 55.7):

Step 1: Create access lists

Create ACL `4000` to deny all packets with `any` source or destination address:

```
awplus# configure terminal
awplus(config)# access-list 4000 deny any any
```

Step 2: Create class-maps

Create the class-map `cmap1` and configure it to match on the TCP flags, `ack` and `syn`:

```
awplus(config)# class-map cmap1
awplus(config-cmap)# match tcp-flags ack syn
awplus(config-cmap)# exit
```

Create the class-map `cmap2` and configure it to match on the TCP flag, `syn`:

```
awplus(config)# class-map cmap2
awplus(config-cmap)# match tcp-flags syn
```

Step 3: Apply access-groups to class-maps

Apply ACL `4000` to this class-map (i.e. to `cmap2`):

```
awplus(config-cmap)# match access-group 4000
awplus(config-cmap)# exit
```

Step 4: Create policy-maps

Create the policy-map pmap1 and associate it with cmap1:

```
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# exit
```

Step 5: Associate class-maps with policy-maps

Associate `cmap2` with this policy-map (`pmap1`):

```
awplus(config-pmap)# class cmap2
awplus(config-pmap-c)# exit
```

ACL Filter Sequence Numbers

To help you manage ACLs you can apply sequence numbers to filters. This allows you to remove filters from named and numbered ACLs without having to reconfigure an ACL.

The ability to add sequence numbers to filters simplifies updates through the ability to position a filter within an ACL. When you add a new filter, you can specify a sequence number to position the filter in the ACL and you can also remove a current filter in an ACL by specifying a sequence number.

ACL Filter Sequence Number Behavior

- If filters with no sequence numbers are applied then the first filter is assigned a sequence number of 10, and successive filters are incremented by 10. Sequence numbers are generated automatically if they are not specified at entry.
- The maximum filter sequence number is 65535. If the sequence number exceeds this maximum, the command will not be recognized and will show the error message:
  `% Unrecognized command`
- If you enter a filter without a sequence number it is assigned a sequence number that is 10 greater than the last sequence number and is placed at the end of the ACL.
- If you enter a filter that matches an already existing filter then the first filter is overwritten with the subsequent filter.
- ACL sequence numbers determine the order of execution of filters in an ACL. Filters in a ACL with a lower value sequence number are executed before filters with a higher value.
- Output from show running-config displays ACL entries without filter sequence numbers. Output from relevant show commands displays ACL entries with their sequence numbers.
- ACL sequence numbers are re-numbered upon switch restart following a reload command, or after powering off and powering on the switch. ACL sequence numbers are renumbered starting from 10 and increment by 10 for each filter. See the sample output in the configuration section that follows for an illustration of this behavior. No ACL sequence number re-number command is available to perform this action.
- The ACL sequence number feature works with numbered and named standard and extended IPv4 and IPv6 access lists, plus named hardware IPv4 and IPv6 access lists
- The name of an access list can be designated as a number. Number in named ACLs must not exist within the range or designated numbered ACLs. (where <1-99> and <1300-1999> are standard numbered ACLs, <100-199> and <2000-2699> are extended numbered ACLs, <3000-3699> and <4000-4699> are hardware numbered ACLs).

ACL Filter Sequence Number Applicability

The ACL sequence number support feature is available with numbered and named standard and extended IPv4 and IPv6 ACLs, and the named hardware IPv4 and IPv6 ACLs.

Numbered standard ACLs are available in the range <1-99> and <1300-1999>, which permit or deny source addresses to control packets coming from network devices or hosts, in software.

Numbered extended ACLs are available in the range <100-199> and <2000-2699>, which permit or deny source addresses and destination addresses (plus ICMP, TCP, UDP messages) to control packets coming from and going to network devices or hosts.

Named hardware IPv4 and IPv6 ACLs are available which permit or deny IP and MAC source and destination addresses plus VLAN IDs to control packets coming from and going to network device and hosts. Named hardware IPv4 and IPv6 ACLs use the ACL sequence number support feature for ACL revision.

The ACL sequence number support feature is available for use with named hardware IPv4 and IPv6 ACLs, but this feature is not available for use with the numbered hardware IPv4 ACLs.

Numbered hardware ACLs are available in the range <3000-3699>, which permit or deny IP source addresses, IP destination addresses, and VLAN IDs to control packets coming from and going to network devices and hosts, in hardware.

Numbered hardware ACLs are available in the range <4000-4699>, which permit or deny MAC source addresses, MAC destination addresses, and VLAN IDs to control packets coming from and going to network devices and hosts, in hardware.

ACL Filter Sequence Number Types

There are ACL filter sequence numbers available for the following types of ACLs:

ACL Type	ACL Command Syntax
IPv4 Standard Numbered ACLs	access-list <1-99> access-list <1300-1999>
IPv4 Extended Numbered ACLs	access-list <100-199> access-list <2000-2699>
IPv4 Standard Named ACLs	access-list standard <*name*>
IPv4 Extended Named ACLs	access-list extended <*name*>
IPv4 Hardware Named ACLs	access-list hardware <*name*>
IPv6 Standard Named ACLs	ipv6 access-list standard <*name*>
IPv6 Extended Named ACLs	ipv6 access-list extended <*name*>
IPv6 Hardware Named ACLs	ipv6 access-list <*name*>

Note that ACL sequence number support for these ACL commands is optional not required. An ACL sequence number will be added automatically, starting at 10 and incrementing by 10.

ACL Commands Without ACL Filter Sequence Numbers

ACL filter sequence numbers is not available for numbered hardware ACL commands:

access-list <3000-3699>
access-list <4000-4699>

ACL Filter Sequence Number Entry Examples

See the below CLI entry examples for prompt sub-modes for ACL filters after ACL commands:

- To create an IPv4 Standard ACL and then define ACL filters at the IPv4 Standard ACL Configuration mode prompt awplus(config-ip-std-acl)#, enter the following commands:

```
awplus(config)# access-list 1
awplus(config-ip-std-acl)# permit 192.168.1.0 0.0.0.255

awplus(config)# access-list standard std_name
awplus(config-ip-std-acl)# permit 192.168.1.0/24
```

- To create an IPv4 Extended ACL and then define ACL filters at the IPv4 Extended ACL Configuration mode prompt awplus(config-ip-ext-acl)#, enter the following commands:

```
awplus(config)# access-list 100
awplus(config-ip-ext-acl)# permit ip 192.168.1.0 0.0.0.255
                           192.168.2.0 0.0.0.255

awplus(config)# access-list extended ext_name
awplus(config-ip-ext-acl)# permit ip 192.168.1.0 0.0.0.255
                           192.168.2.0 0.0.0.255
```

- To create an IPv4 Hardware ACL and then define ACL filters at the IPv4 Hardware ACL Configuration mode prompt awplus(config-ip-hw-acl)#, enter the following commands:

```
awplus(config)# access-list hardware hw_name
awplus(config-ip-hw-acl)# permit ip 192.168.1.0 0.0.0.255
                           192.168.2.0 0.0.0.255
```

- To create an IPv6 Standard ACL and then define ACL filters at the IPv6 Standard ACL Configuration mode prompt awplus(config-ipv6-std-acl)#, enter the following commands:

```
awplus(config)# ipv6 access-list standard
                ipv6_std_name
awplus(config-ipv6-std-acl)# permit 2001:db8::/64
```

- To create an IPv6 Extended ACL and then define ACL filters at the IPv6 Extended

Configuration mode prompt awplus(config-ipv6-ext-acl)#, enter the following commands:

```
awplus(config)# ipv6 access-list extended
                ipv6_ext_name
awplus(config-ipv6-ext-acl)# permit ip 2001:db8::/64
                2001:db9::/64
```

- To create an IPv6 Hardware ACL and then define ACL filters at the IPv6 Hardware Configuration mode prompt awplus(config-ipv6-hw-acl)#, enter the following commands:

```
awplus(config)# ipv6 access-list ipv6_hw_name
awplus(config-ipv6-hw-acl)# permit ip 2001:db8::/64 2001:db9::/
                64
```

ACL Filter Sequence Configuration

First create a named or numbered ACL to enter ACL filters in the ACL sub-modes available:

Step 1: Create a new ACL and add a new filter

Create ACL `10` and then add a new filter to the access-list to permit all packets from the `192.168.1` subnet:

```
awplus# configure terminal
awplus(config)# access-list 10
awplus(config-ip-std-acl)# permit 192.168.1.0 0.0.0.255
awplus(config-ip-std-acl)# end
awplus# show access-list 10
```

```
Standard IP access list 10
   10 permit 192.168.1.0, wildcard bits 0.0.0.255
```

Step 2: Add another filter to the ACL

Append to, or add at the end of, ACL `10` a new filter to deny all packets from the `192.168.2` subnet:

```
awplus# configure terminal
awplus(config)# access-list 10
awplus(config-ip-std-acl)# deny 192.168.2.0 0.0.0.255
awplus(config-ip-std-acl)# end
awplus# show access-list 10
```

```
Standard IP access list 10
   10 permit 192.168.1.0, wildcard bits 0.0.0.255
   20 deny   192.168.2.0, wildcard bits 0.0.0.255
```

Note that if you add a filter to an ACL without specifying a sequence number the new filter is automatically assigned a sequence number. Sequence numbers are assigned in multiples of ten from the sequence number of the last filter.

Step 3: Insert a filter into the ACL

Insert a new filter with the sequence number `15` into ACL `10` to permit packets from the `192.168.3` subnet:

```
                    awplus# configure terminal
             awplus(config)# access-list 10
awplus(config-ip-std-acl)# 15 permit 192.168.3.0 0.0.0.255
awplus(config-ip-std-acl)# end
                    awplus# show access-list 10
```

```
Standard IP access list 10
   10 permit 192.168.1.0, wildcard bits 0.0.0.255
   15 permit 192.168.3.0, wildcard bits 0.0.0.255
   20 deny   192.168.2.0, wildcard bits 0.0.0.255
```

The new filter has precedence over the filter with the sequence number `20`.

Step 4: Remove a filter from the ACL by specifying a filter pattern

Remove the filter with the IP address `192.168.2` from ACL `10`:

```
                    awplus# configure terminal
             awplus(config)# access-list 10
awplus(config-ip-std-acl)# no deny 192.168.2.0 0.0.0.255
awplus(config-ip-std-acl)# end
                    awplus# show access-list 10
```

```
Standard IP access list 10
   10 permit 192.168.1.0, wildcard bits 0.0.0.255
   15 permit 192.168.3.0, wildcard bits 0.0.0.255
```

Step 5: Remove a filter from the ACL by specifying a sequence number

Remove the filter with the sequence number `10` from ACL `10`:

```
                awplus# configure terminal
          awplus(config)# access-list 10
awplus(config-ip-std-acl)# no 10
awplus(config-ip-std-acl)# end
                awplus# show access-list
```

```
Standard IP access list 10
   15 permit 192.168.3.0, wildcard bits 0.0.0.255
```

Creating ACLs in Global Configuration Mode

You can add new filters in Global Configuration mode with the access-list extended (named) command on page 57.4. In this mode the filters are assigned a sequence number corresponding to the order in which there are entered, i.e. the first filter entered has higher precedence in the ACL.

Step 1: Add filters with the **access-list** command

Add filters to ACL `10` using the access-list command:

```
        awplus# configure terminal
awplus(config)# access-list 10 permit 192.168.1.0 0.0.0.255
awplus(config)# access-list 10 deny 192.168.2.0 0.0.0.255
awplus(config)# end
        awplus# show access-list 10
```

```
Standard IP access list 10
   15 permit 192.168.3.0, wildcard bits 0.0.0.255
   20 permit 192.168.1.0, wildcard bits 0.0.0.255
   30 deny 192.168.2.0, wildcard bits 0.0.0.255
```

You can then enter the IPv4 Standard ACL Configuration mode and use the (access-list standard named filter) command on page 57.32 to specify sequence numbers to reorder the filters.

Step 2: Reorder the filters

Reorder the filters in ACL `10` by specifying a sequence number for each filter. The specified sequence number will overwrite the previous sequence number assigned to the filter:

```
                awplus# configure terminal
          awplus(config)# access-list 10
awplus(config-ip-std-acl)# 1021 permit 192.168.1.0 0.0.0.255
awplus(config-ip-std-acl)# 3333 permit 192.168.3.0 0.0.0.255
awplus(config-ip-std-acl)# 2772 deny 192.168.2.0 0.0.0.255
awplus(config-ip-std-acl)# end
                awplus# show access-list 10
```

```
Standard IP access list 10
 1021 permit 192.168.1.0, wildcard bits 0.0.0.255
 2772 deny   192.168.2.0, wildcard bits 0.0.0.255
 3333 permit 192.168.3.0, wildcard bits 0.0.0.255
```

Step 3: Copy the running-config file into the startup-config file

Copy the running-config into the file set as the current startup-config file and then reload the device. Before the reload occurs, you will receive a confirmation request saying: "`reboot system? (y/n):`".

When the device has reboot you can then enter Global Configuration mode and use the show access-group command to display ACL `10`:

```
awplus(config)# exit
       awplus# copy running-config startup-config
       awplus# reload
       awplus# show access-list 10
```

```
Standard IP access list 10
   10 permit 192.168.1.0, wildcard bits 0.0.0.255
   20 deny   192.168.2.0, wildcard bits 0.0.0.255
   30 permit 192.168.3.0, wildcard bits 0.0.0.255
```

After the device has reboot the sequence numbers of the filters in the ACL have been reassigned incrementing from 10.

Display the ACL configuration details

Display the running system status and configuration details for ACLs:

```
awplus# show running-config access-list
```

```
!
access-list 1 deny 10.1.1.0 0.0.0.255
access-list 1 permit any
access-list 2
access-list 5
access-list 10 permit 192.168.1.0 0.0.0.255
access-list 10 deny 192.168.2.0 0.0.0.255
access-list 10 permit 192.168.3.0 0.0.0.255
access-list 20
access-list 25 permit 10.1.2.0 0.0.0.255
access-list 25 deny 192.168.1.0 0.0.0.255
access-list 50
access-list 95 permit any
access-list 100
access-list 1300
access-list 2000
access-list extended acl
access-list extended my-list
access-list extended name
access-list extended name1
access-list standard name3
ipv6 access-list extended ipv6_acl
ipv6 access-list standard ipv6_acl2
ipv6 access-list extended my-ipv6-list
ipv6 access-list extended my-list
ipv6 access-list standard my-new-list
ipv6 access-list standard name
ipv6 access-list standard name1 deny any
ipv6 access-list extended name5
ipv6 access-list standard name6
access-list hw_acl
access-list icmp
access-list my-hw-list
access-list name2
access-list name4
!
```

For more information see show running-config access-list command on page 7.39.

Chapter 56: IPv4 Hardware Access Control List (ACL) Commands

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Introduction

This chapter provides an alphabetical reference for the IPv4 Hardware Access Control List (ACL) commands, and contains detailed command information and command examples about IPv4 hardware ACLs, which are applied directly to interfaces using the access-group command.

Note

See Chapter 55, Access Control Lists Introduction for descriptions of ACLs, and for further information about rules when applying ACLs see the ACL Rules section.

See ACL Filter Sequence Numbers and ACL Filter Sequence Number Behavior sections in Chapter 55, Access Control Lists Introduction about ACL Filters.

To apply ACLs to an LACP channel group, apply it to all the individual switch ports in the channel group. To apply ACLs to a static channel group, apply it to the static channel group itself. For more information on link aggregation see Chapter 20, Link Aggregation Introduction and Configuration, and Chapter 21, Link Aggregation Commands.

Note

Text in parenthesis in command names indicates usage not keyword entry. For example, access-list hardware (named) indicates named IPv4 hardware ACLs entered as `access-list hardware` <*name*> where <*name*> is a placeholder not a keyword.

Note

Parenthesis surrounding ACL filters indicates the type of ACL filter not the keyword entry in the CLI, such as (access-list standard numbered filter) represents command entry in the format shown in the syntax `[<sequence-number>] {deny|permit} {<source>|host <host-address>|any}`.

Note

Software ACLs will deny access unless explicitly permitted by an ACL action.

IPv4 Hardware Access List Commands and Prompts

Many of the ACL commands operate from sub-modes that are specific to particular ACL types. The table "IPv4 Hardware Access List Commands and Prompts" shows the CLI prompts at which ACL commands are entered.

Table 56-1: IPv4 Hardware Access List Commands and Prompts

Command Name	Command Mode	Prompt
show interface access-group	Privileged Exec	awplus#
show access-group	Privileged Exec	awplus#
show access-list (IPv4 Hardware ACLs)	Privileged Exec	awplus#
show interface access-group	Privileged Exec	awplus#
access-group	Global Configuration	awplus(config)#
access-list (hardware IP numbered)	Global Configuration	awplus(config)#
access-list (hardware MAC numbered)	Global Configuration	awplus(config)#
access-list hardware (named)	Global Configuration	awplus(config)#
access-group	Interface Configuration	awplus(config-if)#
(access-list hardware ICMP filter)	IPv4 Hardware ACL Configuration	awplus(config-ip-hw-acl)#
(access-list hardware IP protocol filter)	IPv4 Hardware ACL Configuration	awplus(config-ip-hw-acl)#
(access-list hardware MAC filter)	IPv4 Hardware ACL Configuration	awplus(config-ip-hw-acl)#
(access-list hardware TCP UDP filter)	IPv4 Hardware ACL Configuration	awplus(config-ip-hw-acl)#
commit (IPv4)	IPv4 Hardware ACL Configuration	awplus(config-ip-hw-acl)#

Command List

access-group

This command adds or removes a hardware-based access-list to a switch port interface. The number of hardware numbered and named access-lists that can be added to a switch port interface is determined by the available memory in hardware-based packet classification tables. This command works in both Global Configuration and Interface Configuration modes to apply hardware access-lists to all switch port interfaces or selected switch port interfaces respectively.

The no variant of this command removes the selected access-list from an interface.

Syntax

```
access-group [<3000-3699>|<4000-4699>|<hardware-access-list-name>]
no access-group [<3000-3699>|4000-4699|<hardware-access-list-name>]
```

Parameter	Description
<3000-3699>	Hardware IP access-list.
<4000-4699>	Hardware MAC access-list.
<hardware-access-list-name>	The hardware access-list name.

Mode Interface Configuration or Global Configuration

Default Any traffic on an interface controlled by a hardware ACL that does not explicitly match a filter is permitted.

Usage First create an IP access-list that applies the appropriate permit, deny requirements etc with the access-list (hardware IP numbered) command on page 56.6, the access-list (hardware MAC numbered) command on page 56.16 or the access-list hardware (named) command on page 56.19. Then use this command to apply this hardware access-list to a specific port or port range. Note that this command will apply the access-list only to incoming data packets.

To apply ACLs to an LACP aggregated link, apply it to all the individual switch ports in the aggregated group. To apply ACLs to a static channel group, apply it to the static channel group itself. Do not apply an ACL to a dynamic (LACP) or static aggregated link that spans more than one switch instance (Chapter 21, Link Aggregation Commands).

Note that you cannot apply software standard and extended numbered ACLs to switch port interfaces with the access-group command. This command will only apply hardware ACLs.

Note Hardware ACLs will permit access unless explicitly denied by an ACL action.

Examples To add the numbered hardware access-list `3005` to all switch ports, enter the following commands:

```
awplus# configure terminal
awplus(config)# access-group 3005
```

To add the numbered hardware access-list `3005` to switch port interface `port1.0.1`, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# access-group 3005
```

To add the named hardware access-list `hw-acl` to switch port interface `port1.0.2`, enter the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# access-group hw-acl
```

To apply an ACL to static channel group 2 containing switch `port1.0.5` and `port1.0.6`, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.5-1.0.6
awplus(config-if)# static-channel-group 2
awplus(config)# interface sa2
awplus(config-if)# access-group 3000
```

Related Commands

access-list hardware (named)
access-list (hardware IP numbered)
access-list (hardware MAC numbered)
show interface access-group

access-list (hardware IP numbered)

This command creates an access-list for use with hardware classification, such as QoS. The access-list will match on either TCP or UDP type packets that have the specified source and destination IP addresses and Layer 4 port values or ranges. The parameter any may be specified if an address does not matter and the port values are optional.

Note that specifying the send-to-cpu parameter could result in EPSR healthcheck messages and other control packets being dropped.

The optional vlan parameter can be applied to match tagged (802.1q) packets.

The no variant of this command removes the previously specified IP hardware access-list.

Syntax [ip]

```
access-list <3000-3699>
   {deny|permit|copy-to-cpu|copy-to-mirror|send-to-cpu} ip <source>
   <destination> [vlan <1-4094>]
```

Syntax [icmp]

```
access-list <3000-3699>
   {deny|permit|copy-to-cpu|copy-to-mirror|send-to-cpu} icmp
   <source> <destination> [icmp-type <type-number>]
   [vlan <1-4094>]
```

```
no access-list <3000-3699>
```

Table 56-2: Parameters in the access-list (hardware IP numbered) command - ip|icmp

Parameter	Description
<3000-3699>	Hardware IP access-list number.
deny	Access-list rejects packets that match the source and destination filtering specified with this command.
permit	Access-list permits packets that match the source and destination filtering specified with this command.
copy-to-cpu	Specify packets to copy to the CPU.
copy-to-mirror	Specify packets to copy to the mirror port.
send-to-cpu	Specify packets to send to the CPU. Specifying this parameter could result in EPSR healthcheck messages and other control packets being dropped.
icmp	ICMP packet.
ip	IP packet.

Table 56-2: Parameters in the access-list (hardware IP numbered) command - ip|icmp(cont.)

Parameter(cont.)	**Description**(cont.)	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	`any`	Matches any source IP address.
	`host` *<ip-addr>*	Matches a single source host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>`/`*<prefix>*	An IPv4 address, followed by a forward slash, then the prefix length. This matches any source IP address within the specified subnet.
	<ip-addr> *<reverse-mask>*	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
<destination>	The destination address of the packets. You can specify a single host, a subnet, or all destinations. The following are the valid formats for specifying the destination:	
	`any`	Matches any destination IP address.
	`host` *<ip-addr>*	Matches a single destination host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>`/`*<prefix>*	An IPv4 address, followed by a forward slash, then the prefix length. This matches any destination IP address within the specified subnet.
	<ip-addr> *<reverse-mask>*	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
`icmp-type`	Matches only a specified type of ICMP messages. This is valid only when the filtering is set to match ICMP packets.	

Table 56-2: Parameters in the access-list (hardware IP numbered) command - ip|icmp(cont.)

Parameter(cont.)	**Description**(cont.)	
<type-number>	The ICMP type, as defined in RFC792 and RFC950. Specify one of the following integers to create a filter for the ICMP message type:	
	0	Echo replies.
	3	Destination unreachable messages.
	4	Source quench messages.
	5	Redirect (change route) messages.
	8	Echo requests.
	11	Time exceeded messages.
	12	Parameter problem messages.
	13	Timestamp requests.
	14	Timestamp replies.
	15	Information requests.
	16	Information replies.
	17	Address mask requests.
	18	Address mask replies.
`vlan`	Specifies that the ACL will match on the ID in the packet's VLAN tag.	
<1-4094>	The VLAN VID.	

Syntax [tcp|udp]

```
access-list <3000-3699>
    {copy-to-cpu|copy-to-mirror|deny|permit|send-to-cpu} {tcp|udp}
    <source>
    {eq <sourceport>|lt <sourceport>|gt <sourceport>|ne <sourceport>|
    [range <start-range> <end-range>}
    <destination>
    [eq <destport>|lt <destport>|gt <destport>|ne <destport>]
    [range <start-range> <end-range>]

no access-list <3000-3699>
```

Table 56-3: Parameters in the access-list (hardware IP numbered) command - tcp|udp

Parameter	Description	
<3000-3699>	Hardware IP access-list.	
copy-to-cpu	Specify packets to copy to the CPU.	
copy-to-mirror	Specify packets to copy to the mirror port.	
deny	The access-list rejects packets that match the type, source, and destination filtering specified with this command.	
permit	The access-list permits packets that match the type, source, and destination filtering specified with this command.	
send-to-cpu	Specify packets to send to the CPU. Specifying this parameter could result in EPSR healthcheck messages and other control packets being dropped.	
tcp	The access-list matches only TCP packets.	
udp	The access-list matches only UDP packets.	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	any	Matches any source IP address.
	host *<ip-addr>*	Matches a single source host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>/<prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any source IP address within the specified subnet.
	<ip-addr> *<reverse-mask>*	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering 192.168.1.1 0.0.0.255 is the same as entering 192.168.1.1/24.

Table 56-3: Parameters in the access-list (hardware IP numbered) command - tcp|udp(cont.)

Parameter(cont.)	**Description**(cont.)	
<destination>	The destination address of the packets. You can specify a single host, a subnet, or all destinations. The following are the valid formats for specifying the destination:	
	`any`	Matches any destination IP address.
	`host` *<ip-addr>*	Matches a single destination host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>/<prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any destination IP address within the specified subnet.
	<ip-addr> *<reverse-mask>*	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
<sourceport>	The source (TCP or UDP) port number, specified as an integer between 0 and 65535.	
`range`	Range of port numbers.	
<start-range>	Port number at start of range *<0-65535>*.	
<end-range>	Port number at end of range *<0-65535>*.	
<destport>	The destination (TCP or UDP) port number, specified as an integer between 0 and 65535.	
`eq`	Matches port numbers that are equal to the port number specified immediately after this parameter.	
`lt`	Matches port numbers that are less than the port number specified immediately after this parameter.	
`gt`	Matches port numbers that are greater than the port number specified immediately after this parameter.	
`ne`	Matches port numbers that are not equal to the port number specified immediately after this parameter.	
`range`	Range of port numbers.	
<start-range>	Port number at start of range *<0-65535>*.	
<end-range>	Port number at end of range *<0-65535>*.	
`vlan`	Specifies that the ACL will match on the ID in the packet's VLAN tag.	
<1-4094>	The VLAN VID.	

Syntax [proto]

```
access-list <3000-3699>
    {copy-to-cpu|copy-to-mirror|deny|permit|send-to-cpu} proto <ip-
    protocol> <source> <destination>

no access-list <3000-3699>
```

Table 56-4: Parameters in the access-list (hardware IP numbered) command - proto

Parameter	Description	
<3000-3699>	Hardware IP access-list.	
copy-to-cpu	Specify packets to copy to the CPU.	
copy-to-mirror	Specify packets to copy to the mirror port.	
deny	Access-list rejects packets that match the source and destination filtering specified with this command.	
permit	Access-list permits packets that match the source and destination filtering specified with this command.	
send-to-cpu	Specify packets to send to the CPU. Specifying this parameter could result in EPSR healthcheck messages and other control packets being dropped.	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	any	Matches any source IP address.
	host *<ip-addr>*	Matches a single source host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>/*<prefix>*	An IPv4 address, followed by a forward slash, then the prefix length. This matches any source IP address within the specified subnet.
	<ip-addr> *<reverse-mask>*	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering 192.168.1.1 0.0.0.255 is the same as entering 192.168.1.1/24.

Table 56-4: Parameters in the access-list (hardware IP numbered) command - proto

Parameter(cont.)	**Description**(cont.)	
<destination>	The destination address of the packets. You can specify a single host, a subnet, or all destinations. The following are the valid formats for specifying the destination:	
	`any`	Matches any destination IP address.
	`host` *<ip-addr>*	Matches a single destination host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>`/`*<prefix>*	An IPv4 address, followed by a forward slash, then the prefix length. This matches any destination IP address within the specified subnet.
	<ip-addr> *<reverse-mask>*	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
`proto`	Matches only a specified type of IP Protocol <1-255>.	
<ip-protocol>	The IP protocol number, as defined by IANA (Internet Assigned Numbers Authority http://www.iana.org/assignments/protocol-numbers)	
	Protocol Number	Protocol Description [RFC Reference]
	1	Internet Control Message [RFC792]
	2	Internet Group Management [RFC1112]
	3	Gateway-to-Gateway [RFC823]
	4	IP in IP [RFC2003]
	5	Stream [RFC1190] [RFC1819]
	6	TCP (Transmission Control Protocol) [RFC793]
	8	EGP (Exterior Gateway Protocol) [RFC888]
	9	IGP (Interior Gateway Protocol) [IANA]
	11	Network Voice Protocol [RFC741]
	17	UDP (User Datagram Protocol) [RFC768]
	20	Host monitoring [RFC869]
	27	RDP (Reliable Data Protocol) [RFC908]
	28	IRTP (Internet Reliable Transaction Protocol) [RFC938]
	29	ISO-TP4 (ISO Transport Protocol Class 4) [RFC905]

Table 56-4: Parameters in the access-list (hardware IP numbered) command - proto

Parameter(cont.)	**Description**(cont.)	
<ip-protocol>	30	Bulk Data Transfer Protocol [RFC969]
(cont.)	33	DCCP (Datagram Congestion Control Protocol) [RFC4340]
	48	DSR (Dynamic Source Routing Protocol) [RFC4728]
	50	ESP (Encap Security Payload) [RFC2406]
	51	AH (Authentication Header) [RFC2402]
	54	NARP (NBMA Address Resolution Protocol) [RFC1735]
	58	ICMP for IPv6 [RFC1883]
	59	No Next Header for IPv6 [RFC1883]
	60	Destination Options for IPv6 [RFC1883]
	88	EIGRP (Enhanced Interior Gateway Routing Protocol)
	89	OSPFIGP [RFC1583]
	97	Ethernet-within-IP Encapsulation / RFC3378
	98	Encapsulation Header / RFC1241
	108	IP Payload Compression Protocol / RFC2393
	112	Virtual Router Redundancy Protocol / RFC3768
	134	RSVP-E2E-IGNORE / RFC3175
	135	Mobility Header / RFC3775
	136	UDPLite / RFC3828
	137	MPLS-in-IP / RFC4023
	138	MANET Protocols / RFC-ietf-manet-iana-07.txt
	139-252	Unassigned / IANA
	253	Use for experimentation and testing / RFC3692
	254	Use for experimentation and testing / RFC3692
	255	Reserved / IANA
vlan	Specifies that the ACL will match on the ID in the packet's VLAN tag.	
<1-4094>	The VLAN VID.	

Mode Global Configuration

Default Any traffic on an interface controlled by a hardware ACL that does not explicitly match a filter is permitted.

Usage This command creates an access-list for use with hardware classification, such as when applying QoS. This command can be used to match ICMP packets, IP protocols, or TCP/UDP packets.

For ICMP packets, the <3000-3699> range IP hardware access-list will match any ICMP packet that has the specified source and destination IP addresses and ICMP type.

You may apply the any parameter if the source or destination IP address is not important. The ICMP type is an optional parameter.

Note Hardware ACLs will permit access unless explicitly denied by an ACL action.

Examples Follow the below example commands to configure access-lists for ICMP, IP protocol and TCP.

ICMP Example To create an access-list that will permit ICMP packets with a source address of `192.168.1.0/24` with any destination address and an ICMP type of `5` enter the below commands:

```
awplus# configure terminal
awplus(config)# access-list 3000 permit icmp 192.168.1.0/24
any icmp-type 5
```

To destroy the access-list with an access-list identity of `3000` enter the below commands:

```
awplus# configure terminal
awplus(config)# no access-list 3000
```

IP Example To create an access-list that will permit any type of IP packet with a source address of `192.168.1.1` and any destination address, enter the commands:

```
awplus# configure terminal
awplus(config)# access-list 3000 permit ip 192.168.1.1/32 any
```

To create an access-list that will deny all IGMP packets (IP protocol `2`) from the `192.168.0.0` network, enter the commands:

```
awplus# configure terminal
awplus(config)# access-list 3000 deny proto 2 192.168.0.0/16 any
```

TCP Example To create an access-list that will permit TCP packets with a destination address of `192.168.1.1`, a destination port of 80 and any source address and source port, enter the commands:

```
awplus# configure terminal
awplus(config)# access-list 3000 permit tcp any 192.168.1.1/32
eq 80
```

copy-to-mirror Example

To create an access-list that will copy-to-mirror TCP packets with a destination address of `192.168.1.1`, a destination port of 80 and any source address and source port for use with the mirror interface command, enter the commands:

```
awplus# configure terminal

awplus(config)# access-list 3000 copy-to-mirror tcp any
192.168.1.1/32 eq 80
```

Related Commands

access-group
mirror interface
show running-config
show access-list (IPv4 Hardware ACLs)

access-list (hardware MAC numbered)

This command creates an access-list for use with hardware classification, such as QOS. The access-list will match on packets that have the specified source and destination MAC addresses. The parameter any may be specified if an address does not matter.

Note that specifying the send-to-cpu parameter could result in EPSR healthcheck messages and other control packets being dropped.

Optionally, the vlan and inner-vlan parameters can be matched for tagged (802.1q) packets.

The no variant of this command removes the specified MAC hardware filter access-list.

Syntax

```
access-list <4000-4699>
   {copy-to-cpu|copy-to-mirror|deny|permit|send-to-cpu}
   {<source-mac-address> <source-mac-mask>|any}
   {<destination-mac-address> <destination-mac-mask>|any}
   [vlan <1-4094> [inner-vlan <1-4094>]]

no access-list <4000-4699>
```

Parameter	Description
<4000-4699>	Hardware MAC access-list.
copy-to-cpu	Specify packets to copy to the CPU.
copy-to-mirror	Specify packets to copy to the mirror port.
deny	Access-list rejects packets that match the source and destination filtering.
permit	Access-list permits packets that match the source and destination filtering.
send-to-cpu	Specify packets to send to the CPU. Specifying this parameter could result in EPSR healthcheck messages and other control packets being dropped.
<source-mac-address>	The source MAC address of the packets. Enter this in the format <HHHH.HHHH.HHHH> Where each *H* is a hexadecimal number that represents a 4 bit binary number.
<source-mac-mask	The mask that will be applied to the source MAC addresses. Enter this in the format <HHHH.HHHH.HHHH> Where each *H* is a hexadecimal number that represents a 4 bit binary number. For a mask, each value will be either 0 or F. Where Hex FF = Ignore, and Hex 00 = Match.
any	Any source MAC address.
<destination-mac-address>	The destination MAC address of the packets. Enter this in the format <HHHH.HHHH.HHHH> Where each H is a hexadecimal number that represents a 4 bit binary number.
<destination-mac-mask>	The mask that will be applied to the destination MAC addresses. Enter this in the format <HHHH.HHHH.HHHH> Where each H is a hexadecimal number that represents a 4 bit binary number. For a mask, each value will be either 0 or F. Where Hex FF = Ignore, and Hex 00 = Match.

Parameter(cont.)	**Description**(cont.)
`any`	Any destination MAC address.
`vlan`	Specifies that the ACL will match on the ID in the packet's VLAN tag.
<1-4094>	The VLAN VID.
`inner-vlan`	This parameter is used within double-tagged VLANs. It is the inner VLAN tag (VID); sometimes referred to as the C-TAG (Customer VLAN TAG), where the vlan VID tag is referred to as the S-TAG (Service VLAN TAG).
<1-4094>	The inner VLAN VID.

Mode Global Configuration

Default Any traffic on an interface controlled by a hardware ACL that does not explicitly match a filter is permitted.

Usage This command creates an access-list for use with hardware classification, such as when applying QoS. The <4000-4699> range MAC hardware access-list will match on packets that have the specified source and destination MAC addresses. You may apply the any parameter if the source or destination MAC host address is not important.

Note Hardware ACLs will permit access unless explicitly denied by an ACL action.

Examples To create an access-list that will permit packets with a MAC address of `0000.00ab.1234` and any destination address enter the commands:

```
awplus# configure terminal
awplus(config)# access-list 4000 permit 0000.00ab.1234
0000.0000.0000 any
```

To create an access-list that will permit packets with an initial MAC address component of `0000.00ab` and any destination address, enter the commands:

```
awplus# configure terminal
awplus(config)# access-list 4001 permit 0000.00ab.1234
0000.0000.FFFF any
```

To create an access-list that will copy-to-mirror packets with an initial MAC address component of `0000.00ab` and any destination address for use with the mirror interface command, enter the commands:

```
awplus# configure terminal
awplus(config)# access-list 4001 copy-to-mirror 0000.00ab.1234
0000.0000.FFFF any
```

To destroy the access-list with an access-list identity of `4000` enter the commands:

```
awplus# configure terminal
awplus(config)# no access-list 4000
```

Related Commands

access-group
mirror interface
show running-config
show access-list (IPv4 Hardware ACLs)

access-list hardware (named)

This command creates a named hardware access-list that can be applied to a switch port interface. ACL filters for a named hardware ACL are created in the IPv4 Hardware ACL Configuration mode.

The no variant of this command removes the specified named hardware ACL.

Syntax

```
access-list hardware <hardware-access-list-name>
no access-list hardware <hardware-access-list-name>
```

Parameter	Description
<hardware-access-list-name>	Specify the hardware ACL name to then define ACL filters for in the subsequent IPv4 Hardware ACL Configuration mode.

Mode Global Configuration

Default Any traffic on an interface controlled by a hardware ACL that does not explicitly match a filter is permitted.

Usage Use this command to name a hardware ACL and enter the IPv4 Hardware ACL Configuration mode. If the named hardware ACL doesn't exist, it will be created after entry. If the named hardware ACL does exist, then you can enter IPv4 Hardware ACL Configuration mode for that existing ACL.

Entering this command with the hardware ACL name moves you to the `(config-ip-hw-acl)` prompt for the IPv4 Hardware ACL Configuration mode so you can enter ACL filters with sequence numbers. From this prompt, configure the filters for the ACL. See Chapter 55, Access Control Lists Introduction for complete examples of configured sequenced numbered ACLs.

See also the table "IPv4 Hardware Access List Commands and Prompts" in this chapter. This table shows the relevant prompts at which ACL commands and ACL filters are entered for sequenced ACLs.

Note Hardware ACLs will permit access unless explicitly denied by an ACL action.

Example To create the hardware access-list named `ACL-1` and enter the IPv4 Hardware ACL Configuration mode to specify the ACL filter entry, use the commands:

```
awplus# configure terminal
awplus(config)# access-list hardware ACL-1
awplus(config-ip-hw-acl)#
```

To remove the hardware access-list named `ACL-1`, use the commands:

```
awplus# configure terminal
awplus(config)# no access-list hardware ACL-1
```

Related Commands

access-group
(access-list hardware ICMP filter)
(access-list hardware IP protocol filter)
(access-list hardware TCP UDP filter)
(access-list standard named filter)
show access-group
show access-list (IPv4 Hardware ACLs)

(access-list hardware ICMP filter)

Use this ACL filter to add a new ICMP filter entry to the current hardware access-list. The filter will match on any ICMP packet that has the specified source and destination IP addresses and ICMP type. The parameter any may be specified if an address does not matter and the ICMP type is an optional parameter. If a sequence number is specified, the new filter is inserted at the specified location. Otherwise, the new filter is added at the end of the access-list.

Note that specifying the send-to-cpu parameter could result in EPSR healthcheck messages and other control packets being dropped.

The optional vlan parameter can be applied to match tagged (802.1q) packets.

The no variant of this command removes an ICMP filter entry from the current hardware access-list. You can specify the ICMP filter entry for removal by entering either its sequence number (e.g. `no 10`), or by entering its ICMP filter profile without specifying its sequence number.

Note that the sequence number can be found by running the command, the show access-list (IPv4 Hardware ACLs) command on page 56.39.

Syntax [icmp]

```
[<sequence-number>]
   {deny|permit|send-to-cpu|copy-to-cpu|copy-to-mirror}
   icmp <source> <destination>
   [icmp <icmp-value>] [vlan <1-4094>]

no {deny|permit|send-to-cpu|copy-to-cpu|copy-to-mirror}
   icmp <source> <destination>
   [icmp <icmp-value>] [vlan <1-4094>]

no <sequence-number>
```

Parameter	Description
<sequence-number>	<1-65535> The sequence number for the filter entry of the selected access control list.
deny	Access-list rejects packets that match the source and destination filtering specified with this command.
permit	Access-list permits packets that match the source and destination filtering specified with this command.
send-to-cpu	Specify packets to send to the CPU. Specifying this parameter could result in EPSR healthcheck messages and other control packets being dropped.
copy-to-cpu	Specify packets to copy to the CPU.
copy-to-mirror	Specify packets to copy to the mirror port.
icmp	ICMP packet type.

Parameter(cont.)	**Description**(cont.)	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	<ip-addr>/ <prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any source IP address within the specified subnet.
	<ip-addr> <reverse-mask>	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
	`host` *<ip-addr>*	Matches a single source host with the IP address given by *<ip-addr>* in dotted decimal notation.
	`any`	Matches any source IP address.
<destination>	The destination address of the packets. You can specify a single host, a subnet, or all destinations. The following are the valid formats for specifying the destination:	
	<ip-addr>/ <prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any destination IP address within the specified subnet.
	<ip-addr> <reverse-mask>	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
	`host` *<ip-addr>*	Matches a single destination host with the IP address given by *<ip-addr>* in dotted decimal notation.
	`any`	Matches any destination IP address.
`icmp-type`	The ICMP type.	
<icmp-value>	The value of the ICMP type.	
`vlan`	Specifies that the ACL will match on the ID in the packet's VLAN tag.	
<1-4094>	The VLAN VID.	

Mode IPv4 Hardware ACL Configuration

Default Any traffic on an interface controlled by a hardware ACL that does not explicitly match a filter is permitted.

Usage First create a named hardware access-list that applies the appropriate permit, deny requirements etc. Then use the access-group command on page 56.4 to apply this access-list to a specific port or range. Note that this command will apply the access-list only to incoming data packets.

An ACL can be configured with multiple ACL filters using sequence numbers. If the sequence number is omitted, the next available multiple of 10 will be used as the sequence number for the new filter. A new ACL filter can be inserted into the middle of an existing list by specifying the appropriate sequence number.

Note

You must reach the prompt `awplus(config-ip-hw-acl)#` by running the access-list hardware (named) command on page 56.19, and entering an appropriate access-list name.

Note

Hardware ACLs will permit access unless explicitly denied by an ACL action.

Example To add an access-list filter entry with a sequence number of `100` to the access-list named `my-list` that will permit ICMP packets with a source address of `192.168.1.0/24`, any destination address and an icmp type of `5`, use the commands:

```
awplus# configure terminal
awplus(config)# access-list hardware my-list
awplus(config-ip-hw-acl)# 100 permit icmp 192.168.1.0/24 any
icmp-type 5
```

To remove an access-list filter entry with a sequence number of `100` in the access-list named `my-list`, use the commands:

```
awplus# configure terminal
awplus(config)# access-list hardware my-list
awplus(config-ip-hw-acl)# no 100
```

Related Commands
access-list hardware (named)
show running-config
show access-list (IPv4 Hardware ACLs)

(access-list hardware IP protocol filter)

Use this ACL filter to add an IP protocol type filter entry to the current hardware access-list. The filter will match on any IP packet that has the specified source and destination IP addresses and IP protocol type, or has the optionally specified source and destination MAC addresses. The parameter any may be specified if an address does not matter. If a sequence number is specified, the new filter is inserted at the specified location. Otherwise, the new filter is added at the end of the access-list.

Note that specifying the send-to-cpu parameter could result in EPSR healthcheck messages and other control packets being dropped.

The optional vlan parameter can be applied to match tagged (802.1q) packets.

The no variant of this command removes an IP protocol type filter entry from the current hardware access-list. You can specify the IP protocol type filter entry for removal by entering either its sequence number (e.g. `no 10`), or by entering its IP protocol type filter profile without specifying its sequence number.

Note that the sequence number can be found by running the show access-list (IPv4 Hardware ACLs) command on page 56.39.

Syntax [ip|proto]

```
[<sequence-number>]
   {deny|permit|send-to-cpu|copy-to-cpu|copy-to-mirror}
   {ip|any|proto <ip-protocol>}
   {<source>|dhcpsnooping} <destination>
   [mac {<mac-source-address> <mac-source-mask>|any}
   {<mac-destination-address> <mac-destination-mask>|any}]
   [vlan <1-4094>]

no {deny|permit|send-to-cpu|copy-to-cpu|copy-to-mirror}
   {ip|any|proto <ip-protocol>}
   {<source>|dhcpsnooping} <destination>
   [mac {<mac-source-address> <mac-source-mask>|any}
   {<mac-destination-address> <mac-destination-mask>|any}]
   [vlan <1-4094>]

no <sequence-number>
```

Parameter	Description
`<sequence-number>`	`<1-65535>` The sequence number for the filter entry of the selected access control list.
`deny`	Access-list rejects packets of the type specified.
`permit`	Access-list allows packets of the type specified
`send to cpu`	Specify packets to send to the CPU. Specifying this parameter could result in EPSR healthcheck messages and other control packets being dropped.
`copy to cpu`	Specify packets to copy to the CPU.
`copy to mirror`	Specify packets to copy to the mirror port.
`ip`	IP packets.
`any`	Any packet.

Parameter(cont.)	**Description**(cont.)
`proto <ip-protocol>`	The IP Protocol type specified by it protocol number <1-255>.
`<ip-protocol>`	The IP protocol number, as defined by IANA (Internet Assigned Numbers Authority http://www.iana.org/assignments/protocol-numbers)

Protocol Number	Protocol Description [RFC Reference]
1	Internet Control Message [RFC792]
2	Internet Group Management [RFC1112]
3	Gateway-to-Gateway [RFC823]
4	IP in IP [RFC2003]
5	Stream [RFC1190] [RFC1819]
6	TCP (Transmission Control Protocol) [RFC793]
8	EGP (Exterior Gateway Protocol) [RFC888]
9	IGP (Interior Gateway Protocol) [IANA]
11	Network Voice Protocol [RFC741]
17	UDP (User Datagram Protocol) [RFC768]
20	Host monitoring [RFC869]
27	RDP (Reliable Data Protocol) [RFC908]
28	IRTP (Internet Reliable Transaction Protocol) [RFC938]
29	ISO-TP4 (ISO Transport Protocol Class 4) [RFC905]
30	Bulk Data Transfer Protocol [RFC969]
33	DCCP (Datagram Congestion Control Protocol) [RFC4340]
48	DSR (Dynamic Source Routing Protocol) [RFC4728]
50	ESP (Encap Security Payload) [RFC2406]
51	AH (Authentication Header) [RFC2402]

Parameter(cont.)	**Description**(cont.)	
<ip-protocol> (cont.)	54	NARP (NBMA Address Resolution Protocol) [RFC1735]
	58	ICMP for IPv6 [RFC1883]
	59	No Next Header for IPv6 [RFC1883]
	60	Destination Options for IPv6 [RFC1883]
	88	EIGRP (Enhanced Interior Gateway Routing Protocol)
	89	OSPFIGP [RFC1583]
	97	Ethernet-within-IP Encapsulation / RFC3378
	98	Encapsulation Header / RFC1241
	108	IP Payload Compression Protocol / RFC2393
	112	Virtual Router Redundancy Protocol / RFC3768
	134	RSVP-E2E-IGNORE / RFC3175
	135	Mobility Header / RFC3775
	136	UDPLite / RFC3828
	137	MPLS-in-IP / RFC4023
	138	MANET Protocols / RFC-ietf-manet-iana-07.txt
	139-252	Unassigned / IANA
	253	Use for experimentation and testing / RFC3692
	254	Use for experimentation and testing / RFC3692
	255	Reserved / IANA
dhcpsnooping	The source address learned from the DHCP Snooping binding database.	

Parameter(cont.)	**Description**(cont.)	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	`any`	Matches any source IP address.
	`host` *<ip-addr>*	Matches a single source host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>/*<prefix>*	An IPv4 address, followed by a forward slash, then the prefix length. This matches any source IP address within the specified subnet.
	<ip-addr> *<reverse-mask>*	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
<destination>	The destination address of the packets. You can specify a single host, a subnet, or all destinations. The following are the valid formats for specifying the destination:	
	`any`	Matches any destination IP address.
	`host` *<ip-addr>*	Matches a single destination host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>/*<prefix>*	An IPv4 address, followed by a forward slash, then the prefix length. This matches any destination IP address within the specified subnet.
	<ip-addr> *<reverse-mask>*	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
`mac`	Signifies a MAC and based hardware access-list.	
<mac-source-address>	The source hosts MAC address, entered in HHHH.HHHH.HHHH format.	
<mac-source-mask>	The source hosts MAC wildcard mask entered in HHHH.HHHH.HHHH format. Where Hex `FF` = Ignore, and Hex `00` = Match.	
`any`	Matches any source MAC address.	
<mac-destination-address>	The destination hosts MAC address, entered in HHHH.HHHH.HHHH format.	

Parameter(cont.)	**Description**(cont.)
<mac-destination-mask>	The destination hosts wildcard mask entered in HHHH.HHHH.HHHH format. Where Hex `FF` = Ignore, and Hex `00` = Match.
`any`	Matches any destination MAC address.
`vlan`	Specifies that the ACL will match on the ID in the packet's VLAN tag.
<1-4094>	The VLAN VID.

Mode IPv4 Hardware ACL Configuration

Default Any traffic on an interface controlled by a hardware ACL that does not explicitly match a filter is permitted.

Usage First create a named hardware access-list that applies the appropriate permit, deny requirements etc. Then use the access-group command on page 56.4 to apply this access-list to a specific port or range. Note that this command will apply the access-list only to incoming data packets.

An ACL can be configured with multiple ACL filters using sequence numbers. If the sequence number is omitted, the next available multiple of 10 will be used as the sequence number for the new filter. A new ACL filter can be inserted into the middle of an existing list by specifying the appropriate sequence number.

Note
The access control list being configured is selected by running the access-list hardware (named) command on page 56.19. with the required access control list number, or name, but with no further parameters selected.

Note
Hardware ACLs will permit access unless explicitly denied by an ACL action.

Examples To add an access-list filter entry to the access-list named `my-list` that will permit any type of IP packet with a source address of `192.168.1.1` and any destination address, use the commands:

```
awplus# configure terminal
awplus(config)# access-list hardware my-list
awplus(config-ip-hw-acl)# permit ip 192.168.1.1/32 any
```

To add an access-list filter entry to the access-list named `my-list` that will permit any type of IP packet with a source address of `192.168.1.1` and a MAC source address of `ffee.ddcc.bbaa` with any IP and MAC destination address, use the commands:

```
awplus# configure terminal
awplus(config)# access-list hardware my-list
awplus(config-ip-hw-acl)# permit ip 192.168.1.1/32 any mac
ffee.ddcc.bbaa any
```

To add an access-list filter entry to the access-list named `my-list` a filter that will deny all IGMP packets (protocol `2`) from the `192.168.0.0` network with sequence number `50` in access-list, use the commands:

```
awplus# configure terminal
awplus(config)# access-list hardware my-list
awplus(config-ip-hw-acl)# 50 deny proto 2 192.168.0.0/16 any
```

To add an access-list filter entry to the access-list named `my-list` that will deny all IP packets on vlan `2`, use the commands:

```
awplus# ena
awplus(config)# configure terminal
awplus(config)# access-list hardware my-list
awplus(config-ip-hw-acl)# deny ip any any vlan 2
```

Related Commands

access-list hardware (named)
show running-config
show access-list (IPv4 Hardware ACLs)

(access-list hardware MAC filter)

Use this ACL filter to add a MAC filter entry to the current hardware access-list. The filter will match on any IP packet that has the specified source and destination MAC addresses. The parameter any may be specified if an address does not matter. If a sequence number is specified, the new filter is inserted at the specified location. Otherwise, the new filter is added at the end of the access-list.

Note that specifying the send-to-cpu parameter could result in EPSR healthcheck messages and other control packets being dropped.

Optionally, the vlan and inner-vlan parameters can be matched for tagged (802.1q) packets.

The no variant of this command removes a MAC filter entry from the current hardware access-list. You can specify the MAC filter entry for removal by entering either its sequence number (e.g. `no 10`), or by entering its MAC filter profile without specifying its sequence number.

Note that the sequence number can be found by running the show access-list (IPv4 Hardware ACLs) command on page 56.39.

Syntax [mac]

```
[<sequence-number>]
   {deny|permit|send-to-cpu|copy-to-cpu|copy-to-mirror}
   mac {<source-mac-address> <source-mac-mask>|any}
   {<destination-mac-address> <destination-mac-mask>|any}
   [{vlan <1-4094>|inner-vlan <1-4094>}]

no {deny|permit|send-to-cpu|copy-to-cpu|copy-to-mirror}
   mac {<source-mac-address> <source-mac-mask>|any}
   {<destination-mac-address> <destination-mac-mask>|any}
   [{vlan <1-4094>|inner-vlan <1-4094>}]

no <sequence-number>
```

Parameter	Description
<sequence-number>	<1-65535> The sequence number for the filter entry of the selected access control list.
deny	Specify packets to reject.
permit	Specify packets to accept.
send-to-cpu	Specify packets to send to the CPU. Specifying this parameter could result in EPSR healthcheck messages and other control packets being dropped.
copy-to-cpu	Specify packets to copy to the CPU.
copy-to-mirror	Specify packets to copy to the CPU.
mac	MAC address.
<source-mac-address>	The source MAC address of the packets. Enter this in the format <HHHH.HHHH.HHHH> Where each H is a hexadecimal number that represents a 4 bit binary number.

Parameter(cont.)	Description(cont.)
<source-mac-mask	The mask that will be applied to the source MAC addresses. Enter this in the format <HHHH.HHHH.HHHH> Where each H is a hexadecimal number that represents a 4 bit binary number. For a mask, each value will be either `0` or `F`. Where Hex `FF` = Ignore, and Hex `00` = Match.
`any`	Any source MAC host.
<destination-mac-address>	The destination MAC address of the packets. Enter this in the format <HHHH.HHHH.HHHH> Where each H is a hexadecimal number that represents a 4 bit binary number.
<destination-mac-mask>	The mask that will be applied to the destination MAC addresses. Enter this in the format <HHHH.HHHH.HHHH> Where each H is a hexadecimal number that represents a 4 bit binary number. For a mask, each value will be either `0` or `F`. Where Hex `FF` = Ignore, and Hex `00` = Match.
`any`	Any destination MAC host.
`vlan`	Specifies that the ACL will match on the ID in the packet's VLAN tag.
<1-4094>	The VLAN VID.
`inner-vlan`	This parameter is used within double-tagged VLANs. It is the inner VLAN tag (VID); sometimes referred to as the C-TAG (Customer VLAN TAG), where the vlan VID tag is referred to as the S-TAG (Service VLAN TAG).
<1-4094>	The inner VLAN VID.

Mode IPv4 Hardware ACL Configuration

Default Any traffic on an interface controlled by a hardware ACL that does not explicitly match a filter is permitted.

Usage First create a named hardware access-list that applies the appropriate permit, deny requirements etc. Then use the access-group command on page 56.4 to apply this access-list to a specific port or range. Note that this command will apply the access-list only to incoming data packets.

An ACL can be configured with multiple ACL filters using sequence numbers. If the sequence number is omitted, the next available multiple of 10 will be used as the sequence number for the new filter. A new ACL filter can be inserted into the middle of an existing list by specifying the appropriate sequence number

Note

The access control list being configured is selected by running the access-list hardware (named) command on page 56.19. with the required access control list number, or name, but with no further parameters selected.

Note Hardware ACLs will permit access unless explicitly denied by an ACL action.

Example To add an access-list filter entry to the access-list named `my-list` that will permit packets with a source MAC address of `0000.00ab.1234` and any destination MAC address, use the commands:

```
awplus# configure terminal
awplus(config)# access-list hardware my-list
awplus(config-ip-hw-acl)# permit mac 0000.00ab.1234
0000.0000.0000 any
```

Example To remove an access-list filter entry that permit packets with a source MAC address of `0000.00ab.1234` and any destination MAC address, use the commands:

```
awplus# configure terminal
awplus(config)# access-list hardware my-list
awplus(config-ip-hw-acl)# no permit mac 0000.00ab.1234
0000.0000.0000 any
```

Related Commands
access-group
access-list hardware (named)
show running-config

(access-list hardware TCP UDP filter)

Use this ACL filter to add a TCP or UDP filter entry to the current hardware access-list. The filter will match on any TCP or UDP type packet that has the specified source and destination IP addresses. The parameter any may be specified if an address does not matter. If a sequence number is specified, the new filter is inserted at the specified location. Otherwise, the new filter is added at the end of the access-list.

Note that specifying the send-to-cpu parameter could result in EPSR healthcheck messages and other control packets being dropped.

The optional vlan parameter can be applied to match tagged (802.1q) packets.

The no variant of this command removes a TCP or UDP filter entry from the current hardware access-list. You can specify the TCP or UDP filter entry for removal by entering either its sequence number (e.g. `no 10`), or by entering its TCP or UDP filter profile without specifying its sequence number.

Note that the sequence number can be found by running the show access-list (IPv4 Hardware ACLs) command on page 56.39.

Syntax [tcp|udp]

```
[<sequence-number>]
   {deny|permit|send-to-cpu|copy-to-cpu|copy-to-mirror}
   {tcp|udp}
   [<source>|
   eq <sourceport>|gt <sourceport>|lt <sourceport>|
   ne <sourceport>|range <start-range> <end-range>]
   [<destination>|
   eq <destport>|gt <destport>|lt <destport>|
   ne <destport>|range <start-range> <end-range>]
   [vlan <1-4094>]

no {deny|permit|send-to-cpu|copy-to-cpu|copy-to-mirror}
   {tcp|udp}
   [<source>|
   eq <sourceport>|gt <sourceport>|lt <sourceport>|
   ne <sourceport>|range <start-range> <end-range>]
   [<destination>|
   eq <destport>|gt <destport>|lt <destport>|
   ne <destport>|range <start-range> <end-range>]
   [vlan <1-4094>]

no <sequence-number>
```

Parameter	Description
<sequence-number>	<1-65535> The sequence number for the filter entry of the selected access control list.
deny	Access-list rejects packets that match the source and destination filtering specified with this command.
permit	Access-list permits packets that match the source and destination filtering specified with this command.
send-to-cpu	Specify packets to send to the CPU. Specifying this parameter could result in EPSR healthcheck messages and other control packets being dropped.
copy-to-cpu	Specify packets to copy to the CPU.

Parameter(cont.)	**Description**(cont.)	
`copy-to-mirror`	Specify packets to copy to the mirror port.	
`tcp`	TCP packets.	
`udp`	UDP packets.	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	`any`	Matches any source IP address.
	`host` *<ip-addr>*	Matches a single source host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>/<prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any source IP address within the specified subnet.
	<ip-addr> <reverse-mask>	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
<sourceport>	The source TCP or UDP port number, specified as an integer between 0 and 65535.	
<destination>	The destination address of the packets. You can specify a single host, a subnet, or all destinations. The following are the valid formats for specifying the destination:	
	`any`	Matches any destination IP address.
	`host` *<ip-addr>*	Matches a single destination host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>/<prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any destination IP address within the specified subnet.
	<ip-addr> <reverse-mask>	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
`eq`	Equal to.	

Parameter(cont.)	**Description**(cont.)
`lt`	Less than.
`gt`	Greater than.
`ne`	Not equal to.
<destport>	The source TCP or UDP port number, specified as an integer between 0 and 65535.
`range`	Specify the range of port numbers between 0 and 65535.
<start-range>	The source or destination port number at the start of the range *<0-65535>*.
<end-range>	The source or destination port number at the end of the range *<0-65535>*.
`vlan`	Specifies that the ACL will match on the ID in the packet's VLAN tag.
<1-4094>	The VLAN VID.

Mode IPv4 Hardware ACL Configuration

Default Any traffic on an interface controlled by a hardware ACL that does not explicitly match a filter is permitted.

Usage First create a named hardware access-list that applies the appropriate permit, deny requirements etc. Then use the access-group command on page 56.4 to apply this access-list to a specific port or range. Note that this command will apply the access-list only to incoming data packets.

An ACL can be configured with multiple ACL filters using sequence numbers. If the sequence number is omitted, the next available multiple of 10 will be used as the sequence number for the new filter. A new ACL filter can be inserted into the middle of an existing list by specifying the appropriate sequence number.

Note
The access control list being configured is selected by running the access-list hardware (named) command on page 56.19. with the required access control list number, or name, but with no further parameters selected.

Note
Hardware ACLs will permit access unless explicitly denied by an ACL action.

Example To add an access-list filter entry to access-list named `my-hw-list` that will permit TCP packets with a destination address of `192.168.1.1`, a destination port of `80`, and any source address, and source port, use the commands:

```
awplus# configure terminal
awplus(config)# access-list hardware my-hw-list
awplus(config-ip-hw-acl)# permit tcp any 192.168.1.1/32 eq 80
```

Related Commands

access-list hardware (named)
show running-config
show access-list (IPv4 Hardware ACLs)

commit (IPv4)

Use this command to commit the ACL filter configuration to hardware immediately without exiting Hardware ACL Configuration mode.

Syntax `commit`

Mode IPv4 Hardware ACL Configuration

Usage Normally, when a hardware ACL is edited, the new configuration state of the ACL is not written to hardware until you exit Hardware ACL Configuration mode. By entering this command you can ensure that the current state of a hardware access-list that is being edited is written to hardware immediately.

Scripts typically do not include the exit command to exit configuration modes, potentially leading to ACL filters in hardware not being correctly updated. Using this commit command in a configuration script after specifying a hardware ACL filter ensures that it is updated in the hardware.

Examples To update the hardware with the ACL filter configuration, use the command:

```
awplus# configure terminal
awplus(config)# access-list hardware my-hw-list
awplus(config-ip-hw-acl)# commit
```

Related Commands access-list hardware (named)

show access-group

Use this command to show the access-lists attached globally. If an access-list is specified, only that access-list will be displayed.

Syntax `show access-group [{<3000-3699>|<4000-4699>|<access-list-name>}]`

Parameter	Description
<3000-3699>	Specify a Hardware IP access-list.
<4000-4699>	Specify a Hardware MAC access-list.
<access-list-name>	Specify a Hardware IPv4 access-list name.

Mode User Exec and Privileged Exec

Example To show all access-lists attached globally:

```
awplus# show access-group
```

Output Figure 56-1: Example output from the **show access-group** command

```
Global access control list
access-group 3000
access-group 4000
```

Related Commands ip prefix-list

show access-list (IPv4 Hardware ACLs)

Use this command to display the specified access-list, or all access-lists if none have been specified. Note that only defined access-lists are displayed. An error message is displayed for an undefined access-list.

Syntax

```
show access-list
    [<1-99>|<100-199>|<1300-1999>|<2000-2699>|<3000-3699>|
    <4000-4499>|<access-list-name>]
```

Parameter	Description
<1-99>	IP standard access-list.
<100-199>	IP extended access-list.
<1300-1999>	IP standard access-list (standard - expanded range).
<2000-2699>	IP extended access-list (extended - expanded range).
<3000-3699>	Hardware IP access-list.
<4000-4499>	Hardware MAC access-list.
<access-list-name>	IP named access-list.

Mode User Exec and Privileged Exec

Example To show all access-lists configured on the switch:

```
awplus# show access-list
```

```
Standard IP access list 1
    deny 172.16.2.0, wildcard bits 0.0.0.255
Standard IP access list 20
    deny 192.168.10.0, wildcard bits 0.0.0.255
    deny 192.168.12.0, wildcard bits 0.0.0.255
Hardware IP access list 3001
    permit ip 192.168.20.0 255.255.255.0 any
Hardware IP access list 3020
    permit tcp any 192.0.2.0/24
awplus#show access-list 20
```

Example To show the access-list with an ID of 20:

```
awplus# show access-list 20
```

```
Standard IP access-list 20
    deny 192.168.10.0, wildcard bits 0.0.0.255
    deny 192.168.12.0, wildcard bits 0.0.0.255
```

Note the below error message if you attempt to show an undefined access-list:

```
awplus# show access-list 2
```

```
% Can't find access-list 2
```

Related Commands

access-list extended (named)
access-list (hardware MAC numbered)
access-list hardware (named)

show interface access-group

Use this command to display the access groups attached to a port. If an access group is specified, then the output only includes the ports that the specified access group is attached to. If no access group is specified then this command displays all access groups that are attached to the ports that are specified with *<port-list>*.

Note that access group is the term given for an access-list when it is applied to an interface.

Syntax

```
show interface <port-list> access-group
    [<3000-3699>|<4000-4699>|<access-list-name>]
```

Parameter	Description
<port-list>	Specify the ports to display information. A port-list can be either: ■ a switch port (e.g. port1.0.12) a static channel group (e.g., sa3) or a dynamic (LACP) channel group (e.g., po3) ■ a continuous range of ports separated by a hyphen, e.g., port1.0.1-1.0.24 or port1.0.1-port1.0.24 or po1-po4 ■ a comma-separated list of ports and port ranges, e.g. port1.0.1,port1.0.3-1.0.24. Do not mix switch ports, static channel groups, and LACP channel groups in the same list.
`access group`	Select the access group whose details you want to show.
<3000-3699>	Specifies the Hardware IP access-list.
<4000-4699>	Specifies the Hardware MAC access-list.
<access-list-name>	Specify the Hardware IPv6 access-list name.

Mode User Exec and Privileged Exec

Example To show all access-lists attached to `port1.0.1`, use the command:

```
awplus# show interface port1.0.1 access-group
```

Output Figure 56-2: Example output from the **show interface access-group** command

```
Interface port1.0.1
  access-group 3000
  access-group 3002
  access-group 3001
```

Related Commands access-group

Chapter 57: IPv4 Software Access Control List (ACL) Commands

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show access-list (IPv4 Software ACLs) 57.40
show ip access-list 57.42
show ip prefix-list 57.43

Introduction

This chapter provides an alphabetical reference for the IPv4 Software Access Control List (ACL) commands, and contains detailed command information and command examples about IPv4 software ACLs as applied to Routing and Multicasting, which are not applied to interfaces.

Note

See Chapter 55, Access Control Lists Introduction for descriptions of ACLs, and for further information about rules when applying ACLs see the ACL Rules section.

See ACL Filter Sequence Numbers and ACL Filter Sequence Number Behavior sections in Chapter 55, Access Control Lists Introduction about ACL Filters.

See all relevant Routing commands and configurations in "IPv4 Software Access Control List (ACL) Commands" and all relevant Multicast commands and configurations in "Multicast Applications".

To apply ACLs to an LACP channel group, apply it to all the individual switch ports in the channel group. To apply ACLs to a static channel group, apply it to the static channel group itself. For more information on link aggregation see Chapter 20, Link Aggregation Introduction and Configuration, and Chapter 21, Link Aggregation Commands.

Note

Text in parenthesis in command names indicates usage not keyword entry. For example, access-list hardware (named) indicates named IPv4 hardware ACLs entered as `access-list hardware` <*name*> where <*name*> is a placeholder not a keyword.

Note

Parenthesis surrounding ACL filters indicates the type of ACL filter not the keyword entry in the CLI, such as (access-list standard numbered filter) represents command entry in the format shown in the syntax `[<sequence-number>] {deny|permit} {<source>|host <host-address>|any}`.

Note

Software ACLs will deny access unless explicitly permitted by an ACL action.

IPv4 Software Access List Commands and Prompts

Many of the ACL commands operate from sub-modes that are specific to particular ACL types. The table "IPv4 Software Access List Commands and Prompts" shows the CLI prompts at which ACL commands are entered.

Table 57-1: IPv4 Software Access List Commands and Prompts

Command Name	Command Mode	Prompt
clear ip prefix-list	Privileged Exec	awplus#
show ip access-list	Privileged Exec	awplus#
show ip prefix-list	Privileged Exec	awplus#
access-group	Global Configuration	awplus(config)#
access-list (extended numbered)	Global Configuration	awplus(config)#
access-list standard (named)	Global Configuration	awplus(config)#
access-list (standard numbered)	Global Configuration	awplus(config)#
ip prefix-list	Global Configuration	awplus(config)#
maximum-access-list	Global Configuration	awplus(config)#
(access-list extended ICMP filter)	IPv4 Extended ACL Configuration	awplus(config-ip-ext-acl)#
(access-list extended IP filter)	IPv4 Extended ACL Configuration	awplus(config-ip-ext-acl)#
(access-list extended IP protocol filter)	IPv4 Extended ACL Configuration	awplus(config-ip-ext-acl)#
(access-list extended TCP UDP filter)	IPv4 Extended ACL Configuration	awplus(config-ip-ext-acl)#
(access-list standard named filter)	IPv4 Standard ACL Configuration	awplus(config-ip-std-acl)#
(access-list standard numbered filter)	IPv4 Standard ACL Configuration	awplus(config-ip-std-acl)#

Command List

access-list extended (named)

This command configures an extended named access-list that permits or denies packets from specific source and destination IP addresses. You can either create an extended named ACL together with an ACL filter entry in the Global Configuration mode, or you can use the IPv4 Extended ACL Configuration mode for sequenced ACL filter entry after entering a list name.

The no variant of this command removes a specified extended named access-list.

Syntax [list-name]

```
access-list extended <list-name>

no access-list extended <list-name>
```

Parameter	Description
<list-name>	A user-defined name for the access-list

Syntax [icmp]

```
access-list extended <list-name>
    {deny|permit}
    icmp <source> <destination>
    [icmp-type <type-number>]
    [log]

no access-list extended <list-name>
    {deny|permit}
    icmp <source> <destination>
    [icmp-type <type-number>]
    [log]
```

Table 57-2: Parameters in the access-list extended (named) command - icmp

Parameter	Description
<list-name>	A user-defined name for the access-list.
`deny`	The access-list rejects packets that match the type, source, and destination filtering specified with this command.
`permit`	The access-list permits packets that match the type, source, and destination filtering specified with this command.
`icmp`	The access-list matches only ICMP packets.
`icmp-type`	Matches only a specified type of ICMP messages. This is valid only when the filtering is set to match ICMP packets.

Table 57-2: Parameters in the access-list extended (named) command - icmp(cont.)

Parameter(cont.)	**Description**(cont.)	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	`any`	Matches any source IP address.
	`host` *<ip-addr>*	Matches a single source host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>/*<prefix>*	An IPv4 address, followed by a forward slash, then the prefix length. This matches any source IP address within the specified subnet.
	<ip-addr> *<reverse-mask>*	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
<destination>	The destination address of the packets. You can specify a single host, a subnet, or all destinations. The following are the valid formats for specifying the destination:	
	`any`	Matches any destination IP address.
	`host` *<ip-addr>*	Matches a single destination host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>/*<prefix>*	An IPv4 address, followed by a forward slash, then the prefix length. This matches any destination IP address within the specified subnet.
	<ip-addr> *<reverse-mask>*	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.

Table 57-2: Parameters in the access-list extended (named) command - icmp(cont.)

Parameter(cont.)	**Description**(cont.)	
<type-number>	The ICMP type, as defined in RFC792 and RFC950. Specify one of the following integers to create a filter for the ICMP message type:	
	0	Echo replies.
	3	Destination unreachable messages.
	4	Source quench messages.
	5	Redirect (change route) messages.
	8	Echo requests.
	11	Time exceeded messages.
	12	Parameter problem messages.
	13	Timestamp requests.
	14	Timestamp replies.
	15	Information requests.
	16	Information replies.
	17	Address mask requests.
	18	Address mask replies.
log	Logs the results.	

Syntax [tcp|udp]

```
access-list extended <list-name>
    {deny|permit}
    {tcp|udp}
    <source>
    [eq <sourceport>|lt <sourceport>|gt <sourceport>|ne <sourceport>]
    <destination>
    [eq <destport>|lt <destport>|gt <destport>|ne <destport>]
    [log]]

no access-list extended <list-name>
    {deny|permit}
    {tcp|udp}
    <source>
    [eq <sourceport>|lt <sourceport>|gt <sourceport>|ne <sourceport>]
    <destination>
    [eq <destport>|lt <destport>|gt <destport>|ne <destport>]
    [log]]
```

Table 57-3: Parameters in the access-list extended (named) command - tcp|udp

Parameter	Description	
<list-name>	A user-defined name for the access-list.	
deny	The access-list rejects packets that match the type, source, and destination filtering specified with this command.	
permit	The access-list permits packets that match the type, source, and destination filtering specified with this command.	
tcp	The access-list matches only TCP packets.	
udp	The access-list matches only UDP packets.	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	any	Matches any source IP address.
	host *<ip-addr>*	Matches a single source host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>/<prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any source IP address within the specified subnet.
	<ip-addr> <reverse-mask>	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.

Table 57-3: Parameters in the access-list extended (named) command - tcp|udp(cont.)

Parameter(cont.)	**Description**(cont.)	
<destination>	The destination address of the packets. You can specify a single host, a subnet, or all destinations. The following are the valid formats for specifying the destination:	
	`any`	Matches any destination IP address.
	`host` *<ip-addr>*	Matches a single destination host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>/ *<prefix>*	An IPv4 address, followed by a forward slash, then the prefix length. This matches any destination IP address within the specified subnet.
	<ip-addr> *<reverse-mask>*	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
<sourceport>	The source port number, specified as an integer between 0 and 65535.	
<destport>	The destination port number, specified as an integer between 0 and 65535.	
`eq`	Matches port numbers equal to the port number specified immediately after this parameter.	
`lt`	Matches port numbers less than the port number specified immediately after this parameter.	
`gt`	Matches port numbers greater than the port number specified immediately after this parameter.	
`ne`	Matches port numbers not equal to the port number specified immediately after this parameter.	
`log`	Log the results.	

Syntax [proto|any|ip]

```
access-list extended <list-name>
    {deny|permit}
    {proto <ip-protocol>|any|ip}
    {<source>}
    {<destination>}
    [log]

no access-list extended <list-name>
    {deny|permit}
    {proto <ip-protocol>|any|ip}
    {<source>}
    {<destination>}
    [log]
```

Table 57-4: Parameters in the access-list extended (named) command - proto|ip|any

Parameter	Description	
<list-name>	A user-defined name for the access-list.	
deny	The access-list rejects packets that match the type, source, and destination filtering specified with this command.	
permit	The access-list permits packets that match the type, source, and destination filtering specified with this command.	
proto	Matches only a specified type of IP Protocol.	
any	The access-list matches any type of IP packet.	
ip	The access-list matches only IP packets.	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	any	Matches any source IP address.
	host *<ip-addr>*	Matches a single source host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>/*<prefix>*	An IPv4 address, followed by a forward slash, then the prefix length. This matches any source IP address within the specified subnet.
	<ip-addr> *<reverse-mask>*	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering 192.168.1.1 0.0.0.255 is the same as entering 192.168.1.1/24.

Table 57-4: Parameters in the access-list extended (named) command - proto|ip|any(cont.)

Parameter(cont.)	Description(cont.)	
<destination>	The destination address of the packets. You can specify a single host, a subnet, or all destinations. The following are the valid formats for specifying the destination:	
	`any`	Matches any destination IP address.
	`host` *<ip-addr>*	Matches a single destination host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr>/*<prefix>*	An IPv4 address, followed by a forward slash, then the prefix length. This matches any destination IP address within the specified subnet.
	<ip-addr> *<reverse-mask>*	Alternatively, you can enter a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
`log`	Logs the results.	
<ip-protocol>	The IP protocol number, as defined by IANA (Internet Assigned Numbers Authority http://www.iana.org/assignments/protocol-numbers)	
	Protocol Number	**Protocol Description [RFC Reference]**
	`1`	Internet Control Message [RFC792]
	`2`	Internet Group Management [RFC1112]
	`3`	Gateway-to-Gateway [RFC823]
	`4`	IP in IP [RFC2003]
	`5`	Stream [RFC1190] [RFC1819]
	`6`	TCP (Transmission Control Protocol) [RFC793]
	`8`	EGP (Exterior Gateway Protocol) [RFC888]
	`9`	IGP (Interior Gateway Protocol) [IANA]
	`11`	Network Voice Protocol [RFC741]
	`17`	UDP (User Datagram Protocol) [RFC768]
	`20`	Host monitoring [RFC869]
	`27`	RDP (Reliable Data Protocol) [RFC908]
	`28`	IRTP (Internet Reliable Transaction Protocol) [RFC938]
	`29`	ISO-TP4 (ISO Transport Protocol Class 4) [RFC905]
	`30`	Bulk Data Transfer Protocol [RFC969]

Table 57-4: Parameters in the access-list extended (named) command - proto|ip|any(cont.)

Parameter(cont.)	Description(cont.)	
<ip-protocol> (cont.)	**Protocol Number**	**Protocol Description [RFC Reference]**
	33	Datagram Congestion Control Protocol [RFC4340]
	48	DSR (Dynamic Source Routing Protocol) [RFC4728]
	50	ESP (Encap Security Payload) [RFC2406]
	51	AH (Authentication Header) [RFC2402]
	54	NARP (NBMA Address Resolution Protocol) [RFC1735]
	88	EIGRP (Enhanced Interior Gateway Routing Protocol)
	89	OSPFIGP [RFC1583]
	97	Ethernet-within-IP Encapsulation / RFC3378
	98	Encapsulation Header / RFC1241
	108	IP Payload Compression Protocol / RFC2393
	112	Virtual Router Redundancy Protocol / RFC3768
	134	RSVP-E2E-IGNORE / RFC3175
	135	Mobility Header / RFC3775
	136	UDPLite / RFC3828
	137	MPLS-in-IP / RFC4023
	138	MANET Protocols / RFC-ietf-manet-iana-07.txt
	139-252	Unassigned / IANA
	253	Use for experimentation and testing / RFC3692
	254	Use for experimentation and testing / RFC3692
	255	Reserved / IANA

Mode Global Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage Use this command when configuring access-list for filtering IP software packets. To enable backwards compatibility you can either create access-lists from within this command, or you can enter access-list followed by only the number. This latter method moves you to the IPv4 Extended ACL Configuration mode for the selected access-list number, and from here you can configure your access-lists by using the commands (access-list extended ICMP filter), (access-list extended IP filter), and (access-list extended IP protocol filter).

The table "IPv4 Software Access List Commands and Prompts" on page 57.3 shows the prompts at which ACL commands are entered. See the relevant links shown for the Related Commands.

Note that packets must match both the source and the destination details.

Note Software ACLs will deny access unless explicitly permitted by an ACL action.

Example You can enter the extended named ACL in the Global Configuration mode together with the ACL filter entry on the same line, as in previous software releases as shown below:

```
awplus# configure terminal
awplus(config)# access-list extended TK deny tcp 2.2.2.3/24 eq
14 3.3.3.4/24 lt 12 log
```

Alternatively, you can enter the extended named ACL in Global Configuration mode before specifying the ACL filter entry in the IPv4 Extended ACL Configuration mode, as shown below:

```
awplus# configure terminal
awplus(config)# access-list extended TK
awplus(config-ip-ext-acl)# deny tcp 2.2.2.3/24 eq 14 3.3.3.4/24
lt 12 log
```

Related Commands
(access-list extended ICMP filter)
(access-list extended IP filter)
(access-list extended TCP UDP filter)
show access-group
show running-config
show ip access-list

access-list (extended numbered)

This command configures an extended numbered access-list that permits or denies packets from specific source and destination IP addresses. You can either create an extended numbered ACL together with an ACL filter entry in the Global Configuration mode, or you can use the IPv4 Extended ACL Configuration mode for sequenced ACL filter entry after entering a list number.

The no variant of this command removes a specified extended named access-list.

Syntax [list-number]

```
access-list {<100-199>|<2000-2699>}

no access-list {<100-199>|<2000-2699>}
```

Parameter	Description
<100-199>	IP extended access-list.
<2000-2699>	IP extended access-list (expanded range).

Syntax [deny|permit]

```
access-list {<100-199>|<2000-2699>}
   {deny|permit}
   ip <source> <destination>

no access-list {<100-199>|<2000-2699>}
   {deny|permit}
   ip <source> <destination>
```

Parameter	Description	
<100-199>	IP extended access-list.	
<2000-2699>	IP extended access-list (expanded range).	
deny	Access-list rejects packets that match the source and destination filtering specified with this command.	
permit	Access-list permits packets that match the source and destination filtering specified with this command.	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	any	Matches any source IP address.
	host *<ip-addr>*	Matches a single source host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr> *<reverse-mask>*	An IPv4 address, followed by a reverse mask in dotted decimal format. For example, entering 192.168.1.1 0.0.0.255 is the same as entering 192.168.1.1/24. This matches any source IP address within the specified subnet.
<destination>	The destination address of the packets. You can specify a single host, a subnet, or all destinations. The following are the valid formats for specifying the destination:	

Parameter(cont.)	**Description**(cont.)	
	`any`	Matches any destination IP address.
	`host <ip-addr>`	Matches a single destination host with the IP address given by `<ip-addr>` in dotted decimal notation.
	`<ip-addr> <reverse-mask>`	An IPv4 address, followed by a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`. This matches any destination IP address within the specified subnet.

Mode Global Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage Use this command when configuring access-list for filtering IP software packets. To enable backwards compatibility you can either create access-lists from within this command, or you can enter access-list followed by only the number. This latter method moves you to the IPv4 Extended ACL Configuration mode for the selected access-list number, and from here you can configure your access-lists by using the commands (access-list extended ICMP filter), (access-list extended IP filter), and (access-list extended IP protocol filter).

The table "IPv4 Software Access List Commands and Prompts" on page 57.3 shows the prompts at which ACL commands are entered. See the relevant links shown for the Related Commands.

Note that packets must match both the source and the destination details.

Note Software ACLs will deny access unless explicitly permitted by an ACL action.

Example You can enter the extended named ACL in the Global Configuration mode together with the ACL filter entry on the same line, as in previous software releases as shown below:

```
awplus# configure terminal
awplus(config)# access-list 101 deny ip 172.16.10.0 0.0.0.255
any
```

Alternatively, you can enter the extended named ACL in Global Configuration mode before specifying the ACL filter entry in the IPv4 Extended ACL Configuration mode, as shown below:

```
awplus# configure terminal
awplus(config)# access-list 101
awplus(config-ip-ext-acl)# deny ip 172.16.10.0 0.0.0.255 any
```

Related Commands

(access-list extended ICMP filter)
(access-list extended IP filter)
(access-list extended TCP UDP filter)
show access-group
show running-config
show ip access-list

(access-list extended ICMP filter)

Use this ACL filter to add a new ICMP filter entry to the current extended access-list. If the sequence number is specified, the new filter is inserted at the specified location. Otherwise, the new filter is added at the end of the access-list.

The no variant of this command removes an ICMP filter entry from the current extended access-list. You can specify the ICMP filter entry for removal by entering either its sequence number (e.g. `no 10`), or by entering its ICMP filter profile without specifying its sequence number.

Note that the sequence number can be found by running the show access-list (IPv4 Software ACLs) command.

Syntax [icmp]

```
[<sequence-number>] {deny|permit}
    icmp <source> <destination>
    [icmp-type <icmp-value>] [log]

no {deny|permit} icmp <source> <destination>
    [icmp-type <icmp-value>] [log]

no <sequence-number>
```

Parameter	Description	
<sequence-number>	<1-65535> The sequence number for the filter entry of the selected access control list.	
deny	Access-list rejects packets that match the source and destination filtering specified with this command.	
permit	Access-list permits packets that match the source and destination filtering specified with this command.	
icmp	ICMP packet type.	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	<ip-addr>/<prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any source IP address within the specified subnet.
	any	Matches any source IP address.
<destination>	The destination address of the packets. You can specify a single host, a subnet, or all destinations. The following are the valid formats for specifying the destination:	
	<ip-addr>/<prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any destination IP address within the specified subnet.
	any	Matches any destination IP address.
icmp-type	The ICMP type.	

Parameter(cont.)	Description(cont.)
<icmp-value>	The value of the ICMP type.
log	Log the results.

Mode IPv4 Extended ACL Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage An ACL can be configured with multiple ACL filters using sequence numbers. If the sequence number is omitted, the next available multiple of 10 will be used as the sequence number for the new filter. A new ACL filter can be inserted into the middle of an existing list by specifying the appropriate sequence number.

Note
The access control list being configured is selected by running the access-list (extended numbered) command or the access-list extended (named) command, with the required access control list number, or name - but with no further parameters selected.

Note
Software ACLs will deny access unless explicitly permitted by an ACL action.

Examples To add a new entry in access-list called `my-list` that will reject ICMP packets from `10.0.0.1` to `192.168.1.1`, use the commands:

```
awplus# configure terminal
awplus(config)# access-list extended my-list
awplus(config-ip-ext-acl)# deny icmp 10.0.0.1/32 192.168.1.1/32
```

Use the following commands to add a new filter at sequence number `5` position of the access-list called `my-list`. The filter will accept the ICMP type `8` packets from `10.1.1.0/24` network, to `192.168.1.0` network:

```
awplus# configure terminal
awplus(config)# access-list extended my-list
awplus(config-ip-ext-acl)# 5 permit icmp 10.1.1.0/24
                           192.168.1.0/24 icmp-type 8
```

Related Commands
access-group
show access-group
show running-config
show ip access-list

(access-list extended IP filter)

Use this ACL filter to add a new IP filter entry to the current extended access-list. If the sequence number is specified, the new filter is inserted at the specified location. Otherwise, the new filter is added at the end of the access-list.

The no variant of this command removes an IP filter entry from the current extended access-list. You can specify the IP filter entry for removal by entering either its sequence number (e.g. `no 10`), or by entering its IP filter profile without specifying its sequence number.

Note that the sequence number can be found by running the show access-list (IPv4 Software ACLs) command.

Syntax [ip]

```
[<sequence-number>] {deny|permit} ip <source> <destination>
no {deny|permit} ip <source> <destination>
no <sequence-number>
```

Parameter	Description	
<sequence-number>	<1-65535> The sequence number for the filter entry of the selected access control list.	
`deny`	Access-list rejects packets that match the source and destination filtering specified with this command.	
`permit`	Access-list permits packets that match the source and destination filtering specified with this command.	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	`any`	Matches any source IP address.
	`host` *<ip-addr>*	Matches a single source host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr> *<reverse-mask>*	Alternatively, enter an IPv4 address followed by a reverse mask in dotted decimal format. For example, enter `192.168.1.1 0.0.0.255`.
<destination>	The destination address of the packets. You can specify a single host, a subnet, or all destinations. The following are the valid formats for specifying the destination:	
	`any`	Matches any destination IP address.
	`host` *<ip-addr>*	Matches a single destination host with the IP address given by *<ip-addr>* in dotted decimal notation.
	<ip-addr> *<reverse-mask>*	Alternatively, enter an IPv4 address followed by a reverse mask in dotted decimal format. For example, enter `192.168.1.1 0.0.0.255`.

Mode Extended ACL Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage An ACL can be configured with multiple ACL filters using sequence numbers. If the sequence number is omitted, the next available multiple of 10 will be used as the sequence number for the new filter. A new ACL filter can be inserted into the middle of an existing list by specifying the appropriate sequence number.

Note

The access control list being configured is selected by running the access-list (extended numbered) command or the access-list extended (named) command, with the required access control list number, or name - but with no further parameters selected.

Note

Software ACLs will deny access unless explicitly permitted by an ACL action.

Example 1 [list-number] First use the following commands to enter the IPv4 Extended ACL Configuration mode and define a numbered extended access-list `101`:

```
awplus# configure terminal
awplus(config)# access-list 101
awplus(config-ip-ext-acl)#
```

Then use the following commands to add a new entry to the numbered extended access-list `101` that will reject packets from `10.0.0.1` to `192.168.1.1`:

```
awplus(config-ip-ext-acl)# deny ip host 10.0.0.1 host
                           192.168.1.1
awplus(config-ip-ext-acl)# 20 permit ip any any
```

Example 2 [list-name] First use the following commands to enter the IPv4 Extended ACL Configuration mode and define a named access-list called `my-acl`:

```
awplus# configure terminal
awplus(config)# access-list extended my-acl
awplus(config-ip-ext-acl)#
```

Then use the following commands to add a new entry to the named access-list `my-acl` that will reject packets from `10.0.0.1` to `192.168.1.1`:

```
awplus(config-ip-ext-acl)# deny ip host 10.0.0.1 host
                           192.168.1.1
awplus(config-ip-ext-acl)# 20 permit ip any any
```

Example 3 [list-number] Use the following commands to remove the access-list filter entry with sequence number `20` from extended numbered access-list `101`.

```
awplus# configure terminal
awplus(config)# access-list 101
awplus(config-ip-ext-acl)# no 20
```

Example 4 [list-name] Use the following commands to remove the access-list filter entry with sequence number `20` from extended named access-list `my-acl`:

```
awplus# configure terminal
awplus(config)# access-list extended my-acl
awplus(config-ip-ext-acl)# no 20
```

Related Commands

access-list extended (named)
access-list (extended numbered)
show access-group
show running-config
show ip access-list

(access-list extended IP protocol filter)

Use this ACL filter to add a new IP protocol type filter entry to the current extended access-list. If the sequence number is specified, the new filter is inserted at the specified location. Otherwise, the new filter is added at the end of the access-list.

The no variant of this command removes an IP protocol filter entry from the current extended access-list. You can specify the IP filter entry for removal by entering either its sequence number (e.g. `no 10`), or by entering its IP filter profile without specifying its sequence number.

Note that the sequence number can be found by running the show access-list (IPv4 Software ACLs) command.

Syntax [proto]

```
[<sequence-number>] {deny|permit} proto <ip-protocol>
   <source> <destination> [log]

no {deny|permit} proto <ip-protocol> <source> <destination> [log]

no <sequence-number>
```

Parameter	Description
<sequence-number>	<1-65535> The sequence number for the filter entry of the selected access control list.
deny	Access-list rejects packets that match the source and destination filtering specified with this command.
permit	Access-list permits packets that match the source and destination filtering specified with this command.
proto *<ip-protocol>*	The IP Protocol type specified by its protocol number <1-255>.
<ip-protocol>	The IP protocol number, as defined by IANA (Internet Assigned Numbers Authority http://www.iana.org/assignments/protocol-numbers).

Protocol Number	Protocol Description [RFC Reference]
1	Internet Control Message [RFC792]
2	Internet Group Management [RFC1112]
3	Gateway-to-Gateway [RFC823]
4	IP in IP [RFC2003]
5	Stream [RFC1190] [RFC1819]
6	TCP (Transmission Control Protocol) [RFC793]
8	EGP (Exterior Gateway Protocol) [RFC888]
9	IGP (Interior Gateway Protocol) [IANA]
11	Network Voice Protocol [RFC741]

Parameter(cont.)	**Description**(cont.)	
<ip-protocol> (cont.)	17	UDP (User Datagram Protocol) [RFC768]
	20	Host monitoring [RFC869]
	27	RDP (Reliable Data Protocol) [RFC908]
	28	IRTP (Internet Reliable Transaction Protocol) [RFC938]
	29	ISO-TP4 (ISO Transport Protocol Class 4) [RFC905]
	30	Bulk Data Transfer Protocol [RFC969]
	33	DCCP (Datagram Congestion Control Protocol) [RFC4340]
	48	DSR (Dynamic Source Routing Protocol) [RFC4728]
	50	ESP (Encap Security Payload) [RFC2406]
	51	AH (Authentication Header) [RFC2402]
	54	NARP (NBMA Address Resolution Protocol) [RFC1735]
	88	EIGRP (Enhanced Interior Gateway Routing Protocol)
	89	OSPFIGP [RFC1583]
	97	Ethernet-within-IP Encapsulation / RFC3378
	98	Encapsulation Header / RFC1241
	108	IP Payload Compression Protocol / RFC2393
	112	Virtual Router Redundancy Protocol / RFC3768
	134	RSVP-E2E-IGNORE / RFC3175
	135	Mobility Header / RFC3775
	136	UDPLite / RFC3828
	137	MPLS-in-IP / RFC4023
	138	MANET Protocols / RFC-ietf-manet-iana-07.txt
	139-252	Unassigned / IANA
	253	Use for experimentation and testing / RFC3692
	254	Use for experimentation and testing / RFC3692
	255	Reserved / IANA

Parameter(cont.)	**Description**(cont.)	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	<ip-addr>/<prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any source IP address within the specified subnet.
	`any`	Matches any source IP address.
<destination>	The destination address of the packets. You can specify a single host, a subnet, or all destinations. The following are the valid formats for specifying the destination:	
	<ip-addr>/<prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any destination IP address within the specified subnet.
	`any`	Matches any destination IP address.
`log`	Log the results.	

Mode IPv4 Extended ACL Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage An ACL can be configured with multiple ACL filters using sequence numbers. If the sequence number is omitted, the next available multiple of 10 will be used as the sequence number for the new filter. A new ACL filter can be inserted into the middle of an existing list by specifying the appropriate sequence number.

Note The access control list being configured is selected by running the access-list (extended numbered) command or the access-list extended (named) command, with the required access control list number, or name - but with no further parameters selected.

Note Software ACLs will deny access unless explicitly permitted by an ACL action.

Example 1 [creating a list] Use the following commands to add a new access-list filter entry to the access-list named `my-list` that will reject IP packets from source address `10.10.1.1/32` to destination address `192.68.1.1/32`:

```
awplus# configure terminal
awplus(config)# access-list extended my-list
awplus(config-ip-ext-acl)# deny ip 10.10.1.1/32 192.168.1.1/32
```

Example 2 [adding to a list]

Use the following commands to add a new access-list filter entry at sequence position `5` in the access-list named `my-list` that will accept packets from source address `10.10.1.1/24` to destination address `192.68.1.1/24`:

```
awplus# configure terminal
awplus(config)# access-list extended my-list
awplus(config-ip-ext-acl)# 5 permit ip 10.10.1.1/24 192.168.1.1/
24
```

Related Commands

access-list extended (named)
access-list (extended numbered)
show access-group
show running-config
show ip access-list

(access-list extended TCP UDP filter)

Use this ACL filter to add a new TCP or UDP filter entry to the current extended access-list. If the sequence number is specified, the new filter is inserted at the specified location. Otherwise, the new filter is added at the end of the access-list.

The no variant of this command removes a TCP or UDP filter entry from the current extended access-list. You can specify the TCP or UDP filter entry for removal by entering either its sequence number (e.g. `no 10`), or by entering its TCP or UDP filter profile without specifying its sequence number.

Note that the sequence number can be found by running the show access-list (IPv4 Software ACLs) command.

Syntax [tcp|udp]

```
[<sequence-number>] {deny|permit} {tcp|udp}
   <source>
   {eq <sourceport>|lt <sourceport>|gt <sourceport>|ne <sourceport>}
   <destination>
   [eq <destport>|lt <destport>|gt <destport>|ne <destport>]
   [log]

no {deny|permit} {tcp|udp}
   <source>
   {eq <sourceport>|lt <sourceport>|gt <sourceport>|ne <sourceport>}
   <destination>
   [eq <destport>|lt <destport>|gt <destport>|ne <destport>]
   [log]

no <sequence-number>
```

Parameter	Description	
<sequence-number>	<1-65535> The sequence number for the filter entry of the selected access control list.	
deny	Access-list rejects packets that match the source and destination filtering specified with this command.	
permit	Access-list permits packets that match the source and destination filtering specified with this command.	
tcp	The access-list matches only TCP packets.	
udp	The access-list matches only UDP packets.	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	<ip-addr>/<prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any source IP address within the specified subnet.
	any	Matches any source IP address.
<sourceport>	The source port number, specified as an integer between 0 and 65535.	

Parameter(cont.)	**Description**(cont.)	
<destination>	The destination address of the packets. You can specify a single host, a subnet, or all destinations. The following are the valid formats for specifying the destination:	
	<ip-addr>/<prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any destination IP address within the specified subnet.
	`any`	Matches any destination IP address.
<destport>	The destination port number, specified as an integer between 0 and 65535.	
`eq`	Matches port numbers equal to the port number specified immediately after this parameter.	
`lt`	Matches port numbers less than the port number specified immediately after this parameter.	
`gt`	Matches port numbers greater than the port number specified immediately after this parameter.	
`ne`	Matches port numbers not equal to the port number specified immediately after this parameter.	
`log`	Log the results.	

Mode IPv4 Extended ACL Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage An ACL can be configured with multiple ACL filters using sequence numbers. If the sequence number is omitted, the next available multiple of 10 will be used as the sequence number for the new filter. A new ACL filter can be inserted into the middle of an existing list by specifying the appropriate sequence number.

Note The access control list being configured is selected by running the access-list (extended numbered) command or the access-list extended (named) command, with the required access control list number, or name - but with no further parameters selected.

Note Software ACLs will deny access unless explicitly permitted by an ACL action.

Example 1 [creating a list] To add a new entry to the access-list named `my-list` that will reject TCP packets from `10.0.0.1` on TCP port `10` to `192.168.1.1` on TCP port `20`, use the commands:

```
awplus# configure terminal
awplus(config)# access-list extended my-list
awplus(config-ip-ext-acl)# deny tcp 10.0.0.1/32 eq 10
                           192.168.1.1/32 eq 20
```

Example 2 [adding to a list]

To insert a new entry with sequence number `5` of the access-list named `my-list` that will accept UDP packets from `10.1.1.0/24` network to `192.168.1.0/24` network on UDP port `80`, use the commands:

```
awplus# configure terminal
awplus(config)# access-list extended my-list
awplus(config-ip-ext-acl)# 5 permit udp 10.1.1.0/24
192.168.1.0/24 eq 80
```

Related Commands

access-list extended (named)
access-list (extended numbered)
show access-group
show running-config
show ip access-list

access-list standard (named)

This command configures a standard named access-list that permits or denies packets from a specific source IP address. You can either create a standard named ACL together with an ACL filter entry in the Global Configuration mode, or you can use the IPv4 Standard ACL Configuration mode for sequenced ACL filter entry after first entering an access-list name.

The no variant of this command removes a specified standard named access-list.

Syntax [list-name]

```
access-list standard <standard-access-list-name>

no access-list standard <standard-access-list-name>
```

Parameter	Description
<standard-access-list-name>	Specify a name for the standard access-list.

Syntax [deny|permit]

```
access-list standard <standard-access-list-name> {deny|permit}
   <source>

no access-list standard <standard-access-list-name> {deny|permit}
   <source>
```

Parameter	Description	
<standard-access-list-name>	Specify a name for the standard access-list.	
deny	The access-list rejects packets that match the source filtering specified with this command.	
permit	The access-list permits packets that match the source filtering specified with this command.	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	<ip-addr>/<prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any source IP address within the specified subnet.
	any	Matches any source IP address.

Mode Global Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage Use this command when configuring a standard named access-list for filtering IP software packets. For backwards compatibility you can either create the access-list from within this command, or you can enter this command followed by only the standard access-list name then enter. This latter method moves you to the IPv4 Standard ACL Configuration mode for the selected standard named access-list, and from here you can configure the deny or permit filters for this selected standard named access-list.

See the table "IPv4 Software Access List Commands and Prompts" in this chapter which shows the prompts at which ACL commands are entered. See the relevant links shown for the Related Commands.

Note Software ACLs will deny access unless explicitly permitted by an ACL action.

Examples To define a standard access-list named `my-list` and deny any packets from any source, use the commands:

```
awplus# configure terminal
awplus(config)# access-list standard my-list deny any
```

Alternatively, to define a standard access-list named `my-list` and enter the IPv4 Standard ACL Configuration mode to deny any packets from any source, use the commands:

```
awplus# configure terminal
awplus(config)# access-list standard my-list
awplus(config-ip-std-acl)# 5 deny any
```

Related Commands
(access-list standard named filter)
show access-group
show running-config
show ip access-list

access-list (standard numbered)

This command configures a standard numbered access-list that permits or denies packets from a specific source IP address. You can either create a standard numbered ACL together with an ACL filter entry in the Global Configuration mode, or you can use the IPv4 Standard ACL Configuration mode for sequenced ACL filter entry after first entering an access-list number.

The no variant of this command removes a specified standard numbered access-list.

Syntax [list-number]

```
access-list {<1-99>|<1300-1999>}
no access-list {<1-99>|<1300-1999>}
```

Parameter	Description
<1-99>	IP standard access-list.
<1300-1999>	IP standard access-list (expanded range).

Syntax [deny|permit]

```
access-list {<1-99>|<1300-1999>} {deny|permit} <source>
no access-list {<1-99>|<1300-1999>} {deny|permit} <source>
```

Parameter	Description	
<1-99>	IP standard access-list.	
<1300-1999>	IP standard access-list (expanded range).	
`deny`	Access-list rejects packets from the specified source.	
`permit`	Access-list accepts packets from the specified source.	
<source>	The source address of the packets. You can specify a single host, a subnet, or all sources. The following are the valid formats for specifying the source:	
	<ip-addr> <reverse-mask>	Enter an IPv4 address followed by a reverse mask in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
	`any`	Matches any source IP address.

Mode Global Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage Use this command when configuring a standard numbered access-list for filtering IP software packets. For backwards compatibility you can either create the access-list from within this command, or you can enter this command followed by only the standard access-list name. This moves you to the IPv4 Standard ACL Configuration mode for the selected standard numbered access-list, and from here you can configure the deny or permit filters for this selected standard numbered access-list.

See the table "IPv4 Software Access List Commands and Prompts" in this chapter which shows the prompts at which ACL commands are entered. See the relevant links shown for the Related Commands.

Note Software ACLs will deny access unless explicitly permitted by an ACL action.

Example To create ACL number `67` that will deny packets from subnet `172.16.10`, use the commands:

```
awplus# configure terminal
awplus(config)# access-list 67 deny 172.16.10.0 0.0.0.255
```

Alternatively, to enter the IPv4 Standard ACL Configuration mode to create the ACL filter and deny packets from subnet `172.16.10.0` for the standard numbered access-list `67`, use the commands:

```
awplus# configure terminal
awplus(config)# access-list 67
awplus(config-ip-std-acl)# deny 172.16.10.0 0.0.0.255
```

Related Commands
(access-list standard named filter)
show access-group
show running-config
show ip access-list

(access-list standard named filter)

This ACL filter adds a source IP address filter entry to a current named standard access-list. If the sequence number is specified, the new filter entry is inserted at the specified location. Otherwise, the new entry is added at the end of the access-list.

The no variant of this command removes a source IP address filter entry from the current named standard access-list. You can specify the source IP address filter entry for removal by entering either its sequence number (e.g. `no 10`), or by entering its source IP address filter profile without specifying its sequence number.

Note that the sequence number can be found by running the show access-list (IPv4 Software ACLs) command.

Syntax

```
[<sequence-number>] {deny|permit} {<source> [exact-match]|any}
no {deny|permit} {<source> [exact-match]|any}
no <sequence-number>
```

Parameter	Description	
<sequence-number>	<1-65535> The sequence number for the filter entry of the selected access control list.	
deny	Access-list rejects packets of the source filtering specified.	
permit	Access-list allows packets of the source filtering specified	
<source>	The source address of the packets. You can specify either a subnet or all sources. The following are the valid formats for specifying the source:	
	<ip-addr>/<prefix>	An IPv4 address, followed by a forward slash, then the prefix length. This matches any destination IP address within the specified subnet.
	<ip-addr>	An IPv4 address in a.b.c.d format.
exact-match	Specify an exact IP prefix to match on.	
any	Matches any source IP address.	

Mode IPv4 Standard ACL Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage An ACL can be configured with multiple ACL filters using sequence numbers. If the sequence number is omitted, the next available multiple of 10 will be used as the sequence number for the new filter. A new ACL filter can be inserted into the middle of an existing list by specifying the appropriate sequence number.

Note

The access control list being configured is selected by running the access-list standard (named) command with the required access control list number, or name, but with no further parameters selected.

Note Software ACLs will deny access unless explicitly permitted by an ACL action.

Example Use the following commands to add a new filter entry to access-list `my-list` that will reject IP address `10.1.1.1`:

```
awplus# configure terminal
awplus(config)# access-list standard my-list
awplus(config-ip-std-acl)# deny 10.1.1.1/32
```

Example Use the following commands to insert a new filter entry into access-list `my-list` at sequence position number `15` that will accept IP network `10.1.2.0`:

```
awplus# configure terminal
awplus(config)# access-list standard my-list
awplus(config-ip-std-acl)# 15 permit 10.1.2.0/24
```

Related Commands
access-list standard (named)
show access-group
show running-config
show ip access-list

(access-list standard numbered filter)

This ACL filter adds a source IP address filter entry to a current standard numbered access-list. If a sequence number is specified, the new filter entry is inserted at the specified location. Otherwise, the new filter entry is added at the end of the access-list.

The no variant of this command removes a source IP address filter entry from the current standard numbered access-list. You can specify the source IP address filter entry for removal by entering either its sequence number (e.g. `no 10`), or by entering its source IP address filter profile without specifying its sequence number.

Note that the sequence number can be found by running the show access-list (IPv4 Software ACLs) command.

Syntax

```
[<sequence-number>] {deny|permit} {<source>|host <host-address>|any}
no {deny|permit} {<source>|host <host-address>|any}
no <sequence-number>
```

Parameter	Description	
<sequence-number>	<1-65535> The sequence number for the filter entry of the selected access control list.	
deny	Access-list rejects packets of the type specified.	
permit	Access-list allows packets of the type specified	
<source>	The source address of the packets. You can specify either a subnet or all sources. The following are the valid formats for specifying the source:	
	<ip-addr> <reverse-mask>	Enter a reverse mask for the source address in dotted decimal format. For example, entering `192.168.1.1 0.0.0.255` is the same as entering `192.168.1.1/24`.
	<ip-addr>	An IPv4 address in a.b.c.d format.
host	A single source host.	
<host-address>	Single source host address.	
any	Matches any source IP address.	

Mode IPv4 Standard ACL Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage An ACL can be configured with multiple ACL filters using sequence numbers. If the sequence number is omitted, the next available multiple of 10 will be used as the sequence number for the new filter. A new ACL filter can be inserted into the middle of an existing list by specifying the appropriate sequence number.

Note The access control list being configured is selected by running the access-list standard (named) command with the required access control list number, or name, but with no further parameters selected.

Note Software ACLs will deny access unless explicitly permitted by an ACL action.

Example To add a new entry accepting the IP network `10.1.1.0/24` at the sequence number `15` position, use the commands:

```
awplus# configure terminal
awplus(config)# access-list 99
awplus(config-ip-std-acl)# 15 permit 10.1.2.0 0.0.0.255
```

Related Commands
access-list (standard numbered)
show access-group
show running-config
show ip access-list

clear ip prefix-list

Use this command to reset the hit count to zero in the prefix-list entries.

Syntax `clear ip prefix-list [<list-name>] [<ip-address>/<mask>]`

Parameter	Description
<list-name>	The name of the prefix-list.
<ip-address>/<mask>	The IP prefix and length.

Mode Privileged Exec

Example To clear a prefix-list named List1:

```
awplus# clear ip prefix-list List1
```

ip prefix-list

Use this command to create an entry for a prefix list.

Use the no variant of this command to delete the prefix-list entry.

Syntax

```
ip prefix-list <list-name> seq <1-429496725>
   {deny|permit}
   {any|<ip-prefix>}
   [ge <0-32>] [le <0-32>]

ip prefix-list <list-name> description <text>

ip prefix-list sequence-number

no ip prefix-list <list-name> seq <1-429496725>

no ip prefix-list <list-name> description <text>

no ip prefix-list sequence-number
```

Parameter	Description
`<list-name>`	Specifies the name of a prefix list.
`seq <1-429496725>`	Sequence number of the prefix list entry.
`deny`	Specifies that the prefixes are excluded from the list.
`permit`	Specifies that the prefixes are included in the list.
`<ip-prefix>`	A.B.C.D/M specifies the IP address and length of the network mask.
`any`	Any prefix match. Same as 0.0.0.0/0 le 32.
`le <0-32>`	Specifies the maximum prefix length to be matched.
`ge <0-32>`	Specifies the minimum prefix length to be matched.
`description <text>`	Text description of the prefix list.
`sequence-number`	Specify sequence numbers included or excluded in prefix list.

Mode Global Configuration

Usage When the device processes a prefix list, it starts to match prefixes from the top of the prefix list, and stops whenever a match or deny occurs. To promote efficiency, use the seq parameter and place common matches or denials towards the top of the list. If you do not use the seq parameter, the sequence values are generated in the sequence of 5.

The parameters ge and le specify the range of the prefix lengths to be matched. When setting these parameters, set the le value to be less than 32, and the ge value to be less than the le value.

Example In the below sample configuration, the last `ip prefix-list` command in the below list matches all, and the first `ip prefix-list` command denies the IP network `76.2.2.0`:

```
awplus(config)# router bgp 100
awplus(config-router)# network 172.1.1.0
awplus(config-router)# network 172.1.2.0
awplus(config-router)# neighbor 10.6.5.3 remote-as 300
awplus(config-router)# neighbor 10.6.5.3 prefix-list mylist out
awplus(config-router)# exit
awplus(config)# ip prefix-list mylist seq 5 deny
                76.2.2.0/24
awplus(config)# ip prefix-list mylist seq 100 permit any
```

To deny the IP addresses between `10.0.0.0/14` (`10.0.0.0 255.252.0.0`) and `10.0.0.0/22` (`10.0.0.0 255.255.252.0`) within the `10.0.0.0/8` (`10.0.0.0 255.0.0.0`) addressing range, enter the following commands:.

```
awplus# configure terminal
awplus(config)# ip prefix-list mylist seq 12345 deny 10.0.0.0/
                8 le 22 ge 14
```

Related Commands

match ip address
neighbor prefix-list
match route-type
show access-group

maximum-access-list

Sets the maximum number of filters that can be added to any access-list. These are access-lists within the ranges <1-199>, <1300-1999> and <2000-2699> and named standard and extended access-lists.

The no variant of this command removes the limit on the number of filters that can be added to a software access-list

Syntax

```
maximum-access-list <1-4294967294>
no maximum-access-list
```

Parameter	Description
<1-4294967294>	Filter range.

Mode Global Configuration

Example To set the maximum number of software filters to `200`:

```
awplus# configure terminal
awplus(config)# maximum-access-list 200
```

Related Commands remote-command

show access-list (IPv4 Software ACLs)

Use this command to display the specified access-list, or all access-lists if none have been specified. Note that only defined access-lists are displayed. An error message is displayed for an undefined access-list

Syntax

```
show access-list
    [<1-99>|<100-199>|<1300-1999>|<2000-2699>|<3000-3699>|
    <4000-4499>|<access-list-name>]
```

Parameter	Description
<1-99>	IP standard access-list.
<100-199>	IP extended access-list.
<1300-1999>	IP standard access-list (standard - expanded range).
<2000-2699>	IP extended access-list (extended - expanded range).
<3000-3699>	Hardware IP access-list.
<4000-4499>	Hardware MAC access-list.
<access-list-name>	IP named access-list.

Mode User Exec and Privileged Exec

Example To show all access-lists configured on the switch:

```
awplus# show access-list
```

```
Standard IP access list 1
    deny 172.16.2.0, wildcard bits 0.0.0.255
Standard IP access list 20
    deny 192.168.10.0, wildcard bits 0.0.0.255
    deny 192.168.12.0, wildcard bits 0.0.0.255
Hardware IP access list 3001
    permit ip 192.168.20.0 255.255.255.0 any
Hardware IP access list 3020
    permit tcp any 192.0.2.0/24
awplus#show access-list 20
```

Example To show the access-list with an ID of 20:

```
awplus# show access-list 20
```

```
Standard IP access-list 20
    deny 192.168.10.0, wildcard bits 0.0.0.255
    deny 192.168.12.0, wildcard bits 0.0.0.255
```

Note the below error message if you attempt to show an undefined access-list:

```
awplus# show access-list 2
```

```
% Can't find access-list 2
```

Related Commands

access-list standard (named)
access-list (standard numbered)
access-list (extended numbered)

show ip access-list

Use this command to display IP access-lists.

Syntax

```
show ip access-list [<1-99>|<100-199>|<1300-1999>|<2000-2699>|
   <access-list-name>]
```

Parameter	Description
<1-99>	IP standard access-list.
<100-199>	IP extended access-list.
<1300-1999>	IP standard access-list (expanded range).
<2000-2699>	IP extended access-list (expanded range).
<access-list-name>	IP named access-list.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip access-list
```

Output Figure 57-1: Example output from the **show ip access-list** command

```
Standard IP access-list 1
    permit 172.168.6.0, wildcard bits 0.0.0.255
    permit 192.168.6.0, wildcard bits 0.0.0.255
```

show ip prefix-list

Use this command to display the prefix-list entries. Note that this command is valid for RIP and BGP routing protocols only.

Syntax `show ip prefix-list [<name>|detail|summary]`

Parameter	Description
<name>	Name of a prefix list.
`detail`	Detail of the prefix list.
`summary`	Summary of prefix lists.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip prefix-list
awplus# show ip prefix-list 10.10.0.98/8
awplus# show ip prefix-list detail
```

Chapter 58: IPv6 Hardware Access Control List (ACL) Commands

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Introduction

This chapter provides an alphabetical reference for the IPv6 Hardware Access Control List (ACL) commands, and contains detailed command information and command examples about IPv6 hardware ACLs, which are applied directly to interfaces using the ipv6 traffic-filter command.

Note

See Chapter 55, Access Control Lists Introduction for descriptions of ACLs, and for further information about rules when applying ACLs see the ACL Rules section.

See ACL Filter Sequence Numbers and ACL Filter Sequence Number Behavior sections in Chapter 55, Access Control Lists Introduction about ACL Filters.

To apply ACLs to an LACP channel group, apply it to all the individual switch ports in the channel group. To apply ACLs to a static channel group, apply it to the static channel group itself. For more information on link aggregation see Chapter 20, Link Aggregation Introduction and Configuration, and Chapter 21, Link Aggregation Commands.

Note that text in parenthesis in command names indicates usage not keyword entry. For example, ipv6-access-list (named) indicates named IPv6 ACLs entered as `ipv6-access-list <name>` where `<name>` is a placeholder not a keyword.

Note also that parenthesis surrounding ACL filters indicates the type of ACL filter not the keyword entry in the CLI, such as (ipv6 access-list standard IPv6 filter) represents command entry in the format shown in the syntax `[<sequence-number>] {deny|permit} {<IPv6-source-address/prefix-length>|any}`.

Note

Hardware ACLs will permit access unless explicitly denied by an ACL action.

IPv6 Hardware Access List Commands and Prompts

Many of the ACL commands operate from sub-modes that are specific to particular ACL types. The table "IPv6 Hardware Access List Commands and Prompts" shows the CLI prompts at which ACL commands are entered.

Table 58-1: IPv6 Hardware Access List Commands and Prompts

Command Name	Command Mode	Prompt
show ipv6 access-list (IPv6 Hardware ACLs)	Privileged Exec	awplus#
ipv6 access-list (named)	Global Configuration	awplus(config)#
(ipv6 access-list named ICMP filter)	Global Configuration	awplus(config)#
ipv6 traffic-filter	Interface Configuration	awplus(config-if)#
commit (IPv6)	IPv6 Hardware ACL Configuration	awplus(config-ipv6-hw-acl)#
(ipv6 access-list named ICMP filter)	IPv6 Hardware ACL Configuration	awplus(config-ipv6-hw-acl)#
(ipv6 access-list named protocol filter)	IPv6 Hardware ACL Configuration	awplus(config-ipv6-hw-acl)#
(ipv6 access-list named TCP UDP filter)	IPv6 Hardware ACL Configuration	awplus(config-ipv6-hw-acl)#

Command List

commit (IPv6)

Use this command to commit the ACL filter configuration to hardware immediately without exiting Hardware ACL Configuration mode.

Syntax `commit`

Mode IPv6 Hardware ACL Configuration

Usage Normally, when a hardware ACL is edited, the new configuration state of the ACL is not written to hardware until you exit Hardware ACL Configuration mode. By entering this command you can ensure that the current state of a hardware access-list that is being edited is written to hardware immediately.

Scripts typically do not include the exit command to exit configuration modes, potentially leading to ACL filters in hardware not being correctly updated. Using this commit command in a configuration script after specifying a hardware ACL filter ensures that it is updated in the hardware.

Examples To update the hardware with the ACL filter configuration, use the command:

```
awplus# configure terminal
awplus(config)# ipv6 access-list my-ipv6-acl
awplus(config-ipv6-hw-acl)# commit
```

Related Commands ipv6 access-list (named)

ipv6 access-list (named)

Use this command to either create a new IPv6 hardware access-list, or to select an existing IPv6 hardware access-list in order to apply a filter entry to it.

Use the no variant of this command to delete an existing IPv6 hardware access-list.

Note Before you can delete an access-list, you must first remove it from any interface it is assigned to.

Syntax

```
ipv6 access-list <ipv6-access-list-name>
no ipv6 access-list <ipv6-access-list-name>
```

Parameter	Description
<ipv6-access-list-name>	Specify an IPv6 access-list name.

Mode Global Configuration

Default Any traffic on an interface controlled by a hardware ACL that does not explicitly match a filter is permitted.

Usage Use IPv6 hardware named access-lists to control the transmission of IPv6 packets on an interface, and restrict the content of routing updates. The switch stops checking the IPv6 hardware named access-list when a match is encountered.

For backwards compatibility you can either create IPv6 hardware named access-lists from within this command, or you can enter `ipv6 access-list` followed by only the IPv6 hardware named access-list name. This latter (and preferred) method moves you to the `(config-ipv6-hw-acl)` prompt for the selected IPv6 hardware named access-list number, and from here you can configure the filters for this selected IPv6 hardware named access-list.

Note Hardware ACLs will permit access unless explicitly denied by an ACL action.

Examples To create an IPv6 access-list named `my-ipv6-acl`, use the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list my-ipv6-acl
awplus(config-ipv6-hw-acl)#
```

To delete the IPv6 access-list named `my-ipv6-acl`, use the commands:

```
awplus# configure terminal
awplus(config)# no ipv6 access-list my-ipv6-acl
```

Validation Commands show ipv6 access-list (IPv6 Hardware ACLs)

Related Commands (ipv6 access-list named ICMP filter)
(ipv6 access-list named protocol filter)
(ipv6 access-list named TCP UDP filter)
ipv6 traffic-filter
show ipv6 access-list (IPv6 Hardware ACLs)

(ipv6 access-list named ICMP filter)

Use this ACL filter to add a filter entry for an IPv6 source and destination address and prefix, with ICMP (Internet Control Message Protocol) packets, to the current named IPv6 access-list. If a sequence number is specified, the new entry is inserted at the specified location. Otherwise, the new entry is added at the end of the access-list.

Note that specifying the send-to-cpu parameter could result in EPSR healthcheck messages and other control packets being dropped.

As an optional parameter vlan can be matched for tagged (802.1q) packet.

The no variant of this command removes a filter entry for an IPv6 source and destination address and prefix, with ICMP (Internet Control Message Protocol) packets, from the current named IPv6 access-list. You can specify the filter entry for removal by entering either its sequence number, or its filter entry profile.

Note Hardware ACLs will permit access unless explicitly denied by an ACL action.

Syntax [ip|icmp]

```
[<sequence-number>
   {deny|permit|send-to-cpu|copy-to-cpu|copy-to-mirror}
   {ipv6|icmp}
   {<ipv6-source-address/prefix-length>|
   <ipv6-source-address> <ipv6-source-wildcard>|
   host <ipv6-source-host>|any}
   {<ipv6-destination-address/prefix-length>|
   <ipv6-destintation-addr> <ipv6-destination-wildcard>|
   host <ipv6-destination-host-address>|any} [<icmp-type>]
   [vlan <1-4094>]

no [<sequence-number>]
   {deny|permit|send-to-cpu|copy-to-cpu|copy-to-mirror}
   {ip|icmp}
   {<ipv6-source-address/prefix-length>|
   <ipv6-source-address> <ipv6-source-wildcard>|
   host <ipv6-source-host>|any}
   {<ipv6-destination-address/prefix-length>|
   <ipv6-destination-address> <ipv6-destination-wildcard>|
   host <ipv6-destination-host-address>|any} [<icmp-type>]
   [vlan <1-4094>]

no [<sequence-number>]
```

Parameter	Description
<*sequence-number*>	<1-65535> *The sequence number for the filter entry of the selected access control list.*
deny	Specifies the packets to reject.
permit	Specifies the packets to permit.
send-to-cpu	Specifies the packets to send to the CPU. Specifying this parameter could result in EPSR healthcheck messages and other control packets being dropped.

Parameter(cont.)	Description(cont.)
copy-to-cpu	Specifies the packets to copy to the CPU.
copy-to-mirror	Specifies the packets to copy to the mirror port.
ipv6	IPv6 packet, defined by the following parameters.
icmp	ICMP packet, defined by the following parameters.
<ipv6-source-address/ prefix-length>	Specifies a source address and prefix length. The IPv6 address prefix uses the format X:X::/ prefix-length. The prefix-length is usually set between 0 and 64, or has the value 128.
<ipv6-source-address>	Specifies the IPv6 source address. The IPv6 address uses the format X:X::X:X.
<ipv6-source-wildcard>	Specifies source wildcard bits in IPv6 format X:X::X:X. Note that binary 1 represents a don't care condition, and binary 0 represents a match.
host *<ipv6-source-host>*	Specifies a single source host address. The IPv6 address uses the format X:X::X:X.
any	Specifies any Source host.
<ipv6-destination-address/prefix-length>	Specifies a destination address and prefix length. The IPv6 address uses the format X:X::X:X/Prefix-Length. The prefix-length is usually set between 0 and 64, or has the value 128.
<ipv6-destination-addrress>	Specifies a destination address. The IPv6 address uses the format X:X::X:X.
<ipv6-destination-wildcard>	Specify destination Wildcard bits in IPv6 format X:X::X:X.
host *<ipv6-destination-host-address>*	Specify a single destination host address. The IPv6 address uses the format X:X::X:X.
any	Specifies any destination host.
<icmp-type>	Optional. Specify to filter by ICMP message type number. Valid values are from 0 to 255.
vlan	This parameter can be used in either single or double-tagged VLAN networks. It is the conventional VLAN tag (VID). In a double-tagged network it is sometimes referred to as the STAG.
<1-4094>	The VLAN VID.

Mode IPv6 Hardware ACL Configuration

Default Any traffic on an interface controlled by a hardware ACL that does not explicate match a filter is permitted.

Examples

To specify a hardware IPv6 access-list named `my-acl1` and add an ACL filter entry that blocks all ICMP6 echo requests, enter the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list my-acl1
awplus(config-ipv6-hw-acl)# deny icmp any any icmp-type 128
```

To specify a hardware IPv6 access-list named `my-acl2` and add an ACL filter entry that blocks all ICMP6 echo requests on the default VLAN (`vlan1`), enter the following commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list my-acl2
awplus(config-ipv6-hw-acl)# deny icmp any any icmp-type 128
vlan 1
```

To remove an ACL filter entry that blocks all ICMP6 echo requests from he hardware IPv6 access-list named `my-acl1`, enter the following commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list my-acl1
awplus(config-ipv6-hw-acl)# no deny icmp any any icmp-type 128
```

Validation Commands

show ipv6 access-list (IPv6 Hardware ACLs)

Related Commands

ipv6 access-list (named)
(ipv6 access-list named protocol filter)
(ipv6 access-list named TCP UDP filter)
ipv6 traffic-filter
show ipv6 access-list (IPv6 Hardware ACLs)

(ipv6 access-list named protocol filter)

Use this ACL filter to add a filter entry for an IPv6 source and destination address and prefix, with an IP protocol type specified, to the current named IPv6 access-list. If a sequence number is specified, the new entry is inserted at the specified location. Otherwise, the new entry is added at the end of the access-list.

Note that specifying the send-to-cpu parameter could result in EPSR healthcheck messages and other control packets being dropped.

The no variant of this command removes a filter entry for an IPv6 source and destination address and prefix, with an IP protocol type specified, from the current named IPv6 access-list. You can specify the filter entry for removal by entering either its sequence number, or its filter entry profile.

Syntax

```
[<sequence-number>
   {deny|permit|send-to-cpu|copy-to-cpu|copy-to-mirror}
   {ipv6|proto <ip-protocol>}
   {<ipv6-source-prefix/prefix-length>|<ipv6-source-address>
   <ipv6-source-wildcard>|host <ipv6-source-host>|any}
   {<ipv6-destination-prefix/prefix-length>|
   <ipv6-destination-address> <ipv6-destination-wildcard>|
   host <ipv6-destination-host>|any}

[<sequence-number>]
   no {deny|permit|send-to-cpu|copy-to-cpu|copy-to-mirror}
   {ipv6|proto <ip-protocol>}
   {<ipv6-source-prefix/prefix-length>|<ipv6-source-address>
   <ipv6-source-wildcard>|host <ipv6-source-host>|any}
   {<ipv6-destination-prefix/prefix-length>|
   <ipv6-destination-address> <ipv6-destination-wildcard>|
   host <ipv6-destination-host>|any}

no [<sequence-number>]
```

Parameter	Description
<sequence-number>	<1-65535> *The sequence number for the filter entry of the selected access control list.*
deny	Specifies packets to reject.
permit	Specifies packets to permit.
send-to-cpu	Specifies packets to send to the CPU. Specifying this parameter could result in EPSR healthcheck messages and other control packets being dropped.
copy-to-cpu	Specifies packets to copy to the CPU.
copy-to-mirror	Specifies packets to copy to the mirror port.
ipv6	Specifies IPv6 packet.
proto *<ip-protocol>*	Specify IP protocol number <1-255>.

Parameter(cont.)	Description(cont.)
<ip-protocol>	The IP protocol number, as defined by IANA (Internet Assigned Numbers Authority http://www.iana.org/assignments/protocol-numbers)
	Protocol Number
	1
	2
	3
	4
	5
	6
	8
	9
	11
	17
	20
	27
	28
	29
	30
	33
	48
	50
	51
	54
	58
	59
	60
	88
	89

Parameter(cont.)	Description(cont.)
<ip-protocol>	**Protocol Number**
(cont.)	97
	98
	108
	112
	134
	135
	136
	137
	138
	139-252
	253
	254
	255
<ipv6-source-prefix/ prefix-length>	Specify source address and mask. The IPv6 address uses the format X:X::X:X/Prefix-Length. The prefix-length is usually set between 0 and 64, or has the value 128.
<ipv6-source-address>	Specifies the source address. The IPv6 address uses the format X:X::X:X.
<ipv6-source-wildcard>	Specifies the source wildcard bits, in IPv6 format X:X::X:X.
host *<ipv6-source-host>*	Specifies a single source host. The IPv6 address uses the format X:X::X:X.
any	Specifies any source host. An abbreviation for the IPv6 prefix *::/0*
<ipv6-dest-prefix/prefix-length>	Specifies a destination address and mask. The IPv6 address prefix uses the format X:X::/ prefix-length. The prefix-length is usually set between 0 and 64, or has the value 128.
<ipv6-destination-address>	Specify destination address. The IPv6 address uses the format X:X::X:X.
<ipv6-destination-wildcard>	Specify destination wildcard bits in IPv6 format X:X::X:X
host *<ipv6-destination-host>*	Specify a single destination host address. The IPv6 address uses the format X:X::X:X.
any	Specifies any destination host. An abbreviation for the IPv6 prefix *::/0*

Parameter(cont.)	Description(cont.)
`vlan`	This parameter can be used in either single or double-tagged VLAN networks. It is the conventional VLAN tag (VID). In a double-tagged network it is sometimes referred to as the STAG.
<1-4094>	The VLAN VID.

Mode IPv6 Hardware ACL Configuration

Default Any traffic on an interface controlled by a hardware ACL that does not explicate match a filter is permitted.

Usage This command adds a hardware classification filter (for use with features such as QoS), to a current standard IPv6 access-list. The filter will match on any IP protocol type packet that has the specified source and destination IPv6 addresses and the specified IP protocol type. The parameter `any` may be specified if an address does not matter,

Note Hardware ACLs will permit access unless explicitly denied by an ACL action.

Examples To add an ACL filter entry to block IP traffic from network `2001:0db8::0/64` to the hardware IPv6 access-list named `my-acl`, use the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list my-acl
awplus(config-ipv6-hw-acl)# deny ipv6 2001:0db8::0/64
```

To remove an ACL filter entry that blocks all IPv6 traffic from network `2001:0db8::0/64` from the hardware IPv6 access-list named `my-acl`, use the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list my-acl
awplus(config-ipv6-hw-acl)# no deny ipv6 2001:0db8::0/64
```

Validation Commands show ipv6 access-list (IPv6 Hardware ACLs)

Related Commands ipv6 access-list (named)
(ipv6 access-list named ICMP filter)
(ipv6 access-list named TCP UDP filter)
ipv6 traffic-filter
show ipv6 access-list (IPv6 Hardware ACLs)

(ipv6 access-list named TCP UDP filter)

Use this ACL filter to add a filter entry for an IPv6 source and destination address and prefix, with TCP (Transmission Control Protocol) or UDP (User Datagram Protocol) source and destination ports specified, to the current named IPv6 access-list. If a sequence number is specified, the new entry is inserted at the specified location. Otherwise, the new entry is added at the end of the access-list.

Note that specifying the send-to-cpu parameter could result in EPSR healthcheck messages and other control packets being dropped.

The no variant of this command removes a filter entry for an IPv6 source and destination address and prefix, with TCP or UDP source and destination ports specified, from the current named IPv6 access-list. You can specify the filter entry for removal by entering either its sequence number, or its filter entry profile.

Syntax

```
[<sequence-number>]
   {deny|permit|send-to-cpu|copy-to-cpu|copy-to-mirror} {tcp|udp}
   {<ipv6-source-prefix/prefix-length>|
   <ipv6-source-address> <ipv6-source-wildcard>|
   host <ipv6-source-host>|any}
   {eq <sourceport>|lt <sourceport>|gt <sourceport>|ne <sourceport>}|
   [range <start-range> <end-range>]
   {<ipv6-destination-prefix/prefix-length>|
   <ipv6-destination-address> <ipv6-destination-wildcard>|
   host <ipv6-destination-host>|any}
   {[eq <destport>|lt <destport>|gt <destport>|ne <destport>}
   [range <start-range> <end-range>]

no {deny|permit|send-to-cpu|copy-to-cpu|copy-to-mirror} {tcp|udp}
   {<ipv6-source-prefix/prefix-length>|
   <ipv6-source-address> <ipv6-source-wildcard>|
   host <ipv6-source-host>|any}
   {eq <sourceport>|lt <sourceport>|gt <sourceport>|ne <sourceport>}|
   [range <start-range> <end-range>]
   {<ipv6-destination-prefix/prefix-length>|
   <ipv6-destination-address> <ipv6-destination-wildcard>
   |host <ipv6-destination-host>|any}
   {eq <destport>|lt <destport>|gt <destport>|ne <destport>}|
   [range <start-range> <end-range>]

no <sequence-number>
```

Parameter	Description
<sequence-number>	<1-65535> *The sequence number for the filter entry of the selected access control list.*
deny	Specify packets to reject.
permit	Specifies the packets to permit.
send-to-cpu	Specifies the packets to send to the CPU. Specifying this parameter could result in EPSR healthcheck messages and other control packets being dropped.
copy-to-cpu	Specifies the packets to copy to the CPU.
copy-to-mirror	Specifies the packets to copy to the mirror port.
tcp	Specifies a TCP packet.

Parameter(cont.)	Description(cont.)
udp	Specifies a UDP packet.
<ipv6-source-prefix/ prefix-length>	Specifies the source address with mask. The IPv6 address prefix uses the format X:X::/prefix-length. The prefix-length is usually set between 0 and 64, or has the value 128.
<ipv6-source-address>	Specifies the source address. The IPv6 address uses the format X:X::X:X.
<ipv6-source-wildcard>	Specifies the Source Wildcard bits in IPv6 format X:X::X:X.
host *<ipv6-source-host>*	Specifies the a single source host. The IPv6 address uses the format X:X::X:X.
any	Specifies any Source host. An abbreviation for the IPv6 prefix *::/0*.
eq	Equal to.
lt	Less than.
gt	Greater than.
ne	Not equal to.
<sourceport>	The source port number, specified as an integer between 0 and 65535.
<destport>	The destination port number, specified as an integer between 0 and 65535.
range	Range of port numbers. Match only packets within range.
<start-range>	The port number at the start of the range *<0-65535>*.
<end-range>	The port number at the end of the range *<0-65535>*.
<ipv6-dest-prefix/ prefix-length>	Specify destination address with mask. The IPv6 address prefix uses the format X:X::/prefix-length. The prefix-length is usually set between 0 and 64, or has the value 128.
<ipv6-destination-address>	Specify destination address. The IPv6 address uses the format X:X::X:X.
<ipv6-destination-wildcard>	Specify destination wildcard bits in IPv6 format X:X::X:X .
host *<ipv6-destination-host>*	Specify a single destination host address. The IPv6 address uses the format X:X::X:X.
any	Specifies any destination host. An abbreviation for the IPv6 prefix ::/0.

Parameter(cont.)	Description(cont.)
`vlan`	This parameter can be used in either single or double-tagged VLAN networks. It is the conventional VLAN tag (VID). In a double-tagged network it is sometimes referred to as the STAG.
<1-4094>	The VLAN VID.

Mode IPv6 Hardware ACL Configuration

Default Any traffic on an interface controlled by a hardware ACL that does not explicate match a filter is permitted.

Usage The filter entry will match on any TCP or UDP packet that has the specified source and destination IPv6 addresses and TCP or UDP type. The parameter `any` may be specified if an address does not matter.

Note Hardware ACLs will permit access unless explicitly denied by an ACL action.

Example To add an ACL filter entry that blocks all SSH traffic from network `2001:0db8::0/64` to the hardware IPv6 access-list named `my-acl`, use the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list my-acl
awplus(config-ipv6-hw-acl)# deny tcp 2001:0db8::0/64 any eq 22
```

To add an ACL filter entry that blocks all SSH traffic from network `2001:0db8::0/64` on the default VLAN (`vlan1`) to the hardware IPv6 access-list named `my-acl`, use the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list my-acl
awplus(config-ipv6-hw-acl)# deny tcp 2001:0db8::0/64 any eq 22
vlan 1
```

To remove an ACL filter entry that blocks all SSH traffic from network `2001:0db8::0/64` from the hardware IPv6 access-list named `my-acl`, use the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list my-acl
awplus(config-ipv6-hw-acl)# no deny tcp 2001:0db8::0/64 any eq
22
```

Validation Commands show ipv6 access-list (IPv6 Hardware ACLs)

Related Commands

ipv6 access-list (named)
(ipv6 access-list named ICMP filter)
(ipv6 access-list named protocol filter)
ipv6 traffic-filter
show ipv6 access-list (IPv6 Hardware ACLs)

ipv6 traffic-filter

This command adds an IPv6 hardware-based access-list to an interface. The number of access-lists that can be added is determined by the amount of available space in the hardware-based packet classification tables. You can apply an IPv6 hardware access-list to all ports or selected ports.

Use the no variant of this command to remove an IPv6 hardware-based access-list from an interface. You can remove an IPv6 hardware access-list from all ports or selected ports as required.

Syntax

```
ipv6 traffic-filter <ipv6-access-list-name>
no ipv6 traffic-filter <ipv6-access-list-name>
```

Parameter	Description
<ipv6-access-list-name>	Hardware IPv6 access-list name.

Mode Interface Configuration (to apply an IPv6 hardware ACL to a specific switch port) and Global Configuration (to apply an IPv6 hardware ACL to all of the switch ports)

Usage This command adds an IPv6 hardware-based access-list to an interface. The number of access-lists that can be added is determined by the amount of available space in the hardware-based packet classification tables.

To apply the access-list to all ports on the switch, execute the command in the Global Configuration mode. To apply the access-list to a Layer 2 interface or Layer 2 interface range, apply the command in the Interface Configuration mode. See the examples for each mode below.

Examples To add access-list `acl1` as a traffic-filter to all ports on the switch, enter the commands:

```
awplus# configure terminal
awplus(config)# ipv6 traffic-filter acl1
```

To add access-list `acl1` as a traffic-filter to interface `port1.0.1`, enter the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# ipv6 traffic-filter acl1
```

To remove access-list `acl1` as a traffic-filter from all ports on the switch, enter the commands:

```
awplus# configure terminal
awplus(config)# no ipv6 traffic-filter acl1
```

To remove access-list `acl1` as a traffic-filter from interface `port1.0.1`, enter the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# no ipv6 traffic-filter acl1
```

Related Commands

ipv6 access-list (named)
(ipv6 access-list named ICMP filter)
(ipv6 access-list named protocol filter)
(ipv6 access-list named TCP UDP filter)
ipv6 traffic-filter
show ipv6 access-list (IPv6 Hardware ACLs)

show ipv6 access-list (IPv6 Hardware ACLs)

Use this command to display all configured hardware IPv6 access-lists or the IPv6 access-list specified by name. Omitting the optional access-list name parameter will display all IPv6 ACLs.

Use the show ipv6 access-list standard command to display the IPv6 access-list specified by name as defined from the ipv6 access-list (named) command.

Syntax

```
show ipv6 access-list [<access-list-name>]
show ipv6 access-list standard [<access-list-name>]
```

Parameter	Description
standard	Named standard access-list.
<access-list-name>	Hardware IPv6 access-list name.

Mode User Exec and Privileged Exec

Example To show the standard named ipv6 access-list acl_name use the following command:

```
awplus# show ipv6 access-list standard acl_name
```

Output Figure 58-1: Example output from the **show ipv6 access-list standard** command

```
Named Standard IPv6 access-list acl_name
  deny any
```

Example To show all configured ipv6 access-lists use the command:

```
awplus# show ipv6 access-list
```

Output Figure 58-2: Example output from the **show ipv6 access-list** command

```
IPv6 access-list deny_icmp
  deny icmp any any vlan 1

IPv6 access-list deny_ssh
  deny tcp abcd::0/64 any eq 22
```

Related Commands
ipv6 access-list (named)
(ipv6 access-list named ICMP filter)
(ipv6 access-list named protocol filter)
(ipv6 access-list named TCP UDP filter)
ipv6 traffic-filter

Chapter 59: IPv6 Software Access Control List (ACL) Commands

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Introduction

This chapter provides an alphabetical reference for the IPv6 Software Access Control List (ACL) commands, and contains detailed command information and command examples about IPv6 software ACLs as applied to Routing and Multicasting, which are not applied to interfaces.

Note

See Chapter 55, Access Control Lists Introduction for descriptions of ACLs, and for further information about rules when applying ACLs see the ACL Rules section.

See ACL Filter Sequence Numbers and ACL Filter Sequence Number Behavior sections in Chapter 55, Access Control Lists Introduction about ACL Filters.

See all relevant Routing commands and configurations in "Layer Three, Switching and Routing" and all relevant Multicast commands and configurations in "Multicast Applications".

To apply ACLs to an LACP channel group, apply it to all the individual switch ports in the channel group. To apply ACLs to a static channel group, apply it to the static channel group itself. For more information on link aggregation see Chapter 20, Link Aggregation Introduction and Configuration, and Chapter 21, Link Aggregation Commands.

Note that text in parenthesis in command names indicates usage not keyword entry. For example, ipv6-access-list (named) indicates named IPv6 ACLs entered as `ipv6-access-list <name>` where `<name>` is a placeholder not a keyword.

Note also that parenthesis surrounding ACL filters indicates the type of ACL filter not the keyword entry in the CLI, such as (ipv6 access-list standard IPv6 filter) represents command entry in the format shown in the syntax `[<sequence-number>] {deny|permit} {<IPv6-source-address/prefix-length>|any}`.

Note

Software ACLs will deny access unless explicitly permitted by an ACL action.

IPv6 Software Access List Commands and Prompts

Many of the ACL commands operate from sub-modes that are specific to particular ACL types. The table "IPv6 Software Access List Commands and Prompts" shows the CLI prompts at which ACL commands are entered.

Table 59-1: IPv6 Software Access List Commands and Prompts

Command Name	Command Mode	Prompt
show ipv6 access-list (IPv6 Software ACLs)	Privileged Exec	`awplus#`
ipv6 access-list extended (named)	Global Configuration	`awplus(config)#`
ipv6 access-list standard (named)	Global Configuration	`awplus(config)#`
(ipv6 access-list extended IP protocol filter)	IPv6 Extended ACL Configuration	`awplus(config-ipv6-ext-acl)#`
(ipv6 access-list extended TCP UDP filter)	IPv6 Extended ACL Configuration	`awplus(config-ipv6-ext-acl)#`
(ipv6 access-list standard filter)	IPv6 Standard ACL Configuration	`awplus(config-ipv6-std-acl)#`

Command List

ipv6 access-list extended (named)

Use this command when configuring an IPv6 extended access-list for filtering frames that permit or deny IP, ICMP, TCP, UDP packets or ICMP packets with a specific value based on the source or destination.

The no variant of this command removes a specified IPv6 extended access-list.

Syntax [list-name]

```
ipv6 access-list extended <list-name>

no ipv6 access-list extended <list-name>
```

Parameter	Description
<list-name>	A user-defined name for the IPv6 software extended access-list.

Syntax [any|icmp|ip]

```
ipv6 access-list extended <list-name>
   {deny|permit} {any|icmp|ip}
   {<ipv6-source-address/prefix-length>|any}
   {<ipv6-destination-address/prefix-length>|any}
   [<icmp-type <icmp-type>][log]

no ipv6 access-list extended <list-name>
   {deny|permit} {any|icmp|ip}
   {<ipv6-source-address/prefix-length>|any}
   {<ipv6-destination-address/prefix-length>|any}
   [<icmp-type <icmp-type>][log]
```

Syntax [tcp|udp]

```
ipv6 access-list extended <list-name>
   {deny|permit} {tcp|udp}
   {<ipv6-source-address/prefix-length>|any}
   {eq <sourceport>|lt <sourceport>|gt <sourceport>|ne <sourceport>}
   {<ipv6-destination-address/prefix-length>|any}
   {eq <destport>|lt <destport>|gt <destport>|ne <destport>}
   [log]

no ipv6 access-list extended <list-name> {deny|permit} {tcp|udp}
   {<ipv6-source-address/prefix-length>|any}
   {eq <sourceport>|lt <sourceport>|gt <sourceport>|ne <sourceport>}
   {<ipv6-destination-addr/prefix-length>|any}
   {eq <destport>|lt <destport>|gt <destport>|ne <destport>}
   [log]
```

Parameter	Description
<list-name>	A user-defined name for the IPv6 software extended access-list.
deny	The IPv6 software extended access-list rejects packets that match the type, source, and destination filtering specified with this command.
permit	The IPv6 software extended access-list permits packets that match the type, source, and destination filtering specified with this command.

Parameter(cont.)	**Description**(cont.)
`any`	For ICMP|IP The IPv6 software extended access-list matches any type of packet.
`ip`	For ICMP|IP The IPv6 software extended access-list matches only IP packets.
`icmp`	For ICMP|IP The IPv6 software extended access-list matches only ICMP packets.
`tcp`	For TCP/UDP The IPv6 software extended access-list matches only TCP packets.
`udp`	For TCP/UDP The IPv6 software extended access-list matches only UDP packets.
<ipv6-source-address/prefix-length>	Specifies a source address and prefix length. The IPv6 address prefix uses the format X:X::/prefix-length. The prefix-length is usually set between 0 and 64, or has the value 128.
<ipv6-destination-address/prefix-length>	Specifies a destination address and prefix length. The IPv6 address uses the format X:X::X:X/Prefix-Length. The prefix-length is usually set between 0 and 64, or has the value 128.
`any`	Matches any IPv6 address.
<sourceport>	For TCP/UDP The source port number, specified as an integer between 0 and 65535.
<destport>	For TCP/UDP The destination port number, specified as an integer between 0 and 65535.
`icmp-type`	For ICMP|IP Matches only a specified type of ICMP messages. This is valid only when the filtering is set to match ICMP packets.
`eq`	For TCP/UDP Matches port numbers equal to the port number specified immediately after this parameter.
`lt`	For TCP/UDP Matches port numbers less than the port number specified immediately after this parameter.
`gt`	For TCP/UDP Matches port numbers greater than the port number specified immediately after this parameter.
`ne`	For TCP/UDP Matches port numbers not equal to the port number specified immediately after this parameter.

Parameter(cont.)	**Description**(cont.)	
<icmp-type>	For ICMP|IP The ICMP type, as defined in RFC792 and RFC950. Specify one of the following integers to create a filter for the ICMP message type:	
	0	Echo replies.
	3	Destination unreachable messages.
	4	Source quench messages.
	5	Redirect (change route) messages.
	8	Echo requests.
	11	Time exceeded messages.
	12	Parameter problem messages.
	13	Timestamp requests.
	14	Timestamp replies.
	15	Information requests.
	16	Information replies.
	17	Address mask requests.
	18	Address mask replies.
`log`	Logs the results.	

Mode Global Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage Use IPv6 extended access-lists to control the transmission of IPv6 packets on an interface, and restrict the content of routing updates. The switch stops checking the IPv6 extended access-list when a match is encountered.

For backwards compatibility you can either create IPv6 extended access-lists from within this command, or you can enter `ipv6 access-list extended` followed by only the IPv6 extended access-list name. This latter (and preferred) method moves you to the `(config-ipv6-ext-acl)` prompt for the selected IPv6 extended access-list number, and from here you can configure the filters for this selected access-list.

Note Software ACLs will deny access unless explicitly permitted by an ACL action.

Example 1 [creating a list]

To add a new filter to the access-list named `my-list` that will reject incoming ICMP packets from `2001:0db8::0/64` to `2001:0db8::f/64`, use the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list extended my-list
awplus(config-ipv6-ext-acl)# icmp 2001:0db8::0/64 2001:0db8::f/64
```

Example 2 [adding to a list]

To insert a new filter at sequence number `5` of the access-list named `my-list` that will accept ICMP type 8 packets from the `2001:0db8::0/64` network to the `2001:0db8::f/64` network, use the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list extended my-list
awplus(config-ipv6-ext-acl)# 5 icmp 2001:0db8::0/64
2001:0db8::f/64
```

Example 3 [list with filter]

To create the access-list named `TK` to deny TCP protocols, use the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list extended TK deny tcp any eq
14 any lt 12 log
```

Related Commands

ipv6 access-list extended proto
(ipv6 access-list extended IP protocol filter)
(ipv6 access-list extended TCP UDP filter)
show ipv6 access-list (IPv6 Software ACLs)
show running-config

ipv6 access-list extended proto

Use this command when configuring an IPv6 extended access-list for filtering frames that permit or deny packets with a specific value based on the IP protocol number specified.

The no variant of this command removes a specified IPv6 extended access-list with an IP protocol number.

Syntax

```
ipv6 access-list extended <list-name>
    {deny|permit} proto <ip-protocol>}
    {<ipv6-source-address/prefix>|any}
    {<ipv6-destination-address/prefix>|any} [log]

no ipv6 access-list extended <list-name>
    {deny|permit} proto <ip-protocol>
    {<ipv6-source-address/prefix>|any}
    {<ipv6-destination-address/prefix>|any} [log]
```

Parameter	Description
<list-name>	A user-defined name for the IPv6 software extended access-list.
deny	Specifies the packets to reject.
permit	Specifies the packets to accept.
proto	The IP Protocol type specified by it protocol number <1-255>.
<ip-protocol>	The IP protocol number, as defined by IANA (Internet Assigned Numbers Authority http://www.iana.org/assignments/protocol-numbers).

Protocol	Number
1	
2	
3	
4	
5	
6	
8	

Parameter(cont.)	Description(cont.)
<ip-protocol> (cont.)	**Protocol Number** 9
	11
	17
	20
	27
	28
	29
	30
	33
	48
	50
	51
	54
	58
	59
	60
	88
	89
	97
	98
	108
	112
	134
	135
	136
	137
	138
	139-252
	253
	254
	255
<ipv6-source-address/prefix>	IPv6 source address, or local address. The IPv6 address uses the format X:X::X:X/Prefix-Length. The prefix-length is usually set between 0 and 64, or has the value 128.
any	Any source address or local address.

Parameter(cont.)	Description(cont.)
<ipv6-destination-address/prefix>	IPv6 destination address, or local address. The IPv6 address uses the format X:X::X:X/Prefix-Length. The prefix-length is usually set between 0 and 64, or has the value 128.
`any`	Any destination address or remote address.
`log`	Log the results.

Mode Global Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage Use IPv6 extended access-lists to control the transmission of IPv6 packets on an interface, and restrict the content of routing updates. The switch stops checking the IPv6 extended access-list when a match is encountered.

The filter entry will match on any IP protocol type packet that has the specified source and destination IPv6 addresses and the specified IP protocol type. The parameter `any` may be specified if an address does not matter.

Note Software ACLs will deny access unless explicitly permitted by an ACL action.

Examples To create the IPv6 access-list named `ACL-1` to deny IP protocol `9` packets from `2001:0db8:1::1/128` to `2001:0db8:f::1/128`, use the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list extended ACL-1 deny proto 9
2001:0db8:1::1/128 2001:0db8:f::1/128
```

To remove the IPv6 access-list named `ACL-1` to deny IP protocol `9` packets from `2001:0db8:1::1/128` to `2001:0db8:f::1/128`, use the commands:

```
awplus# configure terminal
awplus(config)# no ipv6 access-list extended ACL-1 deny proto
10 2001:0db8:1::1/128 2001:0db8:f::1/128
```

Related Commands ipv6 access-list extended (named)
(ipv6 access-list extended IP protocol filter)
show ipv6 access-list (IPv6 Software ACLs)
show running-config

(ipv6 access-list extended IP protocol filter)

Use this ACL filter to add a filter entry for an IPv6 source and destination address and prefix, with or without an IP protocol specified, to the current extended IPv6 access-list. If a sequence is specified, the new entry is inserted at the specified location. Otherwise, the new entry is added at the end of the access-list.

The no variant of this command removes a filter entry for an IPv6 source and destination address and prefix, with or without an IP protocol filter entry, from the current extended IPv6 access-list. You can specify the ACL filter entry by entering either its sequence number, or its filter entry profile.

Syntax [ip|proto]

```
[<sequence-number>]
   {deny|permit} {ip|any|proto <ip-protocol>}
   {<ipv6-source-address/prefix>|any}
   {<ipv6-destination-address/prefix>|any} [log]

no {deny|permit} {ip|any|proto <ip-protocol>}
   {<ipv6-source-address/prefix>|any}
   {<ipv6-destination-address/prefix>|any} [log]

no [<sequence-number>]
```

Parameter	Description
<sequence-number>	<1-65535> The sequence number for the filter entry of the selected access control list.
deny	Specifies the packets to reject.
permit	Specifies the packets to accept.
ip	IP packet.
any	Any packet.
proto *<ip-protocol>*	The IP Protocol type specified by it protocol number <1-255>.
<ip-protocol>	The IP protocol number, as defined by IANA (Internet Assigned Numbers Authority http://www.iana.org/assignments/protocol-numbers).

Protocol	Number
1	
2	
3	
4	
5	
6	
8	

Parameter(cont.)	Description(cont.)
<ip-protocol> (cont.)	**Protocol Number** 9
	11
	17
	20
	27
	28
	29
	30
	33
	48
	50
	51
	54
	58
	59
	60
	88
	89
	97
	98
	108
	112
	134
	135
	136
	137
	138
	139-252
	253
	254
	255
<ipv6-source-address/prefix>	IPv6 source address, or local address. The IPv6 address uses the format X:X::X:X/Prefix-Length. The prefix-length is usually set between 0 and 64, or has the value 128.
any	Any source address or local address.

Parameter(cont.)	Description(cont.)
<ipv6-destination-address/prefix>	IPv6 destination address, or local address. The IPv6 address uses the format X:X::X:X/Prefix-Length. The prefix-length is usually set between 0 and 64, or has the value 128.
`any`	Any destination address or remote address.
`log`	Log the results.

Mode IPv6 Extended ACL Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage The filter entry will match on any IP protocol type packet that has the specified source and destination IPv6 addresses and the specified IP protocol type. The parameter `any` may be specified if an address does not matter.

Note Software ACLs will deny access unless explicitly permitted by an ACL action.

Examples To add a new ACL filter entry to the extended IPv6 access-list named `my-list` with sequence number `5` rejecting the IPv6 packet from `2001:db8:1:1` to `2001:db8:f:1`, use the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list extended my-list
awplus(config-ipv6-ext-acl)# 5 deny ip 2001:db8:1::1/128
2001:db8:f::1/128
```

To remove the ACL filter entry to the extended IPv6 access-list named `my-list` with sequence number `5`, use the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list extended my-list
awplus(config-ipv6-ext-acl)# no 5
```

Related Commands
ipv6 access-list extended (named)
show ipv6 access-list (IPv6 Software ACLs)
show running-config

(ipv6 access-list extended TCP UDP filter)

Use this ACL filter to add a filter entry for an IPv6 source and destination address and prefix, with a TCP (Transmission Control Protocol) or UDP (User Datagram Protocol) source and destination port specified, to the current extended IPv6 access-list. If a sequence number is specified, the new entry is inserted at the specified location. Otherwise, the new entry is added at the end of the access-list.

The no variant of this command removes a filter entry for an IPv6 source and destination address and prefix, with a TCP or UDP source and destination port specified, from the current extended IPv6 access-list. You can specify the filter entry for removal by entering either its sequence number, or its filter entry profile.

Syntax [tcp|udp]

```
[<sequence-number>] {deny|permit} {tcp|udp}
    {<ipv6-source-address/prefix>|any}
    {eq <sourceport>|lt <sourceport>|gt <sourceport>|ne <sourceport>}
    {<IPv6-destination-address/prefix>|any}
    {eq <destport>|lt <destport>|gt <destport>|ne <destport>} [log]

no {deny|permit} {tcp|udp}
    {<ipv6-source-address/prefix>|any}
    {eq <sourceport>|lt <sourceport>|gt <sourceport>|ne <sourceport>}}
    {<IPv6-destination-address/prefix>|any}
    {eq <destport>|lt <destport>|gt <destport>|ne <destport>} [log]

no <sequence-number>
```

Parameter	Description
<sequence-number>	<1-65535> The sequence number for the filter entry of the selected access control list.
deny	Specifies the packets to reject.
permit	Specifies the packets to accept.
tcp	TCP packet.
udp	UDP packet.
<ipv6-source-address/prefix>	IPv6 source address, or local address. The IPv6 address uses the format X:X::X:X/Prefix-Length. The prefix-length is usually set between 0 and 64, or has the value 128.
any	Any source address or local address.
eq	Equal to.
lt	Less than.
gt	Greater than.
ne	Not equal to.
<sourceport>	The source port number, specified as an integer between 0 and 65535.

Parameter(cont.)	Description(cont.)
<ipv6-destination-address/prefix>	IPv6 destination address, or local address. The IPv6 address uses the format X:X::X:X/Prefix-Length. The prefix-length is usually set between 0 and 64, or has the value 128.
<destport>	The destination port number, specified as an integer between 0 and 65535.
`log`	Log the results.

Mode IPv6 Extended ACL Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage The filter entry will match on any packet that has the specified source and destination IPv6 addresses and the specified TCP or UDP source and destination port. The parameter `any` may be specified if an address does not matter.

Note Software ACLs will deny access unless explicitly permitted by an ACL action.

Examples To add a new filter entry with sequence number `5` to the access-list named `my-list` to reject TCP packets from `2001:0db8::0/64` port `10` to `2001:0db8::f/64` port `20`, use the following commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list extended my-list
awplus(config-ipv6-ext-acl)# 5 deny tcp 2001:0db8::0/64 eq 10
                             2001:0db8::f/64 eq 20
```

To add a new filter entry with sequence number `5` to the extended IPv6 access-list named `my-list` to reject UDP packets from `2001:0db8::0/64` port `10` to `2001:0db8::f/64` port `20`, use the following commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list extended my-list
awplus(config-ipv6-ext-acl)# 5 deny udp 2001:0db8::0/64 eq 10
                             2001:0db8::f/64 eq 20
```

To remove the filter entry with sequence number `5` to the extended IPv6 access-list named `my-list`, use the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list extended my-list
awplus(config-ipv6-ext-acl)# no 5
```

Related Commands

ipv6 access-list extended (named)
show ipv6 access-list (IPv6 Software ACLs)
show running-config

ipv6 access-list standard (named)

This command configures an IPv6 standard access-list for filtering frames that permit or deny IPv6 packets from a specific source IPv6 address.

The no variant of this command removes a specified IPv6 standard access-list.

Syntax [list-name]

```
ipv6 access-list standard <ipv6-acl-list-name>

no ipv6 access-list standard <ipv6-acl-list-name>
```

Parameter	Description
<*ipv6-acl-list-name*>	A user-defined name for the IPv6 software standard access-list.

Syntax [deny|permit]

```
ipv6 access-list standard <ipv6-acl-list-name>
    [{deny|permit}
    {<ipv6-source-address/prefix-length>|any}
    [exact-match]]

no ipv6 access-list standard <ipv6-acl-list-name>
    [{deny|permit}
    {<ipv6-source-address/prefix-length>|any}
    [exact-match]]
```

Parameter	Description
<*ipv6-acl-list-name*>	A user-defined name for the IPv6 software standard access-list.
`deny`	The IPv6 software standard access-list rejects packets that match the type, source, and destination filtering specified with this command.
`permit`	The IPv6 software standard access-list permits packets that match the type, source, and destination filtering specified with this command.
<*ipv6-source-address/prefix-length*>	Specifies a source address and prefix length. The IPv6 address prefix uses the format X:X::/prefix-length. The prefix-length is usually set between 0 and 64, or has the value 128.
`any`	Matches any source IPv6 address.
`exact-match`	Exact match of the prefixes.

Mode Global Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage Use IPv6 standard access-lists to control the transmission of IPv6 packets on an interface, and restrict the content of routing updates. The switch stops checking the IPv6 standard access-list when a match is encountered.

For backwards compatibility you can either create IPv6 standard access-lists from within this command, or you can enter `ipv6 access-list standard` followed by only the IPv6 standard access-list name. This latter (and preferred) method moves you to the `(config-ipv6-std-acl)` prompt for the selected IPv6 standard access-list, and from here you can configure the filters for this selected IPv6 standard access-list.

Note Software ACLs will deny access unless explicitly permitted by an ACL action.

Example To enter the IPv6 Standard ACL Configuration mode for the access-list named `my-list`, use the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list standard my-list
awplus(config-ipv6-std-acl)#
```

Related Commands
(ipv6 access-list standard filter)
show ipv6 access-list (IPv6 Software ACLs)
show running-config

(ipv6 access-list standard filter)

Use this ACL filter to add a filter entry for an IPv6 source address and prefix length to the current standard IPv6 access-list. If a sequence number is specified, the new entry is inserted at the specified location. Otherwise, the new entry is added at the end of the access-list.

The no variant of this command removes a filter entry for an IPv6 source address and prefix from the current standard IPv6 access-list. You can specify the filter entry for removal by entering either its sequence number, or its filter entry profile.

Syntax [icmp]

```
[<sequence-number>] {deny|permit}
    {<ipv6-source-address/prefix-length>|any}

no {deny|permit}
    {<ipv6-source-address/prefix-length>|any}

no <sequence-number>
```

Parameter	Description
<sequence-number>	<1-65535> The sequence number for the filter entry of the selected access control list.
deny	Specifies the packets to reject.
permit	Specifies the packets to accept.
<ipv6-source-address/prefix-length>	IPv6 source address and prefix-length in the form X:X::X:X/P.
any	Any IPv6 source host address.

Mode IPv6 Standard ACL Configuration

Default Any traffic controlled by a software ACL that does not explicitly match a filter is denied.

Usage The filter entry will match on any IPv6 packet that has the specified IPv6 source address and prefix length. The parameter `any` may be specified if an address does not matter.

Note Software ACLs will deny access unless explicitly permitted by an ACL action.

Examples To add an ACL filter entry with sequence number `5` that will deny any IPv6 packets to the standard IPv6 access-list named `my-list`, enter the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list standard my-list
awplus(config-ipv6-std-acl)# 5 deny any
```

To remove the ACL filter entry that will deny any IPv6 packets from the standard IPv6 access-list named `my-list`, enter the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list standard my-list
awplus(config-ipv6-std-acl)# no deny any
```

Alternately, to remove the ACL filter entry with sequence number `5` to the standard IPv6 access-list named `my-list`, enter the commands:

```
awplus# configure terminal
awplus(config)# ipv6 access-list standard my-list
awplus(config-ipv6-std-acl)# no 5
```

Related Commands

ipv6 access-list standard (named)
show ipv6 access-list (IPv6 Software ACLs)
show running-config

show ipv6 access-list (IPv6 Software ACLs)

Use this command to display all configured IPv6 access-lists or the IPv6 access-list specified by name. Omitting the optional access-list name parameter placeholder will display all IPv6 ACLs.

Use the show ipv6 access-list standard command to display a specified standard named IPv6 access-list that has been defined using the ipv6 access-list standard (named) command.

Syntax

```
show ipv6 access-list [<access-list-name>]
show ipv6 access-list standard <access-list-name>
```

Parameter	Description
`standard`	Named standard access-list.
<access-list-name>	Specify an IPv6 access-list name.

Mode User Exec and Privileged Exec

Example To show the ipv6 access-list specified with the name `acl_name` use the following command:

```
awplus# show ipv6 access-list standard acl_name
```

Output Figure 59-1: Example output from the **show ipv6 access-list** command

```
Named Standard IPv6 access-list name
  deny any
```

Example To show all configured IPv6 access-lists use the following command:

```
awplus# show ipv6 access-list
```

Output Figure 59-2: Example output from the **show ipv6 access-list** command

```
IPv6 access-list deny_icmp
  deny icmp any any vlan 1

IPv6 access-list deny_ssh
  deny tcp abcd::0/64 any eq 22
```

Related Commands
ipv6 access-list extended (named)
(ipv6 access-list extended IP protocol filter)
(ipv6 access-list extended TCP UDP filter)
ipv6 access-list standard (named)
(ipv6 access-list standard filter)

Chapter 60: Quality of Service (QoS) Introduction

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Introduction

This chapter introduces the concept of Quality of Service (QoS) with particular reference to Allied Telesis switches running the AlliedWare Plus™ Operating System. For additional information on using QoS on AT switches see, *How To Configure QoS on x900-24, x900-12, and SwitchBlade x908 Series Switches*. This How To Note is available from http://www.alliedtelesis.com.

The concept of QoS is a departure from the original networking concept of treating all network traffic in the same way. Without QoS, all traffic types are equally likely to be dropped when a link becomes oversubscribed. With QoS, certain traffic types can be given preferential treatment. QoS is therefore a very useful tool both to control congestion and to meter or cap data in order to apply pre-agreed service levels.

Operationally, QoS is applied within the link and network layers. Functionally it provides the capability to intelligently transport your network traffic in order to provide stable and predictable end-to-end network performance.

Business benefits

Quality of Service mechanisms enable:

- network service providers to sell different levels of service to customers, based on what their customers require, and be confident in their ability to guarantee the reliable delivery of these services
- enterprise and educational organizations to actively manage and provide many services across one network, for example live video streaming and standard data services, with preferential treatment being given to mission-critical traffic
- network administrators to manage network congestion as network traffic levels increase and time-critical applications, such as streaming media, become more widely in demand by customers and organizations

QoS Operations

Quality of Service is typically based on how the switch performs the following functions:

- assigns priority to incoming frames (that do not already carry priority information)
- correlates prioritized frames with traffic classes, or maps frames to traffic classes based on other criteria
- correlates traffic classes with egress queues, or maps prioritized frames to egress queues
- provides minimum and maximum bandwidths for traffic classes, egress queues, and/or ports
- schedules frames in egress queues for transmission (for example, empty queues in strict priority or sample each queue)
- re-labels the priority of outgoing frames
- determines which frames to drop or re-queue if the network becomes congested
- reserves memory for switching/routing or QoS operation (for example, reserving buffers for egress queues or buffers to store packets with particular characteristics)

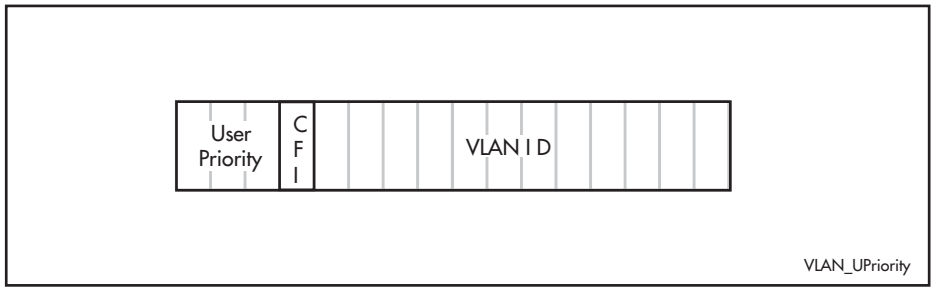
QoS Packet Information

Provision for QoS information to be embedded within the data fields exists within both the data link and network layer protocols. This information can then be used to assess the priority of the data and the resource preferences that need to be applied. The process of applying these service quality tags to your data is known as marking.

Link Layer QoS

Link layer frames entering a port may either be tagged or untagged. VLAN tagged frames contain the additional 802.1Q tag fields shown in Figure 60-1 below. Located within the TCI is a three bit User Priority field. This field is specifically provided to attach QoS based priority information, often referred to as the Class of Service (CoS) field.

Figure 60-1: IEEE 802.1Q Tagging



Appendix G of the IEEE Standard 802.1D provides some useful guidelines on applying priorities to 7 traffic types: These are summarized in the Table 60-1 below:

Table 60-1: CoS Traffic Mapping Guidelines

User Priority	Traffic Types
1	Background
2	Spare
0	Best Effort
3	Excellent Effort
4	Controlled Load
5	Video <100 ms latency and jitter
6	Voice <10 ms latency and jitter
7	Network Control

On the switch you can use the match cos command to select frames that match a particular User Priority value and assign them to a particular class-map. You can then map these incoming frames to one of eight egress queues. This facility enables you to accept frames that are already carrying meaningful priority information and automatically assign them to an appropriate egress queue. For example, you could decide to send frames with a User Priority value of 7 to queue 3, and frames with a User Priority value of 2 to queue 7. The process of assigning queues based on CoS tags is commonly known as “PreMarking”.

Note You configure the pre-marking steps to an ingress port. This process marks the data packets so that when they reach the egress port the decisions made during pre-marking can be applied in accordance with the configuration of the egress port.

Application with VLAN double tagging

Note that if you are using VLAN double tagging, you could use the match cos command to set the individual QoS requirements *within* each client network and also separately within the provider network. You can then use the match inner-cos command to apply particular "*client*" QoS requirements that you want to apply within the provider network. This process applies two levels of QoS within the provider network; one that operates specifically for the network provider, and another that is specific for traffic belonging to selected clients. See "VLAN Double Tagging (VLAN Stacking)" on page 16.5.

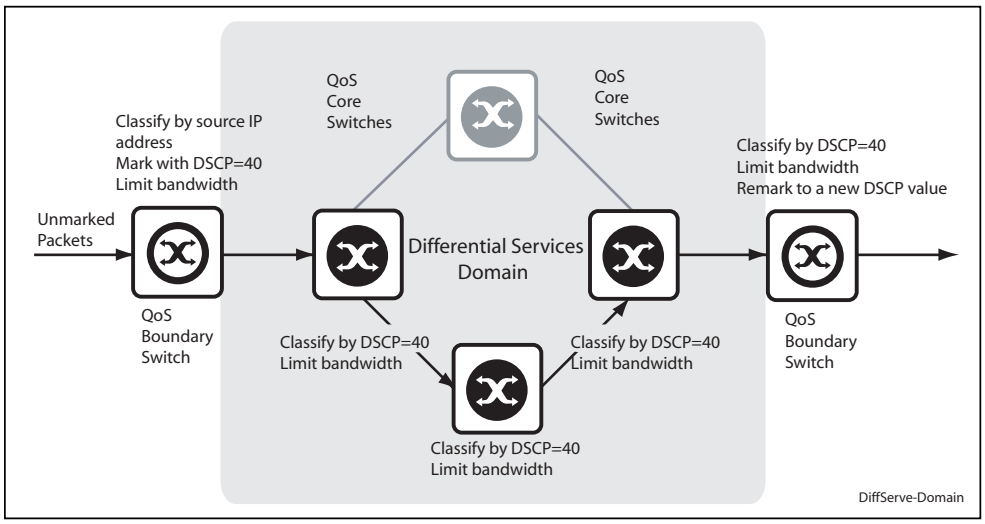
At the network layer IPv4 packets contain an 8 bit field specifically to carry QoS information. This field, defined in RFC 1349, was originally named the Type of Service (ToS) field and contained a *ToS* component and a *Precedence* component. The ToS field however, has since been replaced by the Differentiated Services field.

Differentiated Services Architecture

Whilst a full description of the differential services model is outside the scope of this software reference, a brief introduction is provided. For further information, RFC 2475 provides an in depth definition of the architecture.

The basic differential services model envisages a multi router network within which common service qualities are applied. At the network boundary, *QoS Edge Routers* inspect the traffic and classify it into common service quality groups called Per Hop Behaviors (PHBs). A specific marker value called a Differential Services Code Point (DSCP) is added to the IP header of each packet, which allocates it to a PHB. *QoS Core Routers* within the network can then use the DSCP to decide on an appropriate service quality level to apply. When a network contains a consistently applied differential services code points DSCP it is referred as a Differential Services Domain (often shortened to DiffServe Domain). Figure 60-2 shows a simple Differential Services Domain.

Figure 60-2: Differentiated Services Domain

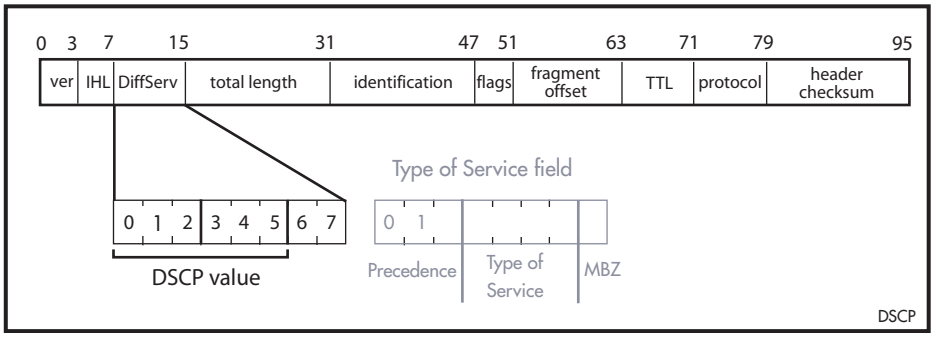


The Differential Services Field

Figure 60-3 shows an IP header containing a Differentiated Services field. The format of this redefined field is explained in RFC 2474; the main difference being that the old ToS field has been replaced by a 6 byte Differentiated Services Code Point (DSCP) field, which now provides for up to 64 defined values.

By applying this model only the QoS edge routers need to fully interrogate the incoming data packets; the QoS core routers are then relieved of this processing task and need only to inspect the DCSP before applying its appropriate forwarding, queueing, and shaping rules.

Figure 60-3: The DSCP bits of the DS field in the IPv4 header



On the switch you can use the match inner-vlan command to select frames containing a particular DSCP value, and associate them with a particular class map and policy map.

You can then use the set queue command to directly map these incoming frames to one of eight egress queues. This facility enables you to accept frames that are already carrying meaningful priority information to be automatically assigned to an appropriate egress queue. For example, you could decide to send frames with a User Priority value of 7 to queue 3, and frames with a User Priority value of 2 to queue 7.

Because the model offers considerable flexibility, and the mapping of traffic types to DCSPs is individual for each network, this locally applied definition is known as a *Differential Services Domain*. The previous section introduced the concept of a Per Hop (service quality) Behaviors or PHBs. RFC 2597 defines a specific PHB group called Assured Forwarding (AF). The AF PHB group provides delivery of IP packets in four independently forwarded AF classes. Within each AF class, an IP packet can be assigned one of three different levels of drop precedence. Table 60-2 shows a list of recommended AF code points.

Table 60-2: Recommended DSCP Code Points

	(Lowest Priority) **Class 1 (001xxxx)**	**Class 2 (010xxxx)**	**Class 3 (011xxxx)**	(Highest Priority) **Class 4 (100xxxx)**
Low Drop Precedence	001010 AF11 Decimal 10	010010 AF21 Decimal 18	011010 AF31 Decimal 26	100010 AF41 Decimal 34
Medium Drop Precedence	001100 AF12 Decimal 12	010100 AF22 Decimal 20	011100 AF32 Decimal 28	100100 AF42 Decimal 36
High Drop Precedence	001110 AF13 Decimal 14	010110 AF23 Decimal 22	011110 AF33 Decimal 30	100110 AF43 Decimal 38

Processing pre-marked packets

A logical question to ask at this point is; how does the QoS switch deal with data that arrives with a pre-existing service level tag such as a DSCP? As previously touched on, the differentiated services model envisages a network that comprises QoS boundary routers at its edge and QoS core routers in its core network.

At the network edge the QoS boundary routers filter the incoming data based on specific packet components. Based on this filtering each packet is assigned a DSCP value. This value will determine the service level - priority, queueing etc - that will be applied.

Within the network core, the packet filtering required is reduced to simply reading the DSCP within each incoming packet, and applying the appropriate set of service levels. This relieves the core routers of the processing overhead of applying complex filtering to its high speed data streams.

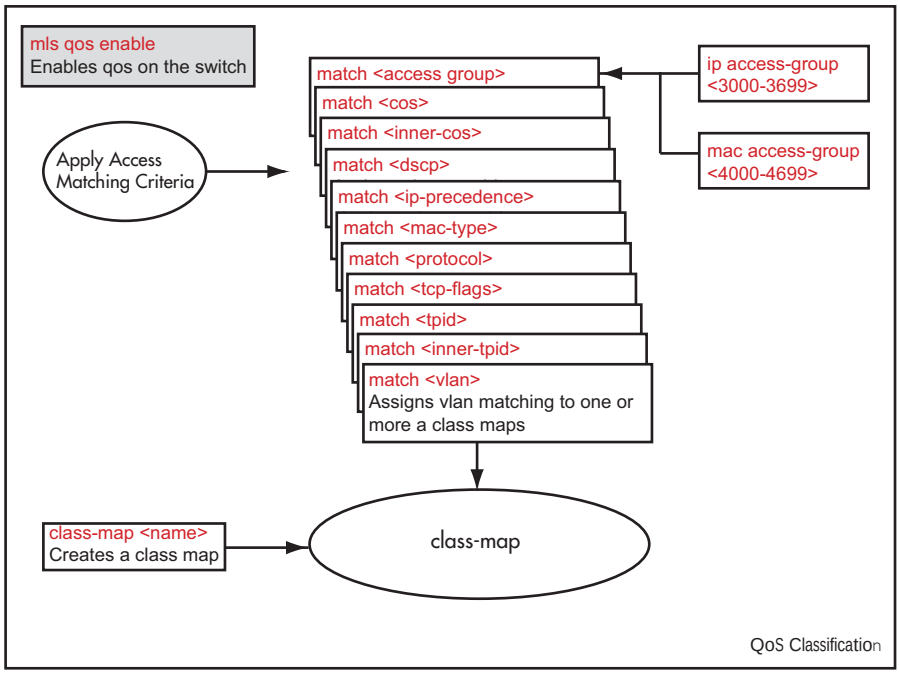
Applying QoS on Your Switch

This section steps you through the various stages of QoS set-up and introduces the QoS commands and how to apply them. Note that before you can configure any QoS functions on your switch, you must first enable QoS by using the mls qos enable command.

Classifying your Data

One of the early steps in setting up QoS on a network is planning and applying your classification rules. Classification is the process of Filtering and Marking. Filtering involves sorting your data into appropriate traffic types. Marking involves tagging the data so that downstream ports and routers can apply appropriate service policy rules. This process is known as premarking. Figure 60-4 illustrates the classifying process, and will be referred to in the examples that follow.

Figure 60-4: QoS Classification Process



At the premarking stage you can assign your data a particular priority level by giving it a link level user priority, see “Link Layer QoS” on page 60.3, or a network level DSCP “Differentiated Services Architecture” on page 60.4. You can also assign the data to a particular output (or egress) queue.

Class Maps

Class Maps are among the pivotal QoS components. They provide the means that associate the classified traffic with its appropriate QoS actions. They are the linking elements for the following functions:

- classification
- policy mapping
- aggregate policing and metering
- pre-marking

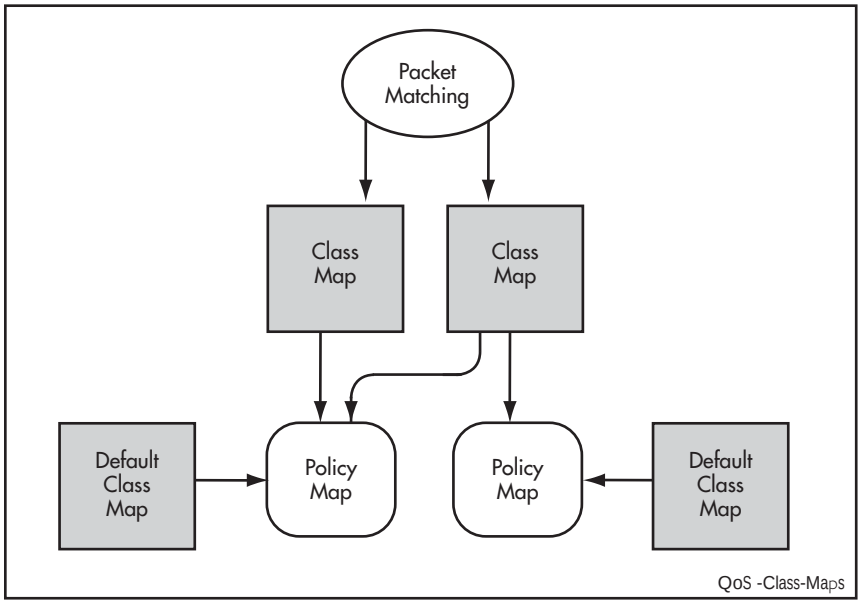
Figure 60-5 shows the relationship between a class-map and its associated functions. Note that the relationship between a class-map and a policy-map can be one-to-one or many-to-one. For information on policy-maps see the section, "Policy Maps" on page 60.10.

Note

If a conflict occurs between the settings in two class maps, priority will be applied to the class map that was created first.

An example of such a conflict is the arrival of a packet that meets the classification requirements of two class maps each configured to the same policy map and set to apply different priority settings to the packet.

Figure 60-5: Relationship between a class map and its associated functions



Creating a class-map

To create a class map, use the class-map command on page 61.4.

This example creates a class-map called `video-traffic` and another called `data-traffic`:

```
awplus# configure terminal
awplus(config)# class-map video-traffic
awplus(config-cmap)# exit
awplus(config)# class-map data-traffic
awplus(config-cmap)#
```

Creating and configuring default class-maps

These (automatically created) default class-maps serve as the means to specify the action that will apply to all unclassified data, i.e. all data within a policy-map that is not captured by any of the applied match commands that are applied to the policy-map by its class-maps.

Each time a new policy-map is created a new class map called "default" is also automatically created and assigned to the new policy map. You can configure any of the default class maps by using the default-action command on page 61.6

To set the default class-map for the policy-map `p-map1` to have the action of `deny`:

```
awplus# config
awplus(config)# policy-map p-map1
awplus(config-pmap)# default-action deny
```

Applying a match command to a class-map

To apply a matching filter to a class map use one of the match commands.

This example creates a filter to select VLAN 5 traffic and applies this filter to the class map named `video-traffic`.

```
awplus# config terminal
awplus(config)# class-map video-traffic
awplus(config-cmap)# match vlan 5
```

Associating a class-map with a policy-map

To associate a class map with a policy map, use the class command on page 61.3.

Note A maximum of 128 class maps may be attached to each policy map.

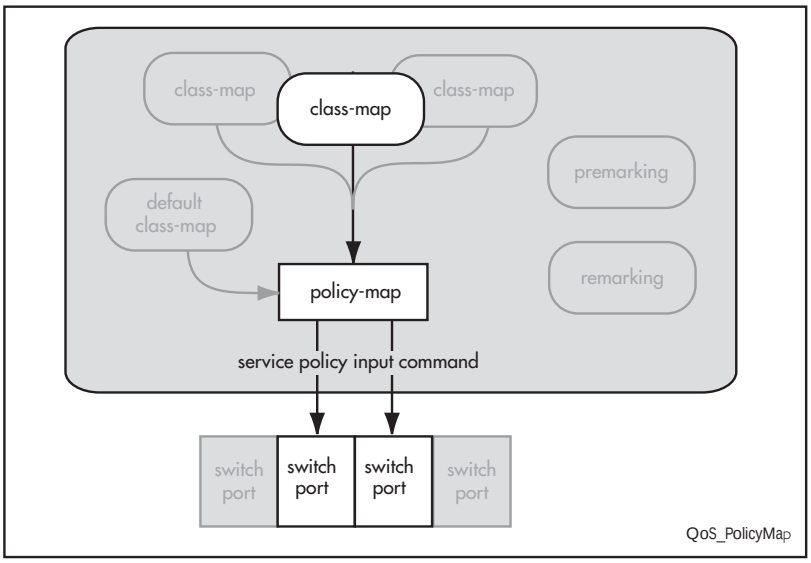
The following example creates a policy map called `policy-one`, and associates it with the class-maps named `video-traffic`, and `database-traffic`:

```
awplus# configure terminal
awplus(config)# policy-map policy-one
awplus(config-pmap)# class video-traffic
awplus(config-pmap-c)# exit
awplus(config-pmap)# class database-traffic
awplus(config-pmap-c)#
```

Policy Maps

Policy maps are the means by which you apply your class-map properties to physical switch ports. Figure 60-8 on page 60.17 illustrates this concept. Note that whilst a policy map can be assigned to several ports, a port cannot have more than one policy-map assigned to it.

Figure 60-6: Policy Maps and Related Entities



To create and name a new policy map you use the policy-map command on page 61.53.

To create a policy-map called `pmap1` use the commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap1
```

Having created the policy map `pmap1` we can use the class command on page 61.3 to assign it to one or more class maps. Since we created the class-maps `video-traffic` and `office-traffic` earlier in this chapter, we can now attach the policy-map `pmap1` to both class-maps.

Use the class command to assign the policy map `pmap1` to the class-maps `video-traffic` and `office-traffic`:

```
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class video-traffic
awplus(config-pmap-c)# exit
awplus(config-pmap)# class office-traffic
awplus(config-pmap-c)#
```

Premarking Your Traffic

Premarking relates to adding QoS markers to your incoming data traffic before it is metered (policed). Network switches will often be configured with two different premarking profiles, one for the QoS edge switches and another for the QoS core switches. This situation would apply if you are operating DSCP domains.

QoS markers can be applied at both the link layer (within the CoS field), and at the network layer (within the DSCP field). For more information on this topic see "QoS Packet Information" on page 60.3.

For boundary QoS switches

Traffic entering QoS boundary switches is unlikely to contain pre-existing QoS tagging. In this case, you can apply one or more of the following QoS mapping options.

- Assign an output queue to data associated with a particular class-map, using the set queue command, and apply it to the input (ingress) port.
- Assign a CoS tag to data associated with a particular class-map using the set cos command. You can then map the CoS tag to an output (egress) port queue (using the mls qos map cos-queue to command).
- Assign a DSCP tag to data associated with a particular class-map using the set dscp command. Alternatively, you can use the trust dscp (XEM-2XP) command to map the DSCP tag to an egress port queue, a CoS value, or both. At the premarking stage you can set this mapping using the mls qos map premark-dscp to command. After policing, you can then use the remarking command mls qos map policed-dscp to in order to reassign a particular DSCP to a specific egress queue, CoS value, or both.

When no other mapping is set, all traffic is sent to the queue that is set by the mls qos queue command. If this command is unset (i.e. in the absence of any other queue selection) and the packet is untagged, traffic will be sent to queue 2.

For core QoS switches

Traffic entering ports within the QoS core network will almost certainly contain some pre-existing QoS tagging. Where this is the case, you can apply one of the following QoS mapping options.

- Map the CoS tag to an egress queue. You can do this either for the whole switch or for specific ports via their assigned policy-maps. See "CoS to egress queue premarking" on page 60.11.
- Map the DSCP tag to an output queue. You can do this either for the whole switch or for specific ports via their assigned policy-maps. When no other mapping is set, all traffic is sent to the queue that is set by the mls qos queue command.
- Remap incoming data DSCP or CoS tags to values that are more appropriate for a particular switch or network.
- Assign bandwidth classes for your packets, based on the incoming DSCP. See Setting the Trust DSCP Map command on page 60.14.

CoS to egress queue premarking

If you are using CoS tagging for your QoS functions, your traffic is likely to be either entering the switch with a pre existing CoS tag, or will have appropriate tags attached via your class-maps and policy-maps. You can now mark the data for a particular egress queue, which will take effect when the data reaches its output port. There are two fundamental methods of applying CoS tagged packets to egress queues:

1. Apply a global mapping of CoS tags to egress queues for all ports.

2. Apply a CoS to egress queue mapping for the class-map / policy-map. This mapping - which forms part of the policy map - is applied at an input port, but will take effect at the packet's destination output port. Note that this procedure takes priority over that described in method (1) above.

These methods and their related commands will be now be described in greater detail.

CoS tagging commands

Three commands can be used set or change the CoS tag mapping. Table 60-3 shows the commands that can set or change the CoS tag within a packet.

Table 60-3: CoS Mapping Commands in Hierarchical Order

Command	Function
set cos	Assigns a CoS tag to a particular class-map / policy map.
mls qos map premark-dscp to	Where a packet contains CoS tag and a DSCP tags. The table set by this command contains a configurable DSCP to CoS tag mapping.
mls qos map policed-dscp to	Finally, the remarking function applied by this command can remap all previously set CoS tagging.

Where a packet entering a port contains a pre-existing DSCP, You can use the command mls qos map policed-dscp to change the following components, DSCP tag, CoS tag, bandwidth class.

Note

Where a packet contains both a CoS and a DSCP field, and each field maps to a different class-map; the switch will apply a priority based on the creation date of the class maps to which they apply - the earlier the creation date, the higher the priority

Mapping CoS tags to traffic types

The command mls qos map cos-queue to, enables you to create a switch-wide mapping of CoS values to egress queues. The default mappings for this command are:

```
COS :            0 1 2 3 4 5 6 7
--------------------------------
QUEUE:           2 0 1 3 4 5 6 7
```

These mappings match the CoS guidelines documented in Annex H.2 of ANSI/IEEE 802.1D 1988 Edition. Table H-15 on page 355 of the standard, shows a table of user priorities for specific traffic types. Table 60-4 shows an adapted version of the ANSI/IEEE table.

Table 60-4: Traffic Type Guidelines

User Priority (egress queue)	CoS Value	Acronym	Traffic type	Internal Traffic Queue Defaults
0 (lowest)	1	BK	Background	
1	2	-	Spare	
2	0	BE	Best Effort	Default
3	3	EE	Excellent Effort	

Table 60-4: Traffic Type Guidelines(cont.)

User Priority (egress queue)	CoS Value	Acronym	Traffic type	Internal Traffic Queue Defaults
4	4	CL	Controlled Load	
5	5	VI	"Video," <100 ms latency and jitter	
6	6	VO	"Voice," <10 ms latency and jitter	EPSR-Management BPDU ARP-Requests
7 (highest)	7	NC	Network Control	Stack Management

CoS settings for VCStack stack operation

In general you can apply the same principles when configuring QoS on a VCStack as you would for single switch; however there are a few specific changes that you will need to make.

Switches within a VCStack, exchange their stack management information and user data over their high speed inter-stacking links. The stack management information is pre-assigned to the egress queue 7. This is the highest value queue, and (in a stacked configuration) its traffic should not be shared with any user data. However, any CoS tagging of 7 applied to the incoming data will automatically be assign to queue 7 as it crosses the internal stacking links. You will therefore need to reconfigure your CoS to Queue settings to ensure that no user data is sent to queue 7.

To prevent this from happening, we recommend that you make appropriate changes to your queue settings (mappings) to reflect the stacking requirement previously described. For more information on this topic, see "Mapping CoS tags to traffic types" on page 60.12.

This process should include (but not be limited to) running the following command to ensure that any remaining user still carrying a CoS 7 tag, will be mapped to egress queue 6.

To remap priority CoS traffic to egress queue 6, run the following command.

```
awplus# config terminal
awplus(config)# mls qos map cos-queue 7 to 6
```

DSCP to egress queue premarking

If you are using DSCP tagging for your QoS functions, your traffic is likely to be entering the switch either with a pre existing DSCP tag, or will have appropriate DSCP tags attached via your class-maps and policy-maps. You can now mark the data for a particular egress queue, which will take effect when the data reaches its output port.

If your switch forms part of a DSCP domain, you can adapt the steps in this section to apply the mappings and settings to match the standards you have selected for the domain. This mapping - which forms part of the policy map - is applied at an input port, but will take effect at the packet's destination output port.

DSCP to egress queue premarking commands

A number of commands can be used for mapping DSCP tags. Where these conflict, the switch applies a pre-defined set of priorities. Table 60-5 lists these priorities in order (lowest priority first).

Where a packet that contains both CoS and a DSCP fields and each field maps to a different class-map / policy-map, the switch will apply a priority based on the creation date of class maps - the earlier the creation date, the higher the priority priorities.

Table 60-5: DSCP Mapping Commands in Hierarchical Order

Command	Function
mls qos map policed-dscp to	This remarking function can remap previously set dscp values and queue selections.
set dscp	With the trust dscp set, this command will change the dscp value in the packet.
mls qos map premark-dscp to	With the trust dscp set, this command applies a remapping table whose values include the dscp and egress queues.
mls qos queue	Sets a default egress queue for each individual port (or range of ports) on the switch.

If no overriding commands have been configured, and there is no CoS value in the packet, then the default setting of the mls qos queue command will send all data out via its port's egress queue 2. You can use the mls qos queue command to reset the egress queue for each port on the switch. If the packet does contain a CoS tag value, then this queue will be that shown in the mapping in the section "Mapping CoS tags to traffic types" on page 60.12.

Setting the Trust DSCP Map

The Trust DSCP mapping table assigns a new set of QoS values for a DSCP value supplied as table input. To configure this table you use the mls qos map premark-dscp to command.

Table 60-6: Drop Probability Table

Table Input	---------- Table Output ----------			
Existing DSCP	New DSCP Value	New CoS Value	New Queue No	New BW Class green yellow red

The Trust DSCP map provides the highest priority of all the pre-marking controls. To apply this table you must first apply the trust setting by using the trust dscp or trust dscp (XEM-2XP) commands.

At this point the DSCP input to the table will be that existing in the incoming packet. However, by setting the set dscp command you can change the DSCP for all packets within the specified class-map or policy-map (for XEM-2XP) specified. Note, that with the trust DSCP set, the DSCP value that is used for table lookup will depend on the applied port's platform type:

- on switch ports belonging to a XEM-2XP lookup is on the DSCP of the incoming packet.
- on switch ports other than the XEM-2XP, lookup is on either the DSCP of the incoming packet, or the DSCP applied to the selected class-map (i.e. that set by the set dscp command).

Policing (Metering) Your Data

Once you have set-up your classification and created your class-maps, you can start conditioning your traffic flows. One tool used for traffic conditioning is the policer (or meter). The principle of policing is to measure the data flow that matches the definitions for a particular class-map; then, by selecting appropriate data rates, allocate the flows into one of three categories: Red, Yellow, or Green. You then decide what action to apply to the Red, Yellow and Green data.

Two metering types can be configured from the mls qos aggregate-police action command on page 61.23, these types are:

- single-rate three-color
- twin-rate three-color

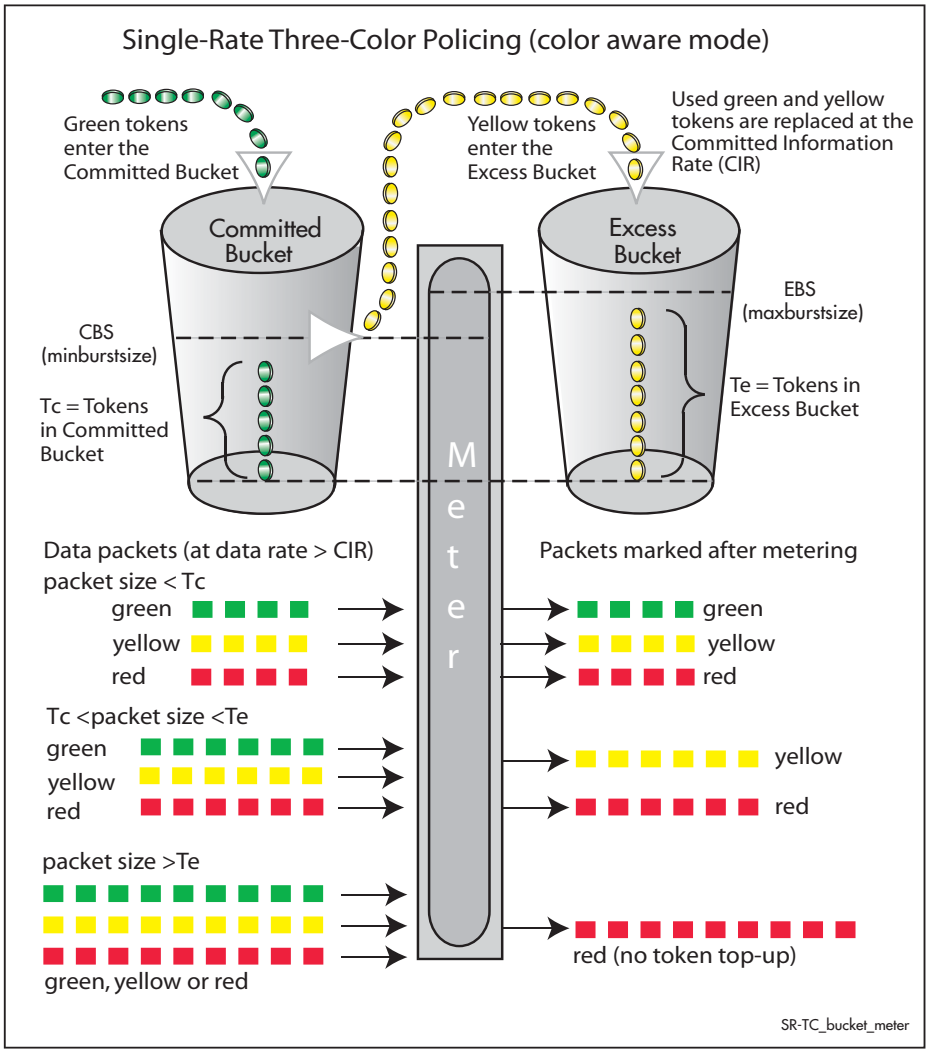
Note that the although the color marking process is carried out on the input port (on ingress), the egress port can also use this color marking to modify its output data flows. The meter operates in the color aware mode; however the premarker that precedes it senses all input data as being green. Note that all external data entering a switch port is considered to be marked green. This means that unless you have re-colored your data at the premarking stage - by using the set bandwidth-class command on page 61.56 - the data entering the meter will be green.

The metering levels, CIR, CBS etc are defined within a policer. This class-map (along with others) is then added to a policy-map, which in turn is attached to a port.

Single-rate Three-color Policing

This policing method is based on that defined in RFC 2697. The principle of single-rate three-color policing is shown in Figure 60-7. For a given class-map, a meter monitors both the token count in the buckets, and the input data flow.

Figure 60-7: Single-rate Three-color Policing



Each byte entering the meter is paired with a token in one of the buckets, and a token is removed as each byte is accepted. If the input data rate is the same as the CIR then the data passes through the port at the same rate as its bucket fills. Hence the bucket level remains constant. In this model, the data buffer is represented by two data buckets. You can specify the CIR using the police single-rate action command.

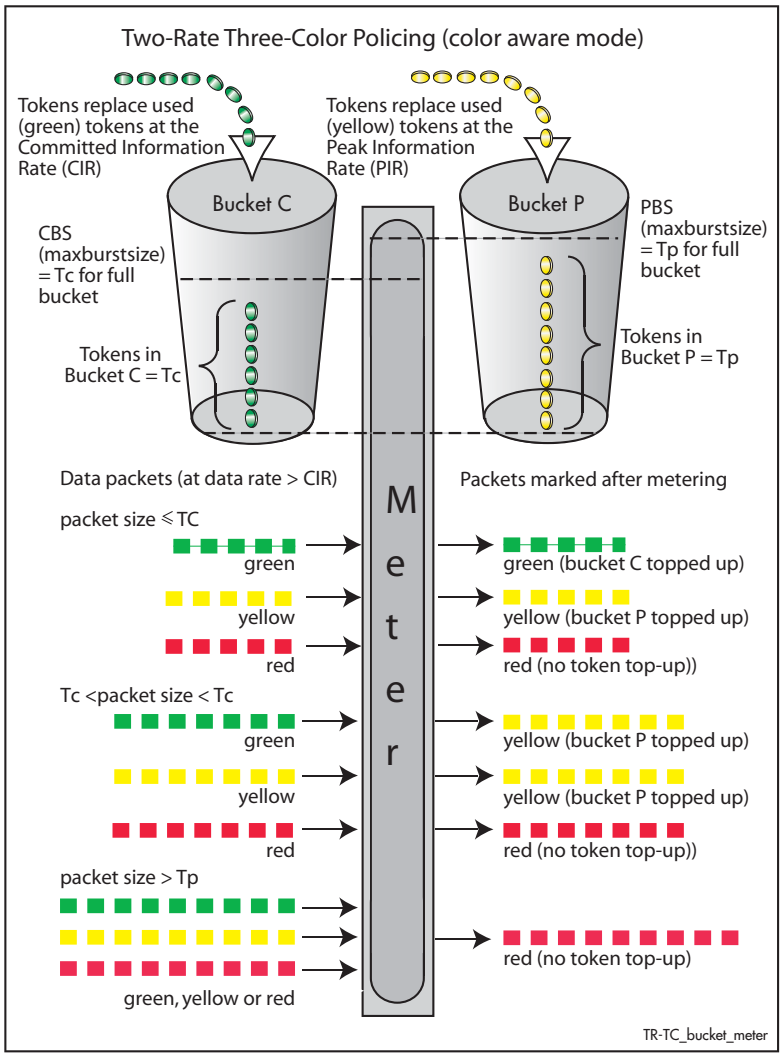
Initially both buckets have their full token count. A surge of date exceeding the CIR will begin to empty the bucket. As the data and tokens are paired, data bytes that match tokens below the CBS level are marked green, those that are between CBS and EBS will be marked yellow, and those that are above EBS are marked red.

Note that although the data is metered per byte, the color marking process is applied per packet. This means that if there were only sufficient tokens available to match part of a packet, then the whole packet would be marked red. Then, depending on the action parameter of the police single-rate action command, the whole packet will be either dropped or forwarded. In either situation, the red marked packet will leave the bucket counts unchanged.

Two-rate Three-color Policing

This policing method is based on that defined in RFC 2698. The principle of two-rate three-color policing is shown in Figure 60-8.

Figure 60-8: Two-rate Three-color Policer



For a given class-map, the meter monitors the token count in both buckets, and the input data flow. Initially tokens enter both buckets until full. As the data enters a port, the meter pairs each byte to a token in one of the buckets, then removes a token from the appropriate bucket. Bucket C is topped up with tokens at the Committed Information Rate (CIR), and bucket P is topped up at the Peak Information Rate (PIR).

When data enters the port at the CIR, the bucket fills at the same rate as the incoming data, thus the token count in bucket C remains constant. Similarly, if data enters the port at the PIR, then the token count in bucket P remains constant. You can specify the CIR and the PIR by using either the police twin-rate action command or the mls qos aggregate-police action command. The function of each of these commands is explained in the section "Configuring and Applying a Policer" on page 60.18.

A surge of data exceeding the CIR will begin to empty bucket C. If bucket C empties to a point where it has insufficient tokens to match to an incoming data packet, then the data packet will be marked yellow. The data will now be measured against the level in bucket P and tokens will be removed from this bucket to match the incoming data. If the incoming data rate drops to less than the CIR then the data will continue to be marked yellow until the level in bucket C has had a chance to fill, whereupon it will be marked *green*.

If the incoming data is greater than the PIR, then bucket P begins to empty. If bucket P empties to a point where it has insufficient tokens to match to an incoming data packet, then the data packet will be marked *red*. In this situation no tokens are removed from either bucket.

Note that although the data is metered per byte, the color marking process is applied per packet. This means that if there were only sufficient tokens available to match part of a packet, then the whole packet would be marked red. Then, depending on the action parameter of the police twin-rate action command, the whole packet will be either dropped, or marked and forwarded. In either situation, the red marked packet will leave the bucket counts unchanged.

Configuring and Applying a Policer

The previous section showed how the policer works and how to select either the single rate or twin rate action. There are two methods to apply a policy to class maps.

1. Select your policy-map and class-map from the command prompt, then enter either the police single-rate action command or the police twin-rate action command whilst selecting the appropriate command parameters.

   This will apply the command to the selected class-map. By running this command several times, each for a different class-map, you can apply separate meter settings to each class-map.

2. Use the mls qos aggregate-police action to create a “named” aggregate policer whilst selecting the appropriate command parameters. Once you have done this, you can use the police-aggregate command to apply the aggregator to the policy-map and class-map selected from the command prompt. Note that you cannot apply an aggregate policer to a class map that has already been attached to a policer by using either the police single-rate action, or the police twin-rate action commands.

The main difference between these two methods is that you use method (1) to apply policing to a number of class-maps, each having its own individually configured meter settings; whereas you use method (2) to apply policing to a number of class-maps and police them all using a single meter setting.

Note A set of class-maps that contribute traffic into a given aggregate policer can belong to different policy-maps. This means that the aggregate policer can meter packets destined for different egress ports.

Remarking Your Data

The remarking process enables you to change the QoS tagging and queue assignments etc from data that has already been marked by the policer. To do this you fill entries in the remarking table by using the mls qos map policed-dscp to command on page 61.32. In order to remark your data ensure that the action parameter of either the police single-rate action or the police twin-rate action is set to policed-dscp-transmit.

The following table shows the remarking options

Table 60-7: Remarking Options

Existing DSCP	BANDWIDTH CLASS		
	Green	Yellow	Red
DSCP value in the packet leaving the meter	New value for DSCP New value for CoS Tag New bandwidth class (Red, Yellow, or Green) New value for egress queue	New value for DSCP New value for CoS Tag New bandwidth class (Red, Yellow, or Green) New value for egress queue	New value for DSCP New value for CoS Tag New bandwidth class (Red, Yellow, or Green) New value for egress queue

Example Traffic whose existing DSCP value is 15 and has its data marked either Green, Yellow or Red is to be remarked to have its existing policed green traffic tagged as follows:

- new DSCP of 20
- new CoS of 3
- new queue of 4
- new bandwidth class of yellow

Table 60-8: Remarking Table Example

DSCP	BANDWIDTH CLASS		
	Green	Yellow	Red
Existing dscp = 1	Remapping for DSCP 1	Remapping for DSCP 1	Remapping for DSCP 1
. . .	Remapping for DSCPs 2 to 14	Remapping for DSCPs 2 to 14	Remapping for DSCPs 2 to 14
Existing dscp =15	New DSCP = 20 New CoS Tag = 3 New bandwidth class = Yellow New egress queue = 4		
. . .	Remapping for DSCPs 2 to 62	Remapping for DSCPs 2 to 62	Remapping for DSCPs 2 to 62
Existing dscp = 63	Remapping for DSCP 63	Remapping for DSCP 63	Remapping for DSCP 63

To configure this setting, you would enter the following commands:

```
awplus# config terminal

awplus(config)# mls qos map policed-dscp 15 bandwidth-class
green to new-dscp 20 new-cos 3 new-queue 4
new-bandwidth-class yellow
```

Configuring the Egress Queues

Previous sections have explained the ingress functions. These include, how the incoming data can be classified and marked according to its priority and allocated to an egress queue, then finally how metering and remarking is applied. At this point the data then flows across the switch to its destination egress port where its transit to the egress queues is controlled.

The means by which data is applied to the egress queues is dependant on three functions:

- Egress queue and QoS markers that are set within each data packet
- Egress controls that are applied to the whole switch
- Egress that are applied to each individual switch port

Fabric queues - The Internal Paths

Although the internal hardware functions of the switch are outside the scope of this manual, the section, "QoS and the Switching Fabric" on page 60.34 provides some background information to help you understand and use the mls qos fabric-queue command. Basically, the internal path that links the fabric adaptors terminates in four fabric queues. These queues schedule the data between the internal fabric adaptors and each port's egress queue.

The mls qos fabric-queue command, mentioned above, enables you to select the scheduling algorithm to be either strict priority, or weighted round robin (WRR). Use the show mls qos fabric-queue to see the present settings on your switch.

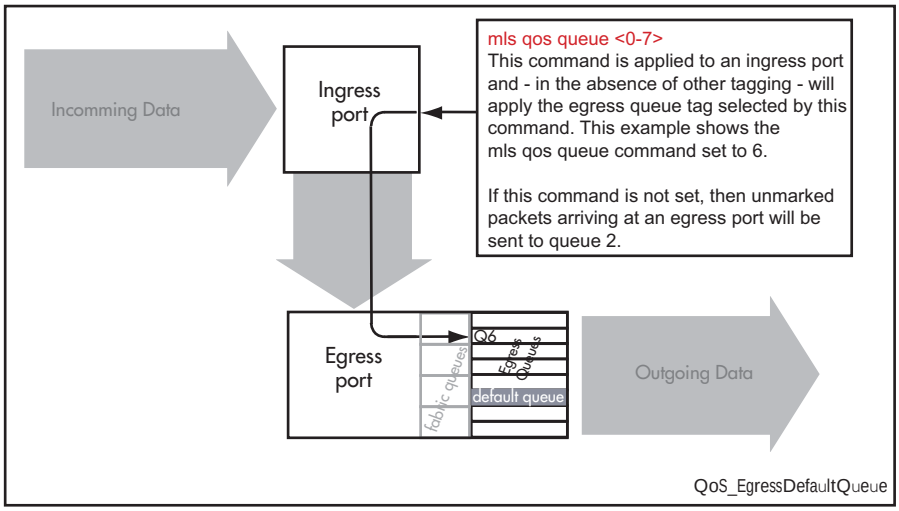
The mls qos fabric-queue command enables you to map the egress queues to 4 internal processor fabric queues. The commands section provides more information such as their default settings and how to reconfigure them.

Egress Queues and QoS markers

Once the data packets have been appropriately filtered, classified, policed, and remarked, they travel across the switch's internal paths carrying their assigned QoS tag markers such as their priority, class and destination queues. For more details on ingress data marking, refer to the earlier sections of this chapter. At the egress port these markers are read and used to determine which queues each data packet will be forwarded to, and the priorities that will be applied.

There are eight egress queues allocated to each egress port. The egress queue that a particular packet passes through is determined by either the configuration of the switch, or the markers contained within the packet itself.

Figure 60-9: Default Egress Queue



Egress Queue Commands Hierarchy

The destination queue that any one packet will take depends on the markers within the packet, and the way the queueing commands have been set. Also, some queueing commands will override others. Here is how the switch prioritizes its queueing commands.

Imagine a packet entering an ingress port then traveling through the switch fabric to reach its appropriate egress port. In this situation the following hierarchy will apply:

1. If the packet enters an egress port carrying no QoS markers and no QoS queueing commands have been set on the switch, then the packet will exit the port via queue number 2.

2. If the packet containing CoS marker arrives at an egress port, then with no other configuration applying, then its queue mapping will be subject to the setting of the mls qos map cos-queue to command.

3. Situations (1) and (2) can be overridden by the mls qos queue command. This command sets a default queue for each switch port.

4. If the set queue command has been applied to specific ports via its class-map / policy map combination, then the queue mapping of this command will override that set by the mls qos queue command for those specific ports.

5. If the trust dscp (XEM-2XP) then the egress queue assignment will be based on the entries in the mls qos map, which is set by the mls qos queue command. This mapping table will override all the previous commands in this list.

6. Finally all the above mappings may be modified by the remarker, by using the mls qos map policed-dscp to command.

Egress Queue Shaping

This section is concerned with how the egress queues are cleared. It does NOT apply to ports on the XEM-2XP module.

There are two aspects to queue shaping:

- Scheduling (strict priority or weighted round robin)
- Drop Mode (tail-drop or weighted early discard)

Scheduling

The scheduler determines how packets in the eight egress port queues are serviced. Two servicing methods can be applied:

- strict priority
- weighted round robin

Strict priority servicing

By default, all queues on all ports are serviced in a strict priority order. This means that the highest numbered priority queue (queue 7) is emptied first; then when it is completely empty, the next highest priority queue is processed, and so on. Thus, for a strict priority queue to be processed, all higher priority queues must be empty.

Strict priority servicing is the default setting; however if your system is configured for weighted round robin (WRR), you can return it to priority queueing by using the commands shown in the following example.

To return queue 3 of `port1.0.1` from WRR servicing to strict priority queueing, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# priority-queue 3
```

Weighted round robin servicing

Two round robin groups can be configured. Using this configuration, all packets in group 1 are serviced first, using the weights specified for the group 1 queues. Once all queues in group 1 are empty, the queues in group 2 are serviced using the weights specified for the group 2 queues. Note that if some queues on the port have also been configured for strict priority, the strict priority queues must be empty before the first weighted round robin group will be serviced.

Example To configure wrr-queue group 1 applying a weighting value of 6 to queues 0 1 2:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# wrr-queue group 1 weight 6 queues 0 1 2
```

Example To configure wrr-queue group 2 applying a weighting value of 12 to queues 3 4 5:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# wrr-queue group 2 weight 12 queues 3 4 5
```

Example In this example port 1.0.1 has queues configured as follows:

- queues 6 and 7 are configured strict priority
- queues 3, 4 and 5 are WRR group 1 with weighting values of 6, 6 and 12 respectively
- queues 0, 1 and 2 are WRR group 2 all with a weighting value of 6

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# priority-queue 6 7
awplus(config-if)# wrr-queue group 1 weight 6 queues 3 4
awplus(config-if)# wrr-queue group 1 weight 12 queues 5
awplus(config-if)# wrr-queue group 2 weight 6 queues 0 1 2
```

In this example, the queues are processed as follows:

1. Queue 7 is processed first.
2. If queue 7 is empty, Queue 6 is processed next.
3. If queues 6 and 7 are empty, queues 3, 4 and 5 are processed with a ratio of 1:1:2.
4. If queues 4 to 7 are empty, queues 0, 1 and 2 are processed with equal weighting.

Drop Mode

Note that this section does not apply to ports on the XEM-2XP

The drop mode sets the limits for packets in the eight egress queues and determines how packets will be dropped if the queues become congested. Two drop methods may be employed, these are:

- Tail Drop
- Weighted Random Early Discard (WRED)

For both the above methods there are 4 pre-existing queue-sets numbered 1-4. You can configure each queue-set with a separate drop mode profile for each of the 8 egress queues.

Your switch has 4 pre-existing queue-sets, one pre-configured for 1G ports and another for 10 G ports. These configurations are shown in Table 60-10 on page -26 and Table 60-11 on page -27. You can name and reconfigure these profiles and change the association of queue sets to switch ports. These steps are explained later in this section.

Note

The default drop mode operation is Tail Drop. In this situation the value set by the mls qos queue-set drop-probability command is ignored, and a drop value of 0 (i.e 100%) is internally applied. Also the value set for the minimum threshold is ignored, and the averaging factor is replaced by an instantaneous comparison of queue size with the maximum threshold figure (Maxth).

Figure 60-10: Queue-Set Defaults for 1G Ports

```
awplus#show mls qos queue-set

Queue Set 1:
Description: 1G Defaults

             BandwidthClass   Min           Max           Drop Probability
-------------------------------------------------------------------------
Queue 0     | Green            100 KB        125 KB        1 (50%)
            | Yellow           100 KB        125 KB        1 (50%)
            | Red              100 KB        125 KB        1 (50%)
-------------------------------------------------------------------------
Queue 1     | Green            100 KB        125 KB        1 (50%)
            | Yellow           100 KB        125 KB        1 (50%)
            | Red              100 KB        125 KB        1 (50%)
-------------------------------------------------------------------------
Queue 2     | Green            100 KB        125 KB        1 (50%)
            | Yellow           100 KB        125 KB        1 (50%)
            | Red              100 KB        125 KB        1 (50%)
-------------------------------------------------------------------------
Queue 3     | Green            100 KB        125 KB        1 (50%)
            | Yellow           100 KB        125 KB        1 (50%)
            | Red              100 KB        125 KB        1 (50%)
-------------------------------------------------------------------------
Queue 4     | Green            100 KB        125 KB        1 (50%)
            | Yellow           100 KB        125 KB        1 (50%)
            | Red              100 KB        125 KB        1 (50%)
-------------------------------------------------------------------------
Queue 5     | Green            100 KB        125 KB        1 (50%)
            | Yellow           100 KB        125 KB        1 (50%)
            | Red              100 KB        125 KB        1 (50%)
-------------------------------------------------------------------------
Queue 6     | Green            100 KB        125 KB        1 (50%)
            | Yellow           100 KB        125 KB        1 (50%)
            | Red              100 KB        125 KB        1 (50%)
-------------------------------------------------------------------------
Queue 7     | Green            100 KB        125 KB        1 (50%)
            | Yellow           100 KB        125 KB        1 (50%)
            | Red              100 KB        125 KB        1 (50%)
-------------------------------------------------------------------------

Queue Length Averaging Factor
  Queue 0: 9
  Queue 1: 9
  Queue 2: 9
  Queue 3: 9
  Queue 4: 9
  Queue 5: 9
  Queue 6: 9
  Queue 7: 9
```

Figure 60-11: Queue-Set Defaults for 10 G Ports

```
Queue Set 2:
Description: 10G Defaults

              BandwidthClass   Min            Max            Drop Probability
-------------------------------------------------------------------------------
Queue 0     | Green            1 MB           1 MB           1 (50%)
            | Yellow           1 MB           1 MB           1 (50%)
            | Red              1 MB           1 MB           1 (50%)
-------------------------------------------------------------------------------
Queue 1     | Green            1 MB           1 MB           1 (50%)
            | Yellow           1 MB           1 MB           1 (50%)
            | Red              1 MB           1 MB           1 (50%)
-------------------------------------------------------------------------------
Queue 2     | Green            1 MB           1 MB           1 (50%)
            | Yellow           1 MB           1 MB           1 (50%)
            | Red              1 MB           1 MB           1 (50%)
-------------------------------------------------------------------------------
Queue 3     | Green            1 MB           1 MB           1 (50%)
            | Yellow           1 MB           1 MB           1 (50%)
            | Red              1 MB           1 MB           1 (50%)
-------------------------------------------------------------------------------
Queue 4     | Green            1 MB           1 MB           1 (50%)
            | Yellow           1 MB           1 MB           1 (50%)
            | Red              1 MB           1 MB           1 (50%)
-------------------------------------------------------------------------------
Queue 5     | Green            1 MB           1 MB           1 (50%)
            | Yellow           1 MB           1 MB           1 (50%)
            | Red              1 MB           1 MB           1 (50%)
-------------------------------------------------------------------------------
Queue 6     | Green            1 MB           1 MB           1 (50%)
            | Yellow           1 MB           1 MB           1 (50%)
            | Red              1 MB           1 MB           1 (50%)
-------------------------------------------------------------------------------
Queue 7     | Green            1 MB           1 MB           1 (50%)
            | Yellow           1 MB           1 MB           1 (50%)
            | Red              1 MB           1 MB           1 (50%)
-------------------------------------------------------------------------------

Queue Length Averaging Factor
  Queue 0: 9
  Queue 1: 9
  Queue 2: 9
  Queue 3: 9
  Queue 4: 9
  Queue 5: 9
  Queue 6: 9
  Queue 7: 9
```

Assigning a queue-set description

You can use the mls qos queue-set description command to assign each of the queue-sets with an appropriate description. For example, you could name your triple-play traffic “Triple-Play” as shown below. You could then assign appropriate profiles for each of 8 triple-play queues within the queue-set.

Example To set the description for queue-set 4 to be “Triple-Play,” use the command:

```
awplus# config terminal
awplus(config)# mls qos queue-set 4 description "Triple-Play"
```

Once you have configured your queue-sets, you can apply each to specific ports by using the mls qos queue-set command. You also use this command to select the drop-mode to apply.

Note the following rules when applying queue-sets to queues and ports:

- a port can only have one queue-set applied to it
- a queue-set can be applied to many ports

Example To set port 1.0.1 to use queue-set 2 in random-detect mode, use the command:

```
awplus# config terminal
awplus(config)# interface port1.0.1
awplus(config-if)# mls qos queue-set 2 random-detect
```

Tail Drop

Note that this section does not apply to ports on the XEM-2XP

In this drop mode each egress queue is configured with a maximum threshold value. This value represents the point where the egress buffer queues are full and the egress port must start dropping data. The port does this by dropping data packets destined for the full queue on a “last in first dropped” basis. This enables the port to clear its data already queued for egress.

If a “reliable” transport protocol, such as TCP is used, this data should be retransmitted, but at a slower rate due to lack of returning “acknowledgements”. The queue threshold value is set using the mls qos queue-set threshold command.

Tail drop is far simpler to configure than its alternative random-detect (RED) and in most situations offers similar performance. In some situations, such as when using the UDP protocol, it is more appropriate to use tail-drop than RED. This is because UDP (unlike TCP) is not a sliding window protocol. UDP is also a popular protocol for “real time” data such as voice and video conferencing. The defaults for tail-drop are shown in Figure 60-10 on page 60.26 and Figure 60-11 on page 60.27.

Note The default drop mode operation is Tail Drop. In this situation the value set by the mls qos queue-set drop-probability command is ignored, and a drop value of 0 (i.e 100%) is internally applied. Also the value set for the minimum threshold is ignored, and the averaging factor is replaced by an instantaneous comparison of queue size with the maximum threshold figure (Maxth).

To reset a port from RED drop-mode to tail drop mode, use the mls qos queue-set command.

Example To set port 1.0.1 to tail-drop to use the command:

```
awplus# config terminal
awplus(config)# interface port1.0.1
awplus(config-if)# mls qos queue-set 2 taildrop
```

Random Early Detection (RED)

Note that this section does not apply to ports on the XEM-2XP

This drop mode was developed as a more graceful way of managing queue congestion than that obtained using the tail-drop method described in the previous section. RED is however far more complex to configure than tail-drop. As previously mentioned, in some situations, such as when using the UDP protocol, it is more appropriate to use tail-drop than RED. This is because UDP (unlike TCP) is not a sliding window protocol and so dropping packets does nothing to slow the incoming data flow. Because UDP is also a popular protocol for "real time" data such as voice and video conferences, dropping packets as the egress queue fills, can result in unnecessary performance degradation of the end-user application.

AlliedWare Plus™ enables you to create different RED curves for each traffic class. This feature is known as Weighted Random Early Detection (WRED).

The defaults for WRED configuration are shown in Figure 60-10 on page 60.26 and Figure 60-11 on page 60.27.

Random early detection operates in a similar way to tail drop but begins to (gracefully) drop packets as the *average queue length*[1] approaches the Maximum threshold point (Max_{th}). The concept is illustrated in Figure 60-12 on page 60.30. This figure shows how packets in the three classes, Red, Yellow, and Green are progressively dropped as their egress queue begins to fill.

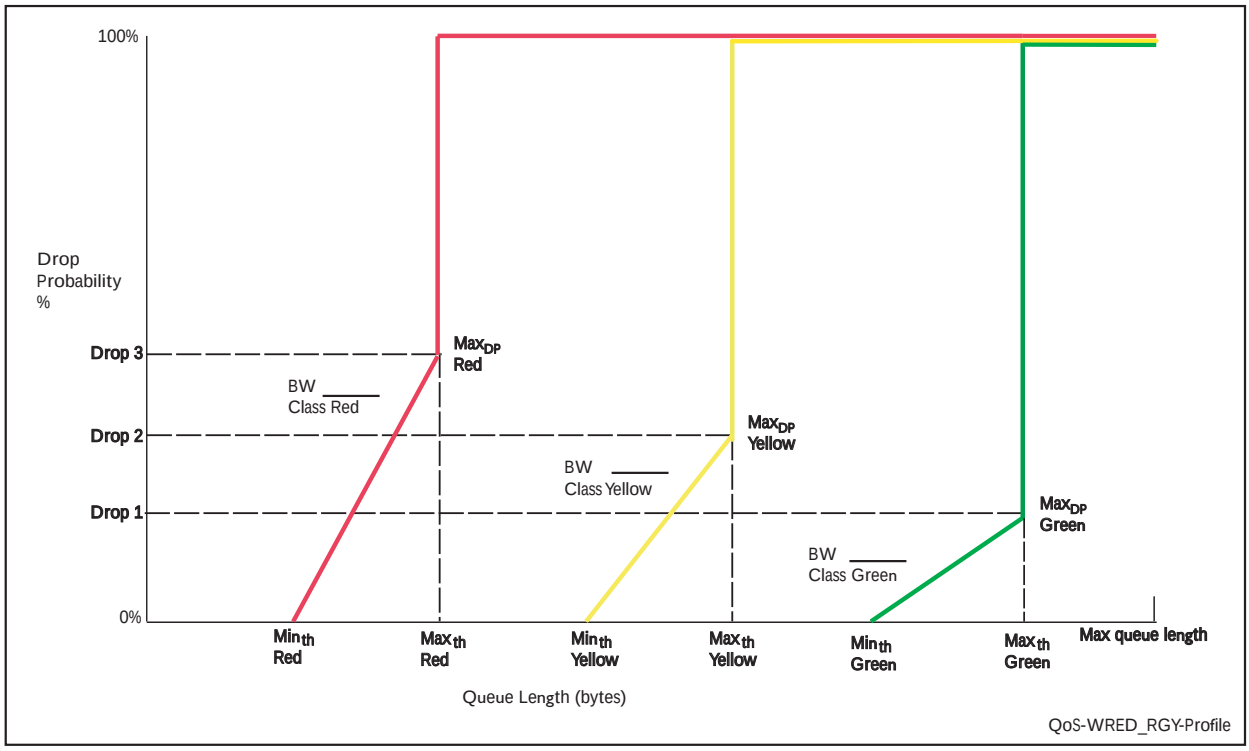
Each queue has an allocated buffer size, illustrated in the figure by the *MAX queue length on the graph's x axis. Traffic entering the queue can be marked either Green (most conformant), Yellow, or Red (least conformant). As the queue length increases it will first reach point* Min_{th} *Red* the minimum threshold for Red traffic. At this point the port begins to drop some of its red class traffic. If the current data flow continues and the queue continues to fill, traffic is dropped in increasing amounts. The vertical axis of the graph shows the probability of a packet being dropped.

1. The following equation is used to calculate the average queue length (Q_{ave}):

   $Q_{ave} = [(1 - 1/2^n) * Q_{ave}] + [1/2^n * (Current\ queue\ length)]$

   Where n = the averaging factor
   See the mls qos queue-set averaging-factor command on page 61.41.

Figure 60-12: Random Early Detect - Drop Profile



As the buffer further increases it will reach the point Max_{th}. At this point the drop probability is at the point Max_dp on the chart's vertical axis. From this point on, any further increase in queue size results in all packets in red traffic being dropped. This should increase the queue space for the remaining yellow and green traffic.

If the queue continues to fill, the above situation will then apply to the yellow and green traffic, as the queue size meets their own configurable thresholds Min_{th} yellow, Max_{th} yellow etc. Setting these thresholds is covered in "Configuring Tail Drop and Random Early Detection" on page 60.30.

Configuring Tail Drop and Random Early Detection

Note that this section does not apply to ports on the XEM-2XP

As previously mentioned the defaults for both drop methods can be seen from Figure 60-10 on page 60.26 and Figure 60-11 on page 60.27. These tables show the same output for both tail-drop and RED detection methods. However, when tail-drop is applied the values for Min_{th} and average queue length (Q_{ave}) are ignored, and the drop probability is either 0 (for a current queue size $<Max_{th}$) or 100% for a current queue size $>Max_{th}$).

The defaults shown are simply factory presets and are not intended to produce a functional configuration. The information in this section is to provide the basic guidelines required for you to set-up a tail-drop or RED detection method based on you own QoS standards.

Some Rules and Guidelines for the x.900 and SwitchBlade® x908 series switches.

- Each port on your switch will be a member of a single switch processor instance: All ports within a XEM are members of the same processor instance. On 24 port

switches, such as the x900-24 series, ports 1-12 and ports 13-24 belong to separate processors.

- Each port contains 8 egress queues; these share the total queue buffer space allocated for the port. The per port upper limit is:
  - 1.8 MB when configured for normal size frames
  - 8.25 MB when configured for Jumbo frames
- Each processor instance has the following buffer limits:
  - When the switch is configured for normal frames, 8.2 MB is shared between its ports. For a 12 port processor, the buffer limit = 0.68 MB_{avg} per port, and for a single port processor, such as a XEM, the buffer limit is 8.2 MB.
  - When the switch is configured for jumbo frames 32 MB is shared between its ports. For a 12 port processor, the buffer limit = 2.6 MB_{avg} per port.
    For a single port processor, such as a XEM, the buffer limit = 32 MB.

Note

For each queue-set, use the wrr-queue queue-limit command on page 61.88 to allocate the buffer size for each of a ports 8 egress queues (see note below), then select suitable threshold values for each of the classes Red, Yellow, and Green for each queue. See mls qos queue-set threshold command on page 61.45.

When setting the wrr-queue queue-limit command, we recommend setting the average queue length for a maximum queue ratio of 37% across all used queues on the particular port (i.e. 4.62% per queue when using 8 queues). This will provide 667 KB per port (83 KB per queue) when the switch is set for normal frame sizes; and 3.1 MB per port (388 KB per queue) when the switch is set to support Jumbo frames. You can then use these values to form the basis for setting the Maxth value for your Green traffic. Once you have set the Maxth Green you can work back from this point to choose appropriate values for your Red and Yellow traffic.

At this point you should be ready to apply your configurations using tail-drop. If you want to use RED you will need to take the following additional steps. Configuring RED for more than a marginal performance advantage over tail-drop, will require a good understanding of RED configuration principles and of your networks traffic profiles and service quality expectations. The following steps are intended to configure a basic RED system using some rule-of-thumb settings. You will probably want to fine tune these settings for real traffic profiles.

- Using the Drop Probability Table below, select an appropriate value for the maximum drop probability value for each of the colors. For TCP traffic we suggest using a drop probability of 3 or 4. For Green traffic using UDP we suggest using a value of 7, for reasons given in the earlier part of this section. See mls qos queue-set drop-probability command on page 61.43.

Table 60-9: Drop Probability Table

Drop Value	0	1	2	3	4	5	6	7
Drop Probability	100%	50%	25%	12.5%	6.25%	3.12%	1.56%	0.78%

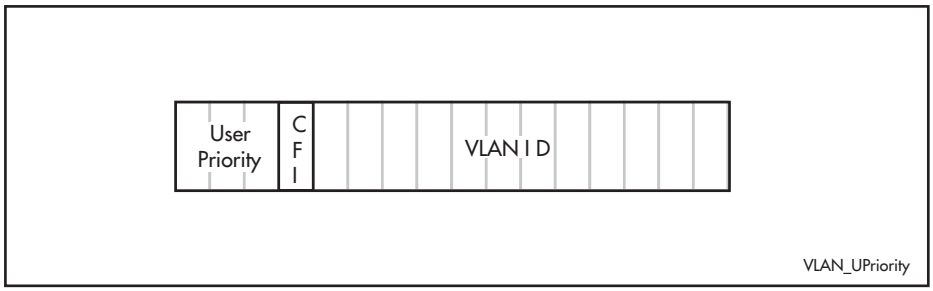
- For each queue-set, select suitable values for Min_{th} for each of the classes Red, Yellow, and Green for each queue within the set. We suggest that you start by setting each Min_{th} to be approximately half the value of the Max_{th} setting that you have already set for that particular color. See the mls qos queue-set threshold command on page 61.45.
- Select a value for the Queue Length Averaging Factor. We suggest you initially use the default of 9. See the mls qos queue-set averaging-factor command on page 61.41.

Egress Queue Mapping

On the switch you can use the match inner-vlan command on page 61.14 to select frames of a particular type. You can then assign these frames with a particular User Priority value then map them to one of eight egress queues. This facility enables you to accept frames that are already carrying meaningful priority information to be automatically assigned to an appropriate egress queue. For example, you could decide to send frames with a User Priority value of 7 to queue 3, and frames with a User Priority value of 2 to queue 7.

Frames entering a port at Layer 2 may be tagged or untagged. VLAN tagged frames contain 3 additional fields as shown in Figure 60-13 below. The User Priority field enables you to map incoming frames to any one of eight egress queues. This facility enables you can accept frames that are already carrying meaningful priority information to be automatically assigned to an appropriate egress queue. For example, you could decide to send frames with a User Priority value of 7 to queue 3, and frames with a User Priority value of 2 to queue 7.

Figure 60-13: User Priority Field



Mapping an Untagged frame to an Egress Queue

Frames entering a port with no VLAN tag and hence no User Priority Field, can be mapped to one of the eight Egress queue by using the mls qos queue command on page 61.38. For example, you could decide to send all untagged frames to a low priority egress queue such as queue 7.

Mapping an IEEE 802.1P value to an Egress Queue

Immediately after ingress, a VLAN-tagged Ethernet frame can be assigned to an appropriate egress queue, based on the priority value that is set within the frame's VLAN Tag Information Field (TIF). To create the mapping between the TIF and a ports egress queue see the mls qos map cos-queue to command on page 61.29.

Storm Protection

Storm protection uses QoS mechanisms to classify on traffic likely to cause a packet storm (broadcast and multicast). Unless you are running an enhanced storm protection feature such as Loop Protection, the per-port storm protection mechanism simply discards any traffic over the configured limit. However, with QoS storm protection, several actions are possible when a storm is detected:

- You can disable the port physically.
- You can disable the port logically.
- You can disable the port for a particular VLAN.

Before you can configure storm protection, you must first set the silicon profile to either extended or qoscounters. Silicon profiles are hardware-dependent - see the platform silicon-profile command on page 15.34. Storm protection is activated on a port after port state decisions have been made, and the port is in the STP forwarding state to forward frames and learn addresses.

When a storm is detected on a port, a message is automatically recorded in the log, and you can configure an SNMP trap to signal that a port has been disabled. When a storm is detected on a trunk or port group, the entire trunk or port group is disabled.

The following table explains the basic concepts involved with storm protection.

Concept	Description
Window	The frequency at which traffic is measured to determine whether storm protection should be activated.
Rate	The amount of traffic per second that must be exceeded before the switch takes the configured action.
Action	What the switch does when it detects a storm on a port.
Timeout	The length of time the port remains disabled after a port has been disabled due to a packet storm.

To set the action to take when triggered by QoS Storm Protection (QSP), use the storm-action command on page 61.78.

To set the time to re-enable the port once disabled by QSP, use the storm-downtime command on page 61.79.

To enable the policy-based storm protection QSP, use the storm-protection command on page 61.80.

QoS and the Switching Fabric

Ports on the x900 series switches belong to one of four switch processor instances: two on the base board and one on each expansion module. Switch instances exchange packets over a switching fabric. The switching fabric recognizes the priorities assigned to each packet and performs QoS queuing.

The switching fabric is different from the switch processor instance in that the switching fabric has four queues, whereas each switch port in a switch processor instance has eight egress queues. These two types of queues must be mapped to each other.

To specify the mapping of the 8 switch processor port queues to the 4 fabric queues, use the command: mls qos map fabric-queue command on page 61.30.

The integers *q0* to *q7* indicate the fabric queue that corresponds to an egress queue.

You can also configure the switching fabric to use different scheduling methods for each of the four fabric queues. This controls the way that fabric queues share the available bandwidth during congested times. See the mls qos map fabric-queue command on page 61.30.

To display information about settings for the switching fabric, use the command: show mls qos fabric-queue command on page 61.63.

Policy-Based Routing

Policy based routing provides a means to create multiple paths to the same destination. The specific path that any particular packet will take can be based on configurable network metrics such as priority, protocol, or VLAN membership. For example, policy based routing can implement policies to allow or deny paths based on the identity of user devices, application, or packet sizes.

Practical Example

The example shown makes use of policy based routing to achieve the following:

1. Ensure that traffic being sent between local VLANs is switched normally.

2. Selects a particular egress path for traffic destined for the wide are networks.

Configuration Overview

A large government building houses employees from three separate government departments: Heath, Welfare, and Employment. Each department has its own local subnet, and an associated VLAN; these are:

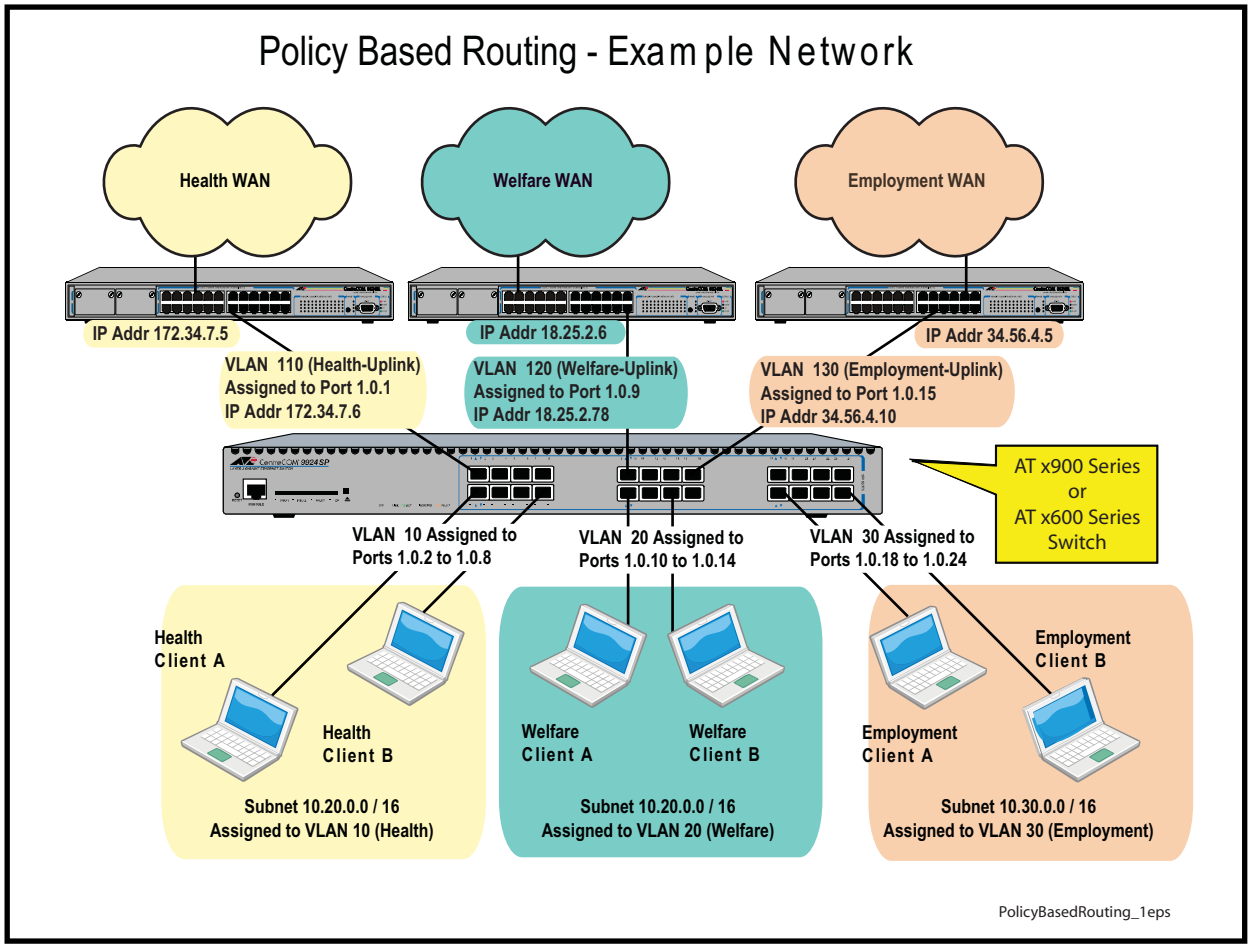
- 10.10.0.0/16 Health, VLAN 10
- 10.20.0.0/16 Welfare, VLAN 20
- 10.30.0.0/16 Employment, VLAN 30

Enquiries to each department are fed through a common Allied Telesis switch. The switch has 3 uplink ports, each of which (for simplicity) will be in a different VLAN and each will supply a connection to its relevant government department and to the Internet via each departments particular ISP (Internet Service Provider). These are:

- Port 1.0.1 Health Uplink, VLAN 110
- Port 1.0.5 Welfare Uplink, VLAN 120
- Port 1.0.21 Employment Uplink, VLAN 130

This configuration is illustrated in Figure 60-14:

Figure 60-14: Policy-Based Routing Example



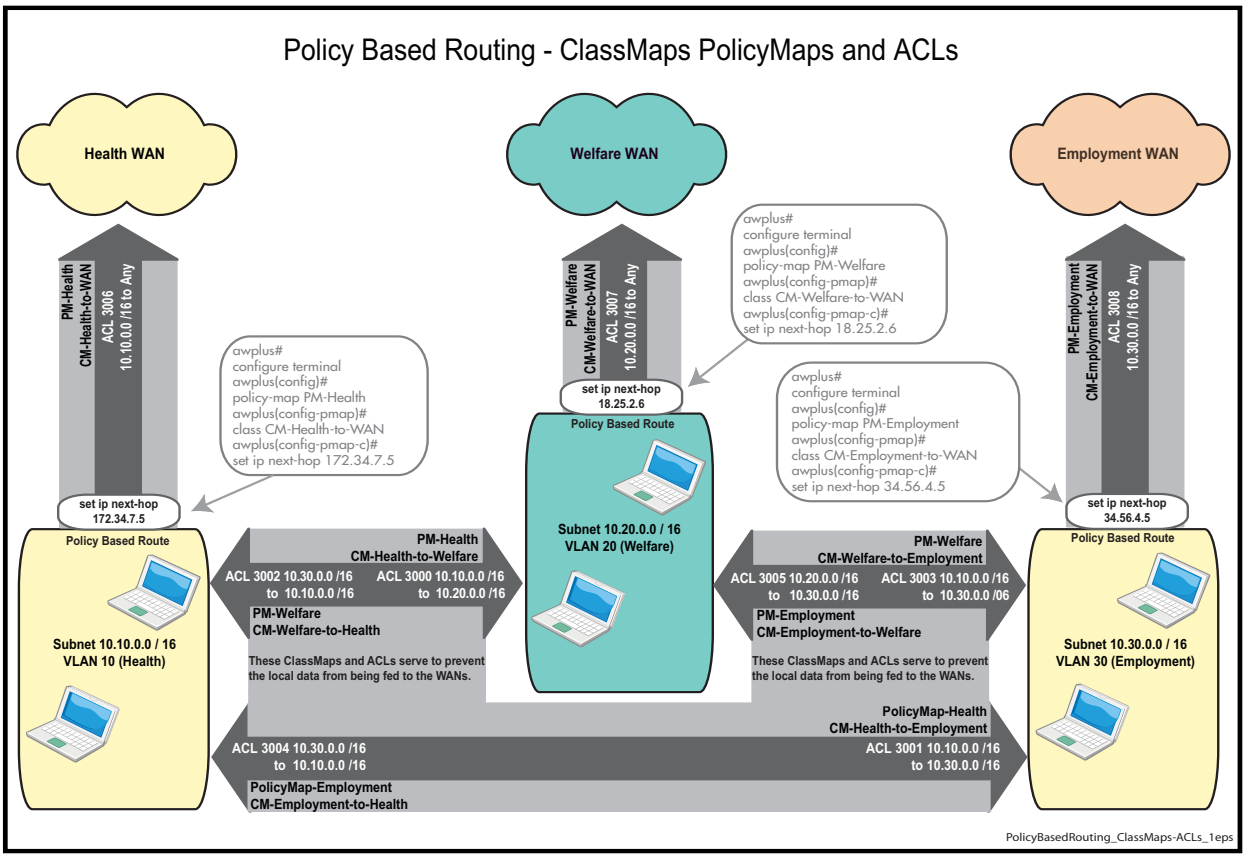
Configuration Steps

The following steps can be used to setup this example network. Since each step involves entering several instances of a command type, a single practical command entry is shown at the end of each step. The set of steps comprise the following:

1. Create VLANs on the switch.
2. Create access control lists (ACLs) that will match the data flows between local subnets.
3. Create ACLs that will match the data flows between local devices and other destinations.
4. Setup class-maps for each department and apply an access-list to each of the class maps.
5. Setup class-maps for each department's wide area connection and apply an access-list to each of these class maps.
6. Create the departmental policy-maps and associate them with their appropriate class-maps.
7. Apply these policy-maps to their appropriate ports.

These class-maps and ACLs are shown diagrammatically in Figure 60-15 below.

Figure 60-15: Policy Based Routing Example - ClassMaps and ACLs



Step 1: Create VLANs on the switch

- Create VLANs 10, 20, and 30
- Apply these VLANs to their appropriate local ports

Practical example: Create VLAN `10` and apply it to `port1.0.2-port1.0.8`.

```
awplus# configure terminal
awplus(config)# interface port port1.0.2-port1.0.8
awplus(config)# switchport mode access
awplus(config)# switchport access vlan 10
```

- Create VLANs 110, 120, and 130
- Apply these VLANs to their appropriate WAN ports

Practical example: Create VLAN `110` and apply it to `port1.0.1`.

```
awplus# configure terminal
awplus(config)# interface port port1.0.1
awplus(config)# switchport mode access
awplus(config)# switchport access vlan 110
```

Step 2: Create access control lists (ACLs) that will match the data flows between local user devices.

- access-list 3000 permit ip 10.10.0.0/16 10.20.0.0/16
  Matches for packets from the Health user devices to Welfare user devices.
- access-list 3001 permit ip 10.10.0.0/16 10.30.0.0/16
  Matches packets from the Health user devices to Employment user devices.
- access-list 3002 permit ip 10.20.0.0/16 10.10.0.0/16
  Matches packets from the Welfare user devices to Health user devices.
- access-list 3003 permit ip 10.20.0.0/16 10.30.0.0/16
  Matches packets from the Welfare user devices to Employment user devices.
- access-list 3004 permit ip 10.30.0.0/16 10.10.0.0/16
  Matches packets from the Employment user devices to Health user devices.
- access-list 3005 permit ip 10.30.0.0/16 10.20.0.0/16
  Matches packets from the Employment user devices to Welfare user devices.

Practical example: Create an ACL that matches packets from the Health user devices to Welfare user devices.

```
awplus# configure terminal
awplus(config)# access-list 3000 permit ip 10.10.0.0/16
10.20.0.0/16
```

Step 3: Create access control lists (ACLs) that will match the data flows between user devices and all other destinations.

- access-list 3006 permit ip 10.10.0.0/16 any
  Matches packets from Health user devices to all other destinations.
- access-list 3007 permit ip 10.20.0.0/16 any
  Matches packets from Welfare user devices all other destinations.
- access-list 3008 permit ip 10.30.0.0/16 any
  Matches packets from Employment user devices to all other destinations.

Practical example: Matches packets from the Health user devices to all other destinations.

```
awplus# configure terminal
awplus(config)# access-list 3006 permit ip 10.10.0.0/16 any
```

Step 4: Setup class-maps for each department and apply an access-list to each of the class maps.

- class-map CM-Health-to-Welfare
  Creates a class map called CM-Health-to-Welfare
- match access-group 3000
  Applies the access-list 3000 to the CM-Health-to-Welfare class-map, so that this class-map applies to all packets matching this ACL.
- class-map CM-Health-to-Employment
  Creates a class map called CM-Health-to-Employment.
- match access-group 3001
  Applies the access-list 3001 to the CM-Health-to-Employment class-map, so that this class-map applies to all packets matching this ACL.
- class-map CM-Welfare-to-Health
  Creates a class map called CM-Welfare-to-Health.
- match access-group 3002
  Applies the access-list 3002 to the CM-Welfare-to-Health class-map, so that this class-map applies to all packets matching this ACL.
- class-map CM-Welfare-to-Employment
  Creates a class map called CM-Welfare-to-Employment.
- match access-group 3003
  Applies the access-list 3003 to the CM-Welfare-to-Employment class-map, so that this class-map applies to all packets matching this ACL.
- class-map CM-Employment-to-Health
  Creates a class map called Employment-to-Health.
- match access-group 3004
  Applies the access-list 3004 to the CM-Employment-to-Health class-map, so that this class-map applies to all packets matching this ACL.
- class-map CM-Employment-to-Health
  Creates a class map called CM-Employment-to-Health.
- match access-group 3005
  Applies the access-list 3005 to the class-map CM-Employment-to-Health class-map, so that this class-map applies to all packets matching this ACL.

Practical example: Create the class-map Health-to-Welfare, then apply access list `3000` to it.

```
awplus# configure terminal
awplus(config)# class-map Health-to-Welfare
awplus(config-cmap)# match access-group 3000
```

Step 5: Setup class-maps for each department's wide area connection and apply an access-list to each of these class maps.

- class-map CM-Health-to-WAN
  Creates a class map called CM-Health-to-WAN.
- match access-group 3006
  Applies the access-list 3006 to the CM-Health-to-WAN class-map, so that this class-map applies to all packets matching this ACL.
- class-map CM-Welfare-to-WAN
  Creates a class map called Welfare-to-WAN
- match access-group 3007
  Applies the access-list 3007 to the CM-Welfare-to-WAN class-map, so that this class-map applies to all packets matching this ACL.
- class-map CM-Employment-to-WAN
  Creates a class map called Employment-to-WAN.
- match access-group 3008
  Applies the access-list 3008 to the CM-Employment-to-WAN class-map, so that this class-map applies to all packets matching this ACL.

Practical example: Create the class-map Health-to-Welfare, then apply access list `3006` to it.

```
awplus# configure terminal
awplus(config)# class-map CM-Health-to-WAN
awplus(config-cmap)# match access-group 3006
```

Step 6: Create the Departmental Policy-Maps and associate them with their appropriate Class-Maps.

- policy-map PM-Health
  Creates the policy-map called PM-Health
- class CM-Health-to-Welfare
- class CM-Health-to-Education
  Attaches the local Health class-maps to the PM-Health policy-map. Note that no action is applied to these two class maps. Packets that match either of these two class-maps will be forwarded across the local network using normal routing / forwarding procedures.
- class CM-Health-to-WAN
- set ip next-hop 172.34.7.5
  Attaches the CM-Health-to-WAN class-map to this policy-map, and gives it a policy-routing action.
- policy-map PM-Welfare
  Creates the policy-map called PM-Welfare
- class CM-Welfare-to-Health
- class CM-Welfare-to-Employment
  Attaches the local Welfare class-maps to the PM-Welfare policy-map. Note that no action is applied to these two class maps. Packets that match either of these two class-maps will be forwarded across the local network using normal routing / forwarding procedures.
- class CM-Welfare-to-WAN

- set ip next-hop 18.25.2.6
  Attaches the Welfare-to-WAN class-map to this policy-map, and gives it a policy-routing action.
- policy-map PM-Employment
  Creates the policy-map called PM- Employment
- class CM-Employment-to-Health
- class CM-Employment-to-Welfare
  Attaches the local Employment class-maps to the PM-Employment policy-map. Note that no action is applied to these two class maps. Packets that match either of these two class-maps will be forwarded across the local network using normal routing / forwarding procedures.
- class CM-Employment-to-WAN
- set ip next-hop 34.56.4.5
  Attaches the Employment-to-WAN class-map to this policy-map, and gives it a policy-routing action.

Practical example: Create the policy-map called PM-Employment and attach its appropriate classmaps.

```
awplus# configure terminal
awplus(config)# policy-map PM-Employment
awplus(config-pmap)# class CM-Employment-to-Health
awplus(config-pmap-c)# exit
awplus(config-pmap)# class CM-Employment-to-Welfare
awplus(config-pmap-c)# exit
awplus(config-pmap)# class CM-Employment-to-WAN
awplus(config-pmap-c)# set ip next-hop 34.56.4.5
```

Step 7: Apply these Policy Maps to appropriate ports.

- service-policy input Health-to-WAN
- service-policy input Welfare-to-WAN
- service-policy input Employment-to-WAN

Practical example: To apply a policy map named pm-employment to `port 1.0.18-port1.0.24`:

```
awplus# configure terminal
awplus(config)# interface port1.0.18-port1.0.24
awplus(config-if)# service-policy input pm-employment
```

Chapter 61: QoS Commands

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Command List

This chapter provides an alphabetical reference for Quality of Service commands. For more information, see Chapter 60, Quality of Service (QoS) Introduction and Chapter 55, Access Control Lists Introduction.

class

Use this command to associate an existing class map to a policy or policy map (traffic classification), and to enter Policy Map Class Configuration mode to configure the class map.

Use the no variant of this command to delete an existing class-map.

For more information on class-maps and policy maps, see the following sections:"Class Maps" on page 60.7 and "Policy Maps" on page 60.10.

Note that if your class map does not exist, you can create it by using the class-map command.

Syntax

```
class {<name>|default}
no class <name>
```

Parameter	Description
<name>	Name of the (already existing) class map.
`default`	Specify the default class map.

Mode Policy Map Class Configuration

Example The following example creates the policy map `pmap1`(using the policy-map command), then associates this to an already existing class map named `cmap1`, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)#
```

Related Commands class-map
policy-map

class-map

Use this command to create a class map.

Use the no variant of this command to delete the named class map.

Syntax

```
class-map <name>
no class-map <name>
```

Parameter	Description
<name>	Name of the class map to be created.

Mode Global Configuration

Example This example creates a class-map called `cmap1`, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)#
```

clear mls qos interface policer-counters

Resets an interface's policer counters to zero. This can either be for a specific class-map or for all class-maps.

Before running this command you must first enable the QoS counter platform enhanced mode.

Syntax

```
clear mls qos interface <port> policer-counters
   [class-map <class-map>]
```

Parameter	Description
<port>	The port may be a switch port (e.g. `port1.0.4`), a static channel group (e.g. `sa3`), or a dynamic (LACP) channel group (e.g. `po4`).
`class-map`	Select a class-map.
<class-map>	Class-map name.

Mode Privileged Exec

Example To reset the policy counters to zero for all class maps for `port1.0.1`, use the command:

```
awplus# clear mls qos interface port1.0.1 policer-counters
```

Related Commands

platform silicon-profile
show mls qos interface policer-counters

default-action

Sets the action for the default class-map belonging to a particular policy-map. The action for a non-default class-map depends on the action of any ACL that is applied to the policy-map.

The default action can therefore be thought of as specifying the action that will be applied to any data that does not meet the criteria specified by the applied matching commands.

Use the no variant of this command to reset to the default action of 'permit'.

Syntax

```
default-action [permit|deny|send-to-cpu|copy-to-cpu|copy-to-mirror|
   send-to-mirror]

no default-action
```

Parameter	Description
`permit`	Packets to permit.
`deny`	Packets to deny.
`send-to-cpu`	Specify packets to send to the CPU.
`copy-to-cpu`	Specify packets to copy to the CPU.
`copy-to-mirror`	Specify packets to copy to the mirror port.
`send-to-mirror`	Specify packets to send to the mirror port.

Default The default is '`permit`'.

Mode Policy Map Configuration

Examples To set the action for the default class-map to `deny`, use the command:

```
awplus(config-pmap)# default-action deny
```

To set the action for the default class-map to `copy-to-mirror` for use with the mirror interface command, use the command:

```
awplus(config-pmap)# default-action copy-to-mirror
```

Related Commands mirror interface

description (QOS policy map)

Adds a textual description of the policy-map. This can be up to 80 characters long.

Use the no variant of this command to remove the current description from the policy-map.

Syntax

```
description <line>
no description
```

Parameter	Description
<line>	Up to 80 character long line description.

Mode Policy Map Configuration

Example To add the description, VOIP traffic, use the commands:

```
awplus(config-pmap)# description VOIP traffic
```

egress-rate-limit

Sets a limit on the amount of traffic that can be transmitted per second from this port.

Use the no variant of this command to disable the limiting of traffic egressing on the interface.

Syntax

```
egress-rate-limit <bandwidth>
no egress-rate-limit
```

Parameter	Description
<bandwidth>	Bandwidth <1-10000000 kbits per second> (usable units: k, m, g). The minimum is 651 Kb. The default unit is Kb (k), but Mb (m) or Gb (g) can also be specified. The command syntax is not case sensitive, so a value such as 20m or 20M will be taken to mean 20 megabits.

Mode Interface Configuration

Examples To enable egress rate limiting on a port, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# egress-rate-limit 500m
% Egress rate limit has been set to 500 Mb
```

To disable egress rate limiting on a port, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# no egress-rate-limit
```

match access-group

Use this command to define match criterion for a class map.

Syntax

```
match access-group {<hw-IP-ACL>|<hw-MAC-ACL>|<hw-named-ACL>}
no match access-group {<hw-IP-ACL>|<hw-MAC-ACL>|<hw-named-ACL>}
```

Parameter	Description
<hw-IP-ACL>	Specify a hardware IP ACL number in the range <3000-3699>.
<hw-MAC-ACL>	Specify a hardware MAC ACL number in the range <4000-4699>.
<hw-named-ACL>	Specify the hardware named ACL.

Mode Class Map Configuration

Usage First create an access-list that applies the appropriate permit, deny requirements etc. Then use the match access-group command to apply this access-list for matching to a class map. Note that this command will apply the access-list matching only to *incoming* data packets.

Examples To configure a class map named `cmap1` with one match criterion: `access-list 3001`, which allows IP traffic from any source to any destination, use the commands:

```
awplus# configure terminal
awplus(config)# access-list 3001 permit ip any any
awplus(config)# class-map cmap1
awplus(config-cmap)# match access-group 3001
```

To configure a class map named `cmap2` with one match criterion: `access-list 3001`, which allows MAC traffic from any source to any destination, use the commands:

```
awplus# configure terminal
awplus(config)# access-list 4001 permit any any
awplus(config)# class-map cmap2
awplus(config-cmap)# match access-group 4001
```

To configure a class map named `cmap3` with one match criterion: `access-list hw_acl`, which allows IP traffic from any source to any destination, use the commands:

```
awplus# configure terminal
awplus(config)# access-list hardware hw_acl
awplus(config-ip-hw-acl)# permit ip any any
awplus(config)# class-map cmap3
awplus(config-cmap)# match access-group hw_acl
```

Related Commands class-map

match cos

Sets the CoS for a class-map to match on.

Use the no variant of this command to remove CoS.

Syntax

```
match cos <0-7>
no match cos
```

Parameter	Description
<0-7>	Specify the CoS value.

Mode Class Map Configuration

Examples To set the class-map's CoS to 4, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match cos 4
```

To remove CoS from a class-map, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# no match cos
```

match dscp

Use this command to define the DSCP to match against incoming packets.

Use the no variant of this command to remove a previously defined DSCP.

Syntax

```
match dscp <0-63>
no match dscp
```

Parameter	Description
<0-63>	Specify DSCP value (only one value can be selected).

Mode Class Map Configuration

Usage Use the match dscp command to define the match criterion after creating a class map.

Examples To configure a class map named `cmap1` with criterion that matches IP DSCP 56, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match dscp 56
```

To remove a previously defined DSCP from a class map named cmap1, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# no match dscp
```

Related Commands class-map

match inner-cos

Sets the Inner CoS for a class-map to match on.

Use the no variant of this command to remove CoS.

Syntax

```
match inner-cos <0-7>
no match inner-cos
```

Parameter	Description
<0-7>	Specify the Inner CoS value.

Mode Class Map Configuration

Examples To set the class-map's inner-cos to 4, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match inner-cos 4
```

To remove CoS from the class-map, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# no match inner-cos
```

match inner-tpid

Sets the Inner Tag Protocol Identifier (TPID) for a class-map to match on.

Use the no variant of this command to remove the TPID for a class-map.

Syntax

```
match inner-tpid <tpid>
no match inner-tpid
```

Parameter	Description
<tpid>	Two byte hexadecimal number representing the TPID.

Mode Class Map Configuration

Examples To set the class-map's inner-tpid to 0x9100, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match inner-tpid 0x9100
```

To remove the class-map's inner-tpid, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# no match inner-tpid
```

match inner-vlan

Use this command to define the inner VLAN ID used as match criteria to classify a traffic class.

Use the no variant of this command to disable the VLAN ID used as match criteria.

Syntax

```
match inner-vlan <1-4094>
no match inner-vlan
```

Parameter	Description
<1-4094>	The VLAN number.

Mode Class Map Configuration

Usage This command is used in double-tagged networks to match on a VLAN ID belonging to the client network. For more information on VLAN double-tagged networks, see "VLAN Double Tagging (VLAN Stacking)" on page 16.5.

Examples To configure a class-map named `cmap1` to include traffic from inner VLAN 3, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match inner-vlan 3
```

To disable the configured VLAN ID as a match criteria for the class-map named `cmap1`, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# no match inner-vlan
```

match ip-precedence

Use this command to identify IP precedence values as match criteria.

Use the no variant of this command to remove IP precedence values from a class map.

Syntax

```
match ip-precedence <0-7>
no match ip-precedence
```

Parameter	Description
<0-7>	The precedence value to be matched.

Mode Class Map Configuration

Example To configure a class-map named `cmap1` to evaluate all IPv4 packets for a precedence value of `5`, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match ip-precedence 5
```

match mac-type

Use this command to set the MAC type for a class-map to match on.

Use no variant of this command to remove MAC type.

Syntax

```
match mac-type {l2bcast|l2mcast|l2ucast}
no match mac-type
```

Parameter	Description
l2bcast	Layer 2 Broadcast.
l2mcast	Layer 2 Multicast.
l2ucast	Layer 2 Unicast.

Mode Class Map Configuration

Examples To set the class-map's MAC type to Layer 2 multicast, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match mac-type l2mcast
```

To remove the class-map's MAC type, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# no match mac-type
```

match protocol

Sets the ethernet format and protocol for a class-map to match on. Select one Layer 2 eth-format “and” one Layer 3 protocol.

Use the no variant of this command to remove ethernet format and protocol from a class-map.

Syntax

```
match eth-format {<layer-two-format>} protocol {<layer-three-
    protocol>}

no match eth-format protocol
```

Parameter	Description
<layer-two-formats>	
802dot2-tagged	802.2 Tagged Packets (enter the parameter name).
802dot2-untagged	802.2 Untagged Packets (enter the parameter name).
ethii-tagged	EthII Tagged Packets (enter the parameter name).
ethii-untagged	EthII Untagged Packets (enter the parameter name).
netwareraw-tagged	Netware Raw Tagged Packets (enter the parameter name).
netwareraw-untagged	Netware Raw Untagged Packets (enter the parameter name).
snap-tagged	SNAP Tagged Packets (enter the parameter name).
snap-untagged	SNAP Untagged Packets (enter the parameter name).
<layer-three-protocols>	
<word>	A Valid Protocol Number in hexidecimal.
any	Note that the parameter “any” is only valid when used with the netwarerawtagged and netwarerawuntagged protocol options.
sna-path-control	Protocol Number 04 (enter the parameter name or its number).
proway-lan	Protocol Number 0E (enter the parameter name or its number).
eia-rs Protocol	Number 4E (enter the parameter name or its number).
proway Protocol	Number 8E (enter the parameter name or its number).
ipx-802dot2	Protocol Number E0 (enter the parameter name or its number).
netbeui	Protocol Number F0 (enter the parameter name or its number).
iso-clns-is	Protocol Number FE (enter the parameter name or its number).
xdot75-internet	Protocol Number 0801(enter the parameter name or its number).

Parameter(cont.)	Description(cont.)
nbs-internet	Protocol Number 0802 (enter the parameter name or its number).
ecma-internet	Protocol Number 0803 (enter the parameter name or its number).
chaosnet	Protocol Number 0804 (enter the parameter name or its number).
xdot25-level-3	Protocol Number 0805 (enter the parameter name or its number).
arp Protocol	Number 0806 (enter the parameter name or its number).
xns-compat	Protocol Number 0807 (enter the parameter name or its number).
banyan-systems	Protocol Number 0BAD (enter the parameter name or its number).
bbn-simnet	Protocol Number 5208 (enter the parameter name or its number).
dec-mop-dump-ld	Protocol Number 6001 (enter the parameter name or its number).
dec-mop-rem-cdons	Protocol Number 6002 (enter the parameter name or its number).
dec-decnet	Protocol Number 6003 (enter the parameter name or its number).
dec-lat	Protocol Number 6004 (enter the parameter name or its number).
dec-diagnostic	Protocol Number 6005 (enter the parameter name or its number).
dec-customer	Protocol Number 6006 (enter the parameter name or its number).
dec-lavc	Protocol Number 6007 (enter the parameter name or its number).
rarp	Protocol Number 8035 (enter the parameter name or its number).
dec-lanbridge	Protocol Number 8038 (enter the parameter name or its number).
dec-encryption	Protocol Number 803D (enter the parameter name or its number).
appletalk	Protocol Number 809B (enter the parameter name or its number).
ibm-sna	Protocol Number 80D5 (enter the parameter name or its number).
appletalk-aarp	Protocol Number 80F3 (enter the parameter name or its number).

Parameter(cont.)	Description(cont.)
snmp	Protocol Number 814Cv.
ethertalk-2	Protocol Number 809B (enter the parameter name or its number).
ethertalk-2-aarp	Protocol Number 80F3 (enter the parameter name or its number).
ipx-snap	Protocol Number 8137 (enter the parameter name or its number).
ipx-802dot3	Protocol Number FFFF (enter the parameter name or its number).
ip	Protocol Number 0800 (enter the parameter name or its number).
ipx	Protocol Number 8137 (enter the parameter name or its number).
ipv6	Protocol Number 86DD (enter the parameter name or its number).

Mode Class Map Configuration

Examples To remove the eth-format and protocol from the class-map, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# no match eth-format protocol
```

To set the class-map's eth-format to ethii-tagged and protocol to 0800 (IP), use the commands:

```
awplus# configure terminal
awplus(config)# class-map
awplus(config-cmap)# match eth-format ethii-tagged protocol
0800
```

or

```
awplus(config-cmap)# match eth-format ethii-tagged protocol ip
```

match tcp-flags

Sets one or more tcp flags (control bits) for a class-map to match on.

Use the no variant of this command to remove one or more tcp flags for a class-map to match on.

Syntax

```
match tcp-flags {[ack][fin][rst][syn][urg]}
no match tcp-flags {[ack][fin][rst][syn][urg]}
```

Parameter	Description
ack	Acknowledge.
fin	Finish.
rst	Reset.
syn	Synchronize.
urg	Urgent.

Mode Class Map Configuration

Examples To set the class-map's tcp flags to `ack` and `syn`, use the commands:

```
awplus# configure terminal
awplus(config)# class-map
awplus(config-cmap)# match tcp-flags ack syn
```

To remove the tcp-flags `ack` and `rst`, use the commands:

```
awplus# configure terminal
awplus(config)# class-map
awplus(config-cmap)# no match tcp-flags ack rst
```

match tpid

Sets the Tag Protocol Identifier (TPID) for a class map to match on.

Use the no variant of this command to remove the TPID for a class-map.

Syntax

```
match tpid <tpid>
no match tpid
```

Parameter	Description
<tpid>	Specify the Tag Protocol Identifier.

Mode Class Map Configuration

Examples To set the TPID of class map named `cmap1` to `0x9100`, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match tpid 0x9100
```

To remove the TPID set previously for class map named `cmap1`, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# no match tpid
```

match vlan

Use this command to define the VLAN ID used as match criteria to classify a traffic class.

Use the no variant of this command to disable the VLAN ID used as match criteria.

Syntax

```
match vlan <1-4094>
no match vlan
```

Parameter	Description
<1-4094>	The VLAN number.

Mode Class Map Configuration

Examples To configure a class-map named `cmap1` to include traffic from VLAN 3, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match vlan 3
```

To disable the configured VLAN ID as a match criteria for the class-map named `cmap1`, use the commands:

```
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# no match vlan
```

mls qos aggregate-police action

This command creates or reconfigures an aggregate-policer for a class-map.

The no variant of this command removes a previously configured exceed action.

Syntax For single rate metering:

```
mls qos aggregate-police <name> single-rate <CIR> <CBS> <EBS>
   action [drop-red|policed-dscp-transmit]
```

For twin rate metering:

```
mls qos aggregate-police <name> twin-rate <CIR> <CBS> <EIR> <PBS>
   action [drop-red|policed-dscp-transmit]
```

```
no mls qos aggregate-police <name>
```

Parameter	Description
<name>	Specify aggregate-policer name.
`single-rate`	Single rate meter (one rate and two burst sizes).
`twin-rate`	Twin rate meter (two rates and two burst sizes).
<CIR>	The Committed Information Rate. Specify an average traffic rate, 1-16000000 (kbps).
<CBS>	The amount by which the data is allowed to burst beyond the value set by the CIR. Specify a value from 0-16777216 (bytes).
<EIR>	Excess Information Rate. Specify an average traffic rate, 1-16000000 (kbps).
<EBS>	*For single-rate metering*, this is the amount by which the data is allowed to burst beyond the value set by the CIR.
<PBS>	*For twin-rate metering*, this is the amount by which the data is allowed to burst beyond the value set by the EIR. Specify a value from 1-16777216 (bytes).
`action`	Specify the action: either drop-red or policed-dscp-transmit.
`drop-red`	Drop the red packets.
`policed-dscp-transmit`	Change packet per policed-dscp map and send it.

Mode Global Configuration

Usage A policer can be used to meter the traffic classified by the class-map and as a result will be given one of three bandwidth classes. These are green (conforming), yellow (partially-conforming), and red (non-conforming).

Once you have created an aggregate policer, you can use the police-aggregate command on page 61.48 to assign it to one or more class-maps. This enables traffic classified by different characteristics to have accumulative application to the same policer. Another application of aggregate policers is to attach them to a single class-map but apply the class-maps to multiple ports (via it's policy-map). This enables the same traffic to have accumulative policed application over multiple ports.

A single-rate policer is based on three values. These are:

- average rate (or Committed Information Rate CIR)
- minimum burst (or Committed Burst Size CBS)
- maximum burst (or Excess Burst Size EBS)

Traffic is classed as green if the rate is less than the combined CIR plus CBS values. Traffic is classed as yellow if the data rate is between the CBS and the EBS. Traffic is classed as red if the rate exceeds the average rate and the EBS.

A dual-rate policer is based on four values. These are:

- average rate (or Committed Information Rate CIR)
- minimum burst (or Committed Burst Size CBS)
- maximum burst (or Excess Burst Size EBS)
- Excess Information Rate (EIR)

Traffic is classed as green if the rate is less than the CIR and CBS. Traffic is classed as yellow if the rate is between the CBS and the EBS. Traffic is classed as red if the rate exceeds the average rate and the EBS.

Using an action of drop-red will result in all packets classed as red being discarded.

When using an action of policed-dscp-transmit the packet will be remarked with the values configured in the policed-dscp map. The index into this map is determined by the DSCP in the packet. If a DSCP index is to be forced regardless of the packet DSCP the set dscp command can be used to achieve this. If no DSCP is present in the packet an index of 0 will be used.

Example To create a single rate meter measuring traffic of 10 Mbps that drops any traffic bursting over 30000 bytes, use the commands:

```
awplus# configure terminal
awplus(config)# mls qos aggregate-police ap1 single-rate 10000
                20000 30000 action drop-red
awplus(config)#
```

Related Commands
mls qos map policed-dscp to
police-aggregate
show mls qos aggregate-policer
show mls qos maps policed-dscp

mls qos cos

This command assigns a CoS (Class of Service) user-priority value to untagged frames entering a specified interface. By default, all untagged frames are assigned a CoS value of 0.

Use the no variant of this command to return the interface to the default CoS setting for untagged frames entering the interface.

Syntax

```
mls qos cos <0-7>

no mls qos cos
```

Parameter	Description
<0-7>	The Class of Service, user-priority value.

Default By default, all untagged frames are assigned a CoS value of 0. Note that for tagged frames, the default behavior is not to alter the CoS value.

Mode Interface Configuration

Example To assign a CoS user priority value of 3 to all untagged packets entering ports 1.0.1 to 1.0.20, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1-port1.0.20
awplus(config-if)# mls qos cos 3
```

mls qos enable

Use this command to globally enable QoS on the switch or stack.

Use the no variant of this command to globally disable QoS and remove all QoS configuration. The no variant of this command removes all class-maps, policy-maps, policers, and queue-sets that have been created. Running the no mls qos command will therefore remove all pre-existing QoS configurations on the switch.

Mode Global Configuration

Syntax

```
mls qos enable
no mls qos
```

Example To enable QoS on the switch, use the commands:

```
awplus# configure terminal
awplus(config)# mls qos enable
```

mls qos fabric-queue

Configures the scheduling algorithm for one or more fabric queues. If the scheduler is weighted round robin (WRR), a weighting can also be specified. You must specify at least one queue when setting this command.

The no variant of this command resets the scheduling algorithm for one or more input fabric queues. Default is priority.

Syntax

```
mls qos fabric-queue {[0][1][2][3]}{priority|wrr [weight <1-30>]}
no mls qos fabric-queue [0][1][2][3]
```

Parameter	Description
`0, 1, 2, 3`	Fabric queues being configured.
`priority`	Applies strict priority queue servicing to the selected queues.
`wrr`	Applies weighted round robin queue servicing to the selected queues.
`weight`	The weight for weighted round robin selection. Queues will then be serviced in proportion to their applied weights. Default is 1.
<1-30>	The weight value.

Mode Global Configuration

Usage Queues can be serviced in either priority sequence or a weighted round-robin sequence. By default all queues are set to priority servicing.

Priority Sequencing

In this mode the queue with the highest number, i.e. queue 3 will be emptied first, then queues 2, 1 and 0. Note that the lower queues will only be serviced if there is no data waiting in the higher numbered queues.

Weighted Round Robin Sequencing

In this mode the weighting that you assign to each queue will determine how often it is serviced with respect to the other WRR queues. For example, if queue 0 is configured with a weight of 5 and queue 1 is configured with a weight of 1, then queue 0 will be serviced 5 times more than queue 1. Setting all weights to the same value will therefore apply an unweighted round selection method.

Mixed Sequencing

If you configure the queues with a mix of priority queueing and WRR, the priority queues will be completely emptied, before the any WRR queue is serviced.

Examples To set the scheduler for fabric queues `0` and `1` to WRR and both have a weight of `5`, use the command:

```
awplus# configure terminal
awplus(config)# mls qos fabric-queue 0 1 wrr weight 5
```

To reset the scheduling algorithm for fabric-queues `0` and `1`, use the command:

```
awplus# configure terminal
awplus(config)# no mls qos fabric-queue 0 1
```

Related Commands mls qos map fabric-queue
show mls qos fabric-queue
show mls qos maps fabric-queue

mls qos map cos-queue to

Used to set the default CoS to queue mapping. This is the default queue mapping for packets that do not get assigned a queue via any other QoS functionality.

Use the no variant of this command to reset the cos-queue map back to its default setting. The default mappings for this command are:

```
CoS Priority :      0 1 2 3 4 5 6 7
--------------------------------
CoS QUEUE:          2 0 1 3 4 5 6 7
```

For more information see, "Mapping CoS tags to traffic types" on page 60.12.

Syntax

```
mls qos map cos-queue <cos-priority> to <queue-number>
no mls qos map cos-queue
```

Parameter	Description
<cos-priority>	CoS priority value. Can take a value 0 to 7.
<queue-number>	Queue number. Can take a value 0 to 7.

Mode Global Configuration

Examples To set the cos-queue map back to its defaults, use the command:

```
awplus# configure terminal
awplus(config)# no mls qos map cos-queue
```

:To map CoS 2 to queue 3, use the command:

```
awplus# configure terminal
awplus(config)# mls qos map cos-queue 2 to 3
```

Related Commands

mls qos map fabric-queue
mls qos queue-set averaging-factor
mls qos queue-set description
mls qos queue-set drop-probability
mls qos queue-set threshold
show mls qos fabric-queue
show mls qos interface
show mls qos maps fabric-queue
show mls qos queue-set

mls qos map fabric-queue

This command maps eight egress queues to four fabric queues. Note that when entering this command, you must supply a mapping for all eight egress queues.

Use the no variant of this command to reset the fabric queue map. This table maps eight egress queues to four fabric-queues. The default maps egress queues 0 and 1 to fabric queue 0, egress queues 2 and 3 to fabric queues 1, egress queues 4 and 5 to fabric queue 2 and egress queues 6 and 7 to fabric queue 3.

Syntax

```
mls qos map fabric-queue q0 q1 q2 q3 q4 q5 q6 q7

no mls qos map fabric-queue
```

Parameter	Description
q0	Egress queue 0 (Select a value 0 to 3 to map this egress queue to one of the four fabric queues q0-q4).
q1	Egress queue 1 (Select a value 0 to 3 to map this egress queue to one of the four fabric queues q0-q4).
q2	Egress queue 2 (Select a value 0 to 3 to map this egress queue the one of the four fabric queues q0-q4).
q3	Egress queue 3 (Select a value 0 to 3 to map this egress queue to one of the four fabric queues q0-q4).
q4	Egress queue 4 (Select a value 0 to 3 to map this egress queue to one of the four fabric queues q0-q4).
q5	Egress queue 5 (Select a value 0 to 3 to map this egress queue to one of the four fabric queues q0-q4).
q6	Egress queue 6 (elect a value 0 to 3 to map this egress queue to one of the four fabric queues q0-q4).
q7	Egress queue 7 (Select a value 0 to 3 to map this egress queue to one of the four fabric queues q0-q4).

Mode Global Configuration

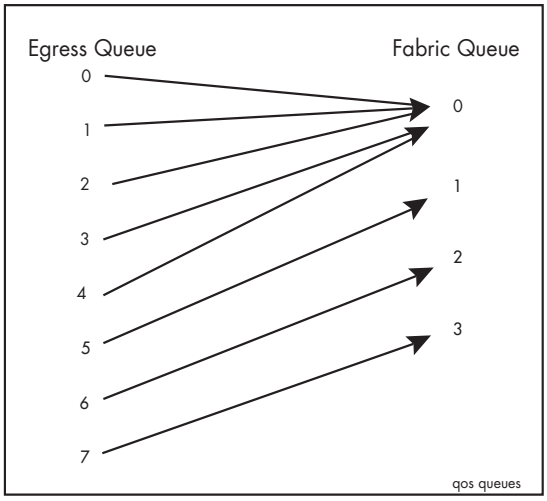
Examples This example maps egress queue 7 to fabric queue 3, egress queue 6 to fabric queue 2, egress queue 5 to fabric queue 1, and the rest of the egress queues to fabric queue 0, as shown in Figure 61-1 on page 61.31 use the command:

```
awplus# configure terminal
awplus(config)# mls qos map fabric-queue 0 0 0 0 0 1 2 3
```

The following table shows how the queue mapping operates in the above example:

Egress Queue	0	1	2	3	4	5	6	7
Fabric Queue Mapping	0	0	0	0	0	1	2	3

Figure 61-1: Egress Queue to Fabric Queue mapping:



To reset the fabric-queue map, use the command:

```
awplus# configure terminal
awplus(config)# no mls qos map fabric-queue
```

Related Commands

mls qos fabric-queue
show mls qos fabric-queue
show mls qos maps fabric-queue

mls qos map policed-dscp to

Configures the policed-dscp map. This is used when a policer is configured with an exceed action of 'policed-dscp-transmit'. Bandwidth-class is optional - if omitted, the changes will be applied to all bandwidth classes. At least one 'new' parameter must be specified.

Use the no variant of this command to reset the policed-dscp map to its default. This is used when a policer is configured with an exceed action of 'policed-dscp-transmit'. Specifying DSCP and bandwidth-class is optional. If no DSCP is specified then all DSCP entries will be reset to their defaults. If no bandwidth-class is specified then all bandwidth-class entries will be reset to their defaults.

Syntax

```
mls qos map policed-dscp <existing-dscp> [bandwidth-class {green|
   yellow|red}] to {[new-dscp <0-63>] [new-cos <0-7>]
   [new-queue <0-7>] [new-bandwidth-class {green|yellow|red}]}

no mls qos map policed-dscp [<new-dscp>] [bandwidth-class {green|
   yellow|red}]
```

Parameter	Description
<existing-dscp>	The value of the DSCP when it leaves the policer (meter) *<0-63>*.
bandwidth-class	Bandwidth Class.
green	Mark the packet as green.
yellow	Mark the packet as yellow.
red	Mark the packet as red.
to	Change the value to:
new-dscp	Modify Egress DSCP.
<0-63>	Egress DSCP value (marked down DSCP).
new-cos	Modify Egress CoS.
<0-7>	Egress CoS value (marked down CoS).
new-queue	Modify Egress Queue.
<0-7>	Egress Queue value (marked down Queue).
new-bandwidth-class	Modify Egress Bandwidth-class.
green	Egress Bandwidth-class green (marked down Bandwidth-class).
yellow	Egress Bandwidth-class yellow (marked down Bandwidth-class).
red	Egress Bandwidth-class red (marked down Bandwidth-class).
<new-dscp>	DSCP entry to reset.
bandwidth-class	bandwidth class to reset.
green	Green traffic.

Parameter(cont.)	Description(cont.)
yellow	Yellow traffic.
red	Red traffic.

Mode Global Configuration

Example To set the entry at DSCP 2 to remark the policed green traffic to a new DSCP of 2, a new CoS of 3, and new queue of 4 and a new bandwidth class of yellow, use the command:

```
awplus# configure terminal
awplus(config)# mls qos map policed-dscp 2 bandwidth-class
green to new-dscp 5 new-cos 3 new-queue 4 new-
bandwidth-class yellow
```

Related Commands
mls qos map policed-dscp to
police single-rate action
police twin-rate action
show mls qos maps policed-dscp

mls qos map premark-dscp to

The operation of this command varies by platform type. These platform types are:

- Generic platform - when applied to ports on the x900 chassis and non 2XP XEMs.
- XEM-2XP platform - when applied to ports on the XEM-2XP module.

Generic Platform

This command configures the premark-dscp map. It is used when traffic is classified by a class-map that has trust dscp configured. Based on a lookup DSCP, the map determines a new DSCP, COS, queue and bandwidth class for the traffic.

If the set dscp command has also been specified for that class-map, the set value is used for the lookup of the premark-dscp map. Otherwise the DSCP value in the packet is used for the lookup.

The no variant of this command resets the premark-dscp map to its defaults. If no DSCP is specified then all DSCP entries will be reset to their defaults.

Syntax

```
mls qos map premark-dscp <0-63> to {[new-dscp <0-63>]
   [new-cos <0-7>] [new-queue <0-7>] [new-bandwidth-class {green|
   yellow|red}]}

no mls qos map premark-dscp [<0-63>]
```

Parameter	Description
`premark-dscp <0-63>`	The DSCP value on ingress.
`new-dscp <0-63>`	The DSCP value that the packet will have on egress. If unspecified, this value will remain the DSCP ingress value.
`new-cos <0-7>`	The CoS value that the packet will have on egress. If unspecified, this value will be set to zero.
`new-queue <0-7>`	Modify Egress Queue.
`new-bandwidth-class`	Modify Egress Bandwidth-class. If unspecified, this value will be set to green.
`green`	Egress Bandwidth-class green (marked down Bandwidth-class).
`yellow`	Egress Bandwidth-class yellow (marked down Bandwidth-class).
`red`	Egress Bandwidth-class red (marked down Bandwidth-class).

Mode Global Configuration

Usage With the "trust dscp" on page 61.83 set, this command (mls qos map premark-dscp) enables you to remap any or all of the dscp, CoS, output queue, or bandwidth class values in one step, i.e. a single run of this command.

Example To set the entry for DSCP `1` to use a new DSCP of `2`, a new CoS of `3`, a new queue of `4` and a new bandwidth class of yellow, use the command:

```
awplus# configure terminal
awplus(config)# mls qos map premark-dscp 1 to new-dscp 2 new-
cos 3 new-queue 4 new-bandwidth-class yellow
```

XEM-2XP Platform

This command configures the premark-dscp map. It is used when traffic is classified by a policy-map that has trust dscp (XEM-2XP) configured. Based on a lookup DSCP, the map determines a new DSCP, COS, queue and bandwidth class for the traffic. The DSCP value in the packet is used for the lookup.

The no variant of this command resets the premark-dscp map to its defaults. If no DSCP is specified then all DSCP entries will be reset to their defaults.

Syntax

```
mls qos map premark-dscp <0-63> to {[new-dscp <0-63>]
   [new-cos <0-7>] [new-queue <0-7>] [new-bandwidth-class{green|
   yellow|red}]}

no mls qos map premark-dscp [<0-63>]
```

Parameter	Description
`premark-dscp <0-63>`	The DSCP value on ingress.
`new-dscp <0-63>`	The DSCP value that the packet will have on egress. If unspecified, this value will remain the DSCP ingress value.
`new-cos <0-7>`	The CoS value that the packet will have on egress. If unspecified, this value will retain its value on ingress.
`new-queue <0-7>`	Modify Egress Queue.
`new-bandwidth-class`	Modify Egress Bandwidth-class. If unspecified, this value will be set to green.
`green`	Egress Bandwidth-class green (marked down Bandwidth-class).
`yellow`	Egress Bandwidth-class yellow (marked down Bandwidth-class).
`red`	Egress Bandwidth-class red (marked down Bandwidth-class).

Mode Global Configuration

Usage With the trust dscp (XEM-2XP) command set, this command (mls qos map premark-dscp) enables you to make the following changes:

1. remap the DSCP (leaving the other settings unchanged)
2. remap any or all of CoS, output queue, or bandwidth class values (leaving the dscp unchanged)

Note If you attempt to remap both the dscp and another setting, only the dscp remap will take effect.

Example To set the entry for DSCP `1` to use a new DSCP of `2`, a new CoS of `3`, a new queue of `4` and a new bandwidth class of `yellow`, use the commands:

```
awplus# configure terminal
awplus(config)# mls qos map premark-dscp 1 to new-dscp 2
awplus(config)# mls qos map premark-dscp 2 to new-cos 3
awplus(config)# mls qos map premark-dscp 2 to new-queue 4
awplus(config)# mls qos map premark-dscp 2 to new-bandwidth-
class yellow
```

Generic and XEM-2XP Platforms

To reset the entry for DSCP `1` use the command:

```
awplus# configure terminal
awplus(config)# no mls qos map premark-dscp 1
```

Related Commands
mls qos map policed-dscp to
set dscp
show mls qos maps premark-dscp
trust dscp (XEM-2XP)

mls qos queue

Configures the default egress queue for any packet arriving on the specified interface. When no default queue is configured the cos-queue map is used to choose the queue for the packet.

Use the no variant of this command to turn off the use of a default queue on the interface.

Syntax

```
mls qos queue <0-7>
```

```
no mls qos queuebb
```

Parameter	Description
<0-7>	The particular queue number.

Mode Interface Configuration

Examples To set the default egress queue to 7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# mls qos queue 6
```

To turn off the default mls queue usage on port1.0.1 use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# no mls qos queue
```

Related Commands show mls qos interface

mls qos queue-set

Sets an interface to use the specified queue-set in either taildrop or random-detect mode.

When operating in taildrop mode only the maximum threshold parameters for each bandwidth-class are used from the queue-set. When the actual queue-length for any bandwidth-class exceeds this threshold the packets are discarded instead of being enqueued to the egress port.

When operating in random-detect mode all the parameters from the queue-set are used. The queue-length that is used in this mode is a calculated “average” queue length which can vary depending on what the averaging-factor has been configured to. This provides a more randomized discarding of packets during congestion and prevents TCP global flow synchronization. The down side of this is that more packets are dropped.

By default all ports are assigned to a queue-set created for each class of port (100 M, 1G or 10 G). All ports are also set to operate in taildrop mode. Also all traffic destined for the CPU will use queue-set 4.

Use the no variant of this command to reset a queue-set back to it's defaults. If one or more queues are specified then only those queue's will be reset. Otherwise, if no queue is specified the entire queue-set will be reset.

Syntax

```
mls qos queue-set <1-4> [random-detect|taildrop]
no mls qos queue-set <1-4> queues [0][1][2][3][4][5][6][7]
```

Parameter	Description
<1-4>	Queue-set ID.
`random-detect`	Apply this queue-set via Weighted Random Detect mode.
`taildrop`	Apply this queue-set via Taildrop mode.
`[0][1]...[7]`	Egress queues.

Mode Global Configuration and Interface Configuration

Usage This command is not applied to ports on the XEM-2XP module.

Examples To set `port1.0.1` to use queue-set `2` in random-detect mode, use the command:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# mls qos queue-set 2 random-detect
```

To reset queue-set `2` back to its defaults for queues 1-3, use the command:

```
awplus# configure terminal
awplus(config)# no mls qos queue-set 2 queues 1 2 3
```

Related Commands
mls qos queue-set averaging-factor
mls qos queue-set description
mls qos queue-set drop-probability

mls qos queue-set threshold
show mls qos interface
show mls qos queue-set

mls qos queue-set averaging-factor

Sets the averaging-factor for the specified queue-set and queue. This determines how quickly the average queue length follows the actual queue length. With a small averaging-factor, the average queue length follows the actual queue length quickly. As you increase the averaging-factor the average queue length will take longer to follow the actual queue length.

The queues parameter is optional and if not specified will default to setting the thresholds for all queues.

This parameter is only valid when a port is using this queue-set in random-detect mode.

Syntax

```
mls qos queue-set <1-4> queues {0 |1 |2 |3 |4 |5 |6 |7} averaging-
    factor <0-15>
```

Parameter	Description
<1-4>	Queue-set ID.
queues	List of queues to configure. Up to 8 queues (0-7) can be configured within a particular queue set.
averaging-factor	Configure queue length averaging factor.
<0-15>	Averaging factor value.

Mode Global Configuration

Usage This command is not applicable to ports on the XEM-2XP

Example To set the averaging-factor for queues 1-3 in queue-set `1` to be `4`, use the command:

```
awplus# configure terminal
awplus(config)# mls qos queue-set 1 queues 1 2 3 averaging-
                factor 4
```

Related Commands

mls qos queue-set
mls qos queue-set description
mls qos queue-set drop-probability
mls qos queue-set threshold
show mls qos interface
show mls qos queue-set

mls qos queue-set description

Sets the description for the specified queue-set. This is a textual string that can be up to 80 characters long.

Syntax `mls qos queue-set <1-4> description <line>`

Parameter	Description
<1-4>	Queue-set ID.
<line>	Description up to 80 characters.

Mode Global Configuration

Example To set the description for queue-set `1` to be "`Customized defaults`", use the commands:

```
awplus# configure terminal
awplus(config)# mls qos queue-set 1 description "Customized
defaults"
```

Related Commands
mls qos queue-set averaging-factor
mls qos queue-set drop-probability
mls qos queue-set threshold
show mls qos interface

mls qos queue-set drop-probability

Sets the drop probability for each bandwidth-class. This probability is the likelihood that a packet is dropped when the average queue length is between the minimum and maximum threshold for that bandwidth class. Once the average queue length is above the maximum threshold the probability jumps to 100%.

The queues parameter is optional and if not specified will default to setting the thresholds for all queues. This parameter is only valid when a port is using this queue-set in random-detect mode.

Syntax

```
mls qos queue-set <1-4> queues [0][1][2][3][4][5][6][7]
   drop-probability <0-15> <0-15> <0-15>
```

Parameter	Description
<1-4>	Queue-set ID.
`[0][2]...[7]`	List of queues to configure. Up to 8 queues (0-7) can be configured within a particular queue set.
`drop-probability`	Configure maximum drop probability for each bandwidth-class. See the following Drop Probability table.
<0-15>	Maximum drop-probability factor for green traffic.
<0-15>	Maximum drop-probability factor for yellow traffic.
<0-15>	Maximum drop-probability factor for red traffic.

Drop Probability

The drop probability is 100% for a setting of 0 and halves for each integer value increase. The following table shows probability values for drop values of 0 to 7. Default: 1.

Drop Value	0	1	2	3	4	5	6	7
Drop Probability	100%	50%	25%	12.5%	6.25%	3.125%	1.562%	0.781%

Mode Global Configuration

Usage This command is not applied to ports on the XEM-2XP module.

Example To set the drop-probability for queues 1-3 in queue-set `2` to be 50%, use the command:

```
awplus# configure terminal
awplus(config)# mls qos queue-set 2 queues 1 2 3
                drop-probability 1 1 1
```

The drop-probability parameter specifies the maximum drop-probability for packets when using the random-detect (RED) drop mode. This is the probability that a packet will be dropped when the computed average queue length reaches the Max threshold value setting for a specific traffic class within a specific queue.

The drop-probability is 100% for a drop value of 0, and halves with each increment. For example, a drop1 value of 4 gives a drop probability of 1/16, or 6.25%. The default is 1.

Related Commands

mls qos queue-set
mls qos queue-set averaging-factor
mls qos queue-set description
mls qos queue-set threshold
show mls qos interface
show mls qos queue-set

mls qos queue-set threshold

Sets the threshold parameters for the specified queue-set. There are six threshold parameters, which comprise a minimum and a maximum threshold value for each bandwidth-class.

The queues parameter is optional and if not specified will default to setting the thresholds for all queues. The minimum parameters are only valid when a port is using this queue-set in random-detect mode.

Note that only the maximum threshold setting will be applied when tail-drop mode is selected. However you must still enter a value for the minimum threshold; one method is to enter the same value for both maximum and minimum entries. See examples.

Syntax

```
mls qos queue-set <1-4> queues {0|1|2|3|4|5|6|7} threshold
   <1-16000000> <1-16000000> <1-16000000> <1-16000000> <1-16000000>
   <1-16000000>

no mls qos queue-set <1-4> queues {0|1|2|3|4|5|6|7}
```

Parameter	Description
<1-4>	Queue-set ID.
queues	List of queues to configure. Up to 8 queues (0-7) can be configured within a particular queue set.
threshold	Configure thresholds.
<1-16000000>	Minimum threshold for green traffic (Bytes).
<1-16000000>	Maximum threshold for green traffic (Bytes).
<1-16000000>	Minimum threshold for yellow traffic (Bytes).
<1-16000000>	Maximum threshold for yellow traffic (Bytes).
<1-16000000>	Minimum threshold for red traffic (Bytes).
<1-16000000>	Maximum threshold for red traffic (Bytes).

Mode Global Configuration

Usage This command is not applied to ports on the XEM-2XP module.

Examples Random Early Discard (RED) Example
To set the thresholds for queues 1-3 in queue-set 1 to a minimum or 1KB and a maximum of 2 KB, use the commands:

```
awplus# configure terminal
awplus(config)# mls qos queue-set 1 queues 1 2 3 threshold
1024 2048 1024 2048 1024 2048
```

Tail Drop Example

To set the thresholds for queue 2 in queue-set 1 to 1KB, use the commands:

```
awplus# configure terminal

awplus(config)# mls qos queue-set 1 queues 2 threshold 1024
                1024 1024 1024 1024 1024
```

Related Commands

mls qos queue-set
mls qos queue-set averaging-factor
mls qos queue-set description
mls qos queue-set drop-probability
show mls qos interface
show mls qos queue-set

no police

Disables any policer previously configured on the class-map.

Syntax `no police`

Mode Priority Map Class Configuration

Usage This command disables any policer previously configured on the class-map.

Example To disable policing on a class-map use the command:

```
awplus# configure terminal
awplus(config)# policymap name
awplus(config-pmap)# class classname
awplus(config-pmap-c)# no police
```

Related Commands
mls qos map policed-dscp to
police single-rate action
police twin-rate action
show mls qos maps policed-dscp

police-aggregate

Use this command to apply a previously created aggregate-policer to the class-map.

Use the no variant of this command to remove a previously created aggregate-policer from the class-map.

Syntax

```
police-aggregate <name>
no police-aggregate <name>
```

Parameter	Description
<name>	Specify a aggregate policer name.

Mode Policy Map Class Configuration

Usage This command enables you to apply an aggregate policer to a number of different class maps, and meter them as one group. Note that you cannot apply this command to any class map that already has a policer assigned by using the police single (or twin) rate exceed action command.

Examples To apply aggregate policer `ap1` to a class-map, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map name
awplus(config-pmap)# class classname
awplus(config-pmap-c)# police-aggregate ap1
```

To remove a previously created aggregate-policer from the class-map, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map name
awplus(config-pmap)# class classname
awplus(config-pmap-c)# no police-aggregate ap1
```

Related Commands
mls qos aggregate-police action
mls qos map premark-dscp to
mls qos map policed-dscp to
show mls qos aggregate-policer
show mls qos maps policed-dscp

police single-rate action

Configures a single-rate policer for a class-map.

Syntax

```
police single-rate <cir> <cbs> <ebs> action
   {drop-red|policed-dscp-transmit}|
```

Parameter	Description	
<cir>	Specify the Committed Information Rate (CIR) (1-16000000 kbps).	
<cbs>	Specify the Committed Burst Size (CBS) (0-16777216 bytes).	
<ebs>	Specify a Excess Burst Size (EBS) (0-16777216 bytes).	
`action`	Specify the action if rate is exceeded.	
	`drop-red`	Drop the red packets.
	`policed-dscp-transmit`	Modify packets using the *policed-dscp map*, then transmit. You can configure the remark policed-dscp map using the mls qos map policed-dscp to command on page 61.32.

Mode Policy Map Class Configuration

Usage A policer can be used to meter the traffic classified by the class-map and as a result will be given one of three bandwidth classes. These are green (conforming), yellow (partially-conforming), and red (non-conforming). A single-rate policer is based on three values. These are the average rate, minimum burst and maximum burst.

Color	Definition
`green`	The traffic rate is less than the average rate and minimum burst.
`yellow`	The traffic rate is between the minimum burst and the maximum burst.
`red`	The traffic rate exceeds the average rate and the maximum burst.

Using an action of drop-red means that any packets classed as red are discarded.

Note This command will not take effect when applied to a class map that attaches to a channel group whose ports span processor instances.

Example To configure a single rate meter measuring traffic of 10 Mbps that drops a sustained burst of traffic over this rate, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map name
awplus(config-pmap)# class classname
awplus(config-pmap-c)# police single-rate 10000 1875000 1875000
                        action drop-red
```

Related Commands

mls qos map policed-dscp to
no police
police twin-rate action
show mls qos maps policed-dscp

police twin-rate action

Configures a twin-rate policer for a class-map.

Syntax

```
police twin-rate <cir> <pir> <cbs> <pbs> action
   {drop-red|policed-dscp-transmit}|
```

Parameter	Description	
`<cir>`	Specify the Committed Information Rate (CIR) (1-16000000 kbps).	
`<pir>`	Specify the Peak Information Rate (PIR) (kbps).	
`<pbs>`	Specify the Peak Burst Size (PBS) (0-16777216 bytes).	
`action`	Specify the action if rate is exceeded.	
	`drop-red`	Drop the red packets.
	`policed-dscp-transmit`	Modify packets using the *policed-dscp map*, then transmit. You can configure the remark policed-dscp map using the mls qos map policed-dscp to command on page 61.32.

Mode Policy Map Class Configuration

Usage A policer can be used to meter the traffic classified by the class-map and as a result will be given one of three bandwidth classes. These are green (conforming), yellow (partially-conforming), and red (non-conforming).

A twin-rate policer is based on four values. These are the minimum rate, minimum burst size, maximum rate, and maximum burst size.

Bandwidth Class	Definition
`green`	The sum of the number of existing (buffered) bytes plus those arriving at the port per unit time, result in a value that is less than that set for the CBS.
`yellow`	The sum of the number of existing (buffered) bytes plus those arriving at the port per unit time, result in a value that is between those set for the CBS and the PBS.
`red`	The sum of the number of existing (buffered) bytes plus those arriving at the port per unit time, result in a value that exceeds that set for the PBS.

Using an action of drop-red means that any packets classed as red will be discarded.

When using an action of policed-dscp-transmit the packet will be remarked with the values configured in the policed-dscp map. The index into this map is determined by the DSCP in the packet. If a DSCP index is to be forced regardless of the packet DSCP the set dscp command can be used to achieve this. If no DSCP is present in the packet an index of 0 is used.

Example To configure a twin rate meter measuring a minimum rate of 10 Mbps and a maximum rate of 20 Mbps that uses the policed-dscp map to remark any non-conforming traffic, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map name
awplus(config-pmap)# class classname
awplus(config-pmap-c)# police twin-rate 10000 20000 1875000
3750000 action policed-dscp-transmit
```

Related Commands
mls qos map policed-dscp to
no police
police twin-rate action
show mls qos maps policed-dscp

policy-map

Use this command to create a policy map and to enter Policy Map Configuration mode to configure the specified policy map.

Use the no variant of this command to delete an existing policy map.

Syntax

```
policy-map <name>
no policy-map <name>
```

Parameter	Description
<name>	Name of the policy map.

Mode Global Configuration

Example To create a policy-map called `pmap1`, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)#
```

Related Commands class-map

priority-queue

Configures strict priority based scheduling on the specified egress queues. You must specify at least one queue.

Syntax `priority-queue {0}[1][2][3][4][5][6][7]`

Parameter	Description
`{0}[1]...[7]`	Specify queues to apply the scheduling rule in the range <0-7>. To apply priorities of `4`, `5` and `6` to queues `0`, `1` and `2` enter: `awplus(config-if)#priority-queue 4 5 6`

Mode Interface Configuration

Usage By default, the queues on all ports are set for priority queueing. You can change the queue emptying sequence to weighted round robin, by using the commands:mls qos fabric-queue command on page 61.27, or wrr-queue group weight queues command on page 61.87. You can then use the priority-queue command to reset the selected queues to priority queueing. Note that the emptying sequence for priority queueing is always highest queue number to lowest queue number.

For more information on queueing operation, see the chapter, Quality of Service (QoS) Introduction.

Example To apply priority based scheduling of `5`, `6` and `7` to egress queues 0, 1 and 2, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.1.12
awplus(config-if)# priority-queue 5 6 7
```

Related Commands
mls qos fabric-queue
show mls qos interface
show mls qos interface queue-counters
wrr-queue group weight queues

service-policy input

Use this command to apply a policy map to the input of an interface.

Use the no variant of this command to remove a policy map and interface association.

Syntax

```
service-policy input <policy-map>
no service-policy input <policy-map>
```

Parameter	Description
<policy-map>	Policy map name that the input will applied to.

Mode Interface Configuration

Usage This command can be applied to switch ports or static channel groups, but not to dynamic (LACP) channel groups.

Example To apply a policy map named `pmap1` to interface `port1.0.2`, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# service-policy input pmap1
```

set bandwidth-class

Use this command to set a bandwidth-class color to assign to classified traffic. The color represents the traffic's conformance to the policers allocated bandwidth. Green traffic is assumed to be conforming, yellow is semi-conforming, and red is non-conforming.

Use the no variant of this command to turn off a bandwidth-class color assigned to classified traffic.

Syntax

```
set bandwidth-class {green|yellow|red}
no set bandwidth-class {green|yellow|red}
```

Parameter	Description
green	Mark the packet as green.
yellow	Mark the packet as yellow.
red	Mark the packet as red.

Mode Policy Map Class Configuration

Examples To set the bandwidth class for all traffic classified by this class-map, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# set bandwidth-class green
```

Note that the class-map and policy-maps should already have been created by using the class-map command on page 61.4 and the policy-map command on page 61.53.

To turn off the setting of a packets in the green bandwidth-class, for the policy `pmap1` and the class `cmap1`, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# no set bandwidth-class green
```

Related Commands

class-map
set cos
set dscp
set queue
trust dscp
trust dscp (XEM-2XP)

set cos

Use this command to set a CoS value to assign to classified traffic.

Use the no variant of this command to turn off the CoS value assigned to classified traffic.

Note that this command is not valid with trust dscp (XEM-2XP).

Syntax

```
set cos <0-7>
no set cos
```

Parameter	Description
<0-7>	The new CoS value to be assigned.

Mode Policy Map Class Configuration

Examples To set the CoS value to 7 for all traffic classified by the selected class-map and policy-map, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# set cos 7
```

To turn off the above setting, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# no set cos
```

Related Commands
set bandwidth-class
set dscp
set queue
set dscp

set dscp

For a specific class-map and policy-map this command will assign or change the DSCP value within the packet. Note that where more than one class map has been assigned to a particular DSCP, the switch will apply the action of the class-map that was created first.

If trust dscp (XEM-2XP) has also been specified, the value determined by the set dscp command (i.e. that assigned to the class map and policy map) will be the value that is used by the lookup process in the premark-dscp mapping. The result of the lookup with then be assigned to the traffic.

The no variant of this command will negate the DSCP value specified with the set dscp command.

Syntax

```
set dscp <0-63>
no set dscp
```

Parameter	Description
<0-63>	The new DSCP value. A value between 0 and 63.

Mode Policy Map Class Configuration

Example To set a DSCP value of `35` to all traffic classified by a class-map of `cmap1` and a policy map of `pmap1`, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# set dscp 35
```

Related Commands

set bandwidth-class
set cos
set queue
trust dscp
trust dscp (XEM-2XP)

set ip next-hop (PBR)

Forwards traffic matching this class map to the specified nexthop.

When this command is set, all packets that match a selected class map will be forwarded to the specified nexthop.

The no variant of this command removes the next-hop address (in the context of its policy-map and class-map) from the configuration.

Syntax

```
set ip next-hop <ip-addr>
no set ip next-hop
```

Parameter	Description
<ip-addr>	The IP address of the next hop destination.

Mode Policy Map Class Configuration

Usage In typical deployments of policy-based routing, some traffic types require normal routing (i.e. via the routes in the IP routing table) while other traffic types require policy based routing.

Where the traffic to be policy routed is a subset of the traffic that is to be normally routed, then the configuration is reasonably simple. The policy-map will contain one or more classes that match the traffic to be policy routed, and will have their next-hop configured by this command - set ip next-hop (PBR). The remaining traffic will be conventionally routing routed according to the rules set for the default class - providing that this is not subject to the set ip next-hop (PBR).

The situation becomes a little more complex where the traffic requiring normal routing is a subset of the traffic to be policy-routed. In this situation the policy-map would need to contain one, or more, classes that match the requirement for normal routing, These classes would not be configured with a set ip next-hop (PBR) command. Then the remaining traffic classes that require normal routing would have the set ip next-hop (PBR) command applied to them. Note that this traffic could be just the default class, if ALL other traffic types were to be policy-routed.

Also note that the order in which the classes are configured in the policy-map is important; because traffic is matched against the classes in the order that they were assigned to the policy map.

Details of a practical example of such a policy-based routing is shown in "Policy-Based Routing" on page 60.35.

Example To forward a packet to a 192.168.1.1, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# set ip next-hop 192.168.1.1
```

Related Commands
set bandwidth-classs
set cos
set dscp
set queue

set queue

Use this command to set a queue value to assign to classified traffic. This will override the default queue as configured by mls qos queue command on page 61.38, but may be overridden by subsequent QoS mechanisms (such as remarking).

Use the no variant of this command to negate the queue value assigned to classified traffic by the set queue command.

This command is not valid if the trust dscp (XEM-2XP) command is set.

Syntax

```
set queue <0-7>
no set queue
```

Parameter	Description
<0-7>	Specify a new Queue value.

Mode Policy Map Class Configuration

Example To set the queue to value 7 for all traffic classified as cmap1 and pmap1, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# set queue 7
```

Related Commands

set bandwidth-class
set cos
set dscp
trust dscp
trust dscp (XEM-2XP)

show class-map

Use this command to display the QoS class maps to define the match criteria to classify traffic.

Syntax `show class-map <class-map name>`

Parameter	Description
<class-map name>	Name of the class map.

Mode User Exec and Privileged Exec

Example To display the QoS class maps to define the match criteria to classify traffic, use the command:

```
awplus# show class-map cmap1
```

Output Figure 61-2: Example output from the **show class-map** command

```
CLASS-MAP-NAME: cmap1
      Set IP DSCP: 56
      Match IP DSCP: 7
```

Related Commands class-map

show mls qos aggregate-policer

Displays all or a single aggregate-policer. If no name is specified, all aggregate policers will be displayed.

Syntax `show mls qos aggregate-policer [<name>]`

Parameter	Description
<name>	Aggregate policer name.

Mode User Exec and Privileged Exec

Example To display all aggregate-policers, use the command:

```
awplus# show mls qos aggregate-policer
```

Output Figure 61-3: Example output from the **show mls qos aggregate-policer** command

```
AGGREGATE-POLICER-NAME: ap1
Policer single-rate action drop-red:
average rate(1 kbps) minimum burst(2 B) maximum burst(3 B)
AGGREGATE-POLICER-NAME: ap2
Policer twin-rate action drop-red policed-dscp-tx:
minimum rate(1 kbps) maximum rate(2 kbps) minimum burst(3 B)
maximum burst(4 B)
```

Related Commands mls qos aggregate-police action
police-aggregate

show mls qos fabric-queue

Displays the scheduling algorithms for the fabric queues.

Syntax `show mls qos fabric-queue`

Mode User Exec and Privileged Exec

Example To display all scheduling algorithms for the fabric-queues, use the command:

```
awplus# show mls qos fabric-queue
```

Output Figure 61-4: Example output from the **show mls qos fabric-queue** command

```
fabric queue: 0
Scheduler: WRR
Weight: 5
Fabric Queue: 1
Scheduler: WRR
Weight: 1
Fabric Queue: 2
Scheduler: Priority
Fabric Queue: 3
Scheduler: Priority
```

Related Commands mls qos fabric-queue
show mls qos maps fabric-queue

show mls qos interface

Displays the current settings for the interface. This includes it's default CoS and queue, scheduling used for each queue, and any policies/maps that are attached.

Syntax `show mls qos interface [<port>]`

Parameter	Description
<port>	Switch port.

Mode User Exec and Privileged Exec

Example To display current CoS and queue settings for interface `port1.0.1`, use the command:

```
awplus# show mls qos interface port1.0.1
```

Output Figure 61-5: Example output from the **show mls qos interface** command

```
Default CoS:   7
    Default Queue: 7
    Number of egress queues: 8
    Queue Set: 1
    Egress Queue:         0
      Status:             Enabled
      Scheduler:          Strict Priority
      Queue Limit:        12%
      Egress Rate Limit: 0 Kb
    Egress Queue:         1
      Status:             Enabled
      Scheduler:          Strict Priority
      Queue Limit:        12%
      Egress Rate Limit: 0 Kb
    Egress Queue:         2
      Status:             Enabled
      Scheduler:          Strict Priority
      Queue Limit:        12%
      Egress Rate Limit: 0 Kb
    Egress Queue:         3
      Status:             Enabled
      Scheduler:          Wrr Group 2
      Weight:             10
      Queue Limit:        12%
      Egress Rate Limit: 0 Kb
    Egress Queue:         4
      Status:             Enabled
      Scheduler:          Wrr Group 1
      Weight:             10
      Queue Limit:        12%
      Egress Rate Limit: 0 Kb
    Egress Queue:         5
      Status:             Enabled
      Scheduler:          Strict Priority
      Queue Limit:        12%
      Egress Rate Limit: 0 Kb
    Egress Queue:         6
      Status:             Enabled
      Scheduler:          Strict Priority
      Queue Limit:        12%
      Egress Rate Limit: 0 Kb
    Egress Queue:         7
      Status:             Enabled
      Scheduler:          Strict Priority
      Queue Limit:        12%
      Egress Rate Limit: 0 Kb
```

Table 61-1: Parameters in the output of the **show mls qos interface** command

Parameter	Description
`Default CoS`	The default CoS priority that will be applied to all packets arriving on this interface.
`Default Queue`	The default queue that will be applied to all packets arriving on this interface.
`Number of egress queues`	The total number of egress queues available on this interface.
`Queue Set`	Drop queue set that has been applied to the port. This could either be operating in threshold or random-detect mode.
`Egress Queue X`	Number of this egress queue.
`Status`	Queue can either be enabled or disabled.
`Scheduler`	The scheduling mode being used for servicing the transmission of packets on this port.
`Queue Limit`	The percentage of the ports buffers that have been allocated to this queue.
`Egress Rate Limit`	The amount of traffic that can be transmitted via this queue per second. 0 Kb means there is currently no rate-limiting enabled.

Related Commands

mls qos queue
wrr-queue group weight queues
wrr-queue queue-limit

show mls qos interface policer-counters

Display an interface's policer counters. This can either be for a specific class-map or for all class-maps attached to the interface. If no class-map is specified all class-map policer counters attached to the interface will be displayed.

These are the counters based on metering performed on the specified class-map. Therefore, the 'Dropped packets' counter is the number of bytes dropped due to metering. This is different from the packets dropped via a 'deny' action in the ACL.

You must enable the QoS counter platform enhanced mode before running this command.

Syntax

```
show mls qos interface <port> policer-counters
   [class-map <class-map>]
```

Parameter	Description
<port>	Switch port.
`class-map`	Select a class-map.
<class-map>	Class-map name.

Mode User Exec and Privileged Exec

Example To show the counters for all class-maps attached to `port1.1.1`, use the command:

```
awplus# show mls qos interface port1.1.1 policer-counters
```

Output Figure 61-6: Example output from the **show mls qos interface policer-counters** command

```
Interface:           port1.1.1
   Class-map:         cmap1
     Aggregate Bytes: 128
     Green Bytes:     128
     Yellow Bytes:    0
     Red Bytes:       0
     Dropped Bytes:   0
```

Related Commands

mls qos queue
wrr-queue group weight queues
wrr-queue queue-limit

show mls qos interface queue-counters

Display an interface's egress queue counters. This can either be for a specific queue or for all queues on the interface. If no queue is specified all queue counters on the interface will be displayed.

The counters show the number of frames currently in the queue and the maximum number of frames allowed in the queue, for individual egress queues and the port's queue (which will be a sum of all eight egress queues).

Syntax

```
show mls qos interface <port> queue-counters queue [<0-7>]
```

Parameter	Description
<port>	Switch port.
<0-7>	Queue.

Mode User Exec and Privileged Exec

Usage The output of this command is now device specific. Specific output applies to switch ports on the XEM-2XP module, generic output applies to all other switch ports.

On the XEM-2XP, the maximum value of 219 represents (73+73+73) frames, where the value 73 (219 divided by 3) is the drop precedence, red, green, and yellow. It is therefore possible that for unmetered traffic (where all traffic is treated as being green) the queue length of 73 frames could be exceeded. Note also that the figure of 219 shown in the example is derived from the settings made in the wrr-queue queue-limit command on page 61.88 command.

Example Generic Port To show the counters for all queues on `port1.0.1`, use the command:

```
awplus# show mls qos interface port1.0.1 queue-counters
```

Output Generic Ports Figure 61-7: Example output from the **show mls qos interface queue-counters** command

```
Interface port1.0.1 Queue Counters:
   Port queue length         0 (maximum 896)
   Egress Queue length:
     Queue 0                 0 (maximum 112)
     Queue 1                 0 (maximum 112)
     Queue 2                 0 (maximum 112)
     Queue 3                 0 (maximum 112)
     Queue 4                 0 (maximum 112)
     Queue 5                 0 (maximum 112)
     Queue 6                 0 (maximum 112)
     Queue 7                 0 (maximum 112)
```

Output XEM-2XP Ports

Figure 61-8: Example output from the **show mls qos interface queue-counters** command

```
Interface port1.1.1 Queue Counters:
   Port queue length          0 (maximum 600)
   Egress Queue length:
     Queue 0                  0 (maximum 219)
     Queue 1                  0 (maximum 219)
     Queue 2                  0 (maximum 219)
     Queue 3                  0 (maximum 219)
     Queue 4                  0 (maximum 219)
     Queue 5                  0 (maximum 219)
     Queue 6                  0 (maximum 219)
     Queue 7                  0 (maximum 219)
```

Table 61-2: Parameters in the output of the **show mls qos interface queue-counters** command

Parameter	Description
`Interface`	Port we are showing the counters for.
`Port queue length`	Number of frames in the port's queue. This will be the sum of all egress queues on the port.
`Egress Queue length`	Number of frames in a specific egress queue, subject to the specific operation on the XEM-2XP module - see Usage Section.

Related Commands

wrr-queue queue-limit

show mls qos interface storm-status

Show the current configuration and status of the QoS Storm Protection (QSP) on the given port.

Syntax `show mls qos interface <port> storm-status`

Parameter	Description
<port>	Switch port.

Mode User Exec and Privileged Exec

Example To see the QSP status on `port1.0.1`, use command:

```
awplus# show mls qos interface port1.0.1 storm-status
```

Output Figure 61-9: Example output from the **show mls qos interface storm-status** command

```
Interface:            port1.0.1
Storm-Protection:     Enabled
Port-status:          Enabled
Storm Action:         vlandisable
Storm Window:         5000 ms
Storm Downtime:       0 s
Timeout Remaining:    0 s
Last read data-rate:  0 kbps
Storm Rate:           1000 kbps
```

Related Commands
storm-action
storm-downtime
storm-protection
storm-rate
storm-window

show mls qos maps cos-queue

Show the current configuration of the cos-queue map.

Syntax `show mls qos maps cos-queue`

Mode User Exec and Privileged Exec

Example To display the current configuration of the cos-queue map, use the command:

```
awplus# show mls qos maps cos-queue
```

Output Figure 61-10: Example output from the **show mls qos maps cos-queue** command

```
COS-TO-QUEUE-MAP:
      COS :            0 1 2 3 4 5 6 7
      --------------------------------
      QUEUE:           0 7 1 3 4 5 6 7
```

Related Commands mls qos map cos-queue to

show mls qos maps fabric-queue

Displays the fabric queue map, which is a table mapping eight egress queues to four input fabric queues.

Syntax `show mls qos maps fabric-queue`

Mode User Exec and Privileged Exec

Example To display the `fabric-queue` map, use the command:

```
awplus# show mls qos maps fabric-queue
```

Output Figure 61-11: Example output from the **show mls qos maps fabric-queue** command

```
Egress Queue    Fabric Queue
    ----------------------
    0                0
    1                0
    2                1
    3                1
    4                2
    5                2
    6                3
    7                3
```

Output Parameter	Meaning
`Egress Queue`	Egress queue indexing the table
`Fabric Queue`	Resulting fabric queue for the egress queue lookup.

Related Commands
mls qos fabric-queue
mls qos map fabric-queue
show mls qos fabric-queue

show mls qos maps policed-dscp

Displays the policed-dscp map. This is used when a policer is configured with an exceed action of 'policed-dscp-transmit'.

Syntax `show mls qos maps policed-dscp [<0-63>]`

Parameter	Description
<0-63>	DSCP table entry.

Mode User Exec and Privileged Exec

Example To display the policed-dscp map for DSCP `1`, use the command:

```
awplus# show mls qos maps policed-dscp 1
```

Output Figure 61-12: Example output from the **show mls qos maps policed-dscp** command

```
POLICED-DSCP-MAP:
DSCP 1
Bandwidth Class Green Yellow Red
-------------------------------------------------
New DSCP 1 1 1
New CoS 0 0 0
New Queue 0 0 0
New Bandwidth Class green yellow red
```

Related Commands
mls qos map premark-dscp to
no police
police single-rate action
police twin-rate action

show mls qos maps premark-dscp

Displays the premark-dscp map. This map is used when the trust dscp (XEM-2XP) command has been specified for a policymap's class-map to replace the DSCP, CoS, queue, and bandwidth class of a packet matching the class-map based on a lookup DSCP value.

If the set dscp command has also been specified for that class-map, the set value is used for the lookup of the premark-dscp map. Otherwise the DSCP value in the packet is used for the lookup.

Syntax

```
show mls qos maps premark-dscp [<0-63>]
```

Parameter	Description
<0-63>	DSCP table entry.

Mode User Exec and Privileged Exec

Example To display the premark-dscp map for DSCP 1, use the command:

```
awplus# show mls qos maps premark-dscp 1
```

Output Figure 61-13: Example output from the **show mls qos maps premark-dscp** command

```
PREMARK-DSCP-MAP:

    DSCP 1
    Bandwidth Class         Green    Yellow   Red
    ------------------------------------------------
    New DSCP                1        -        -
    New CoS                 0        -        -
    New Queue               0        -        -
    New Bandwidth Class     green    -        -
```

Related Commands

mls qos map premark-dscp to
set dscp
trust dscp (XEM-2XP)

show mls qos queue-set

Displays the specified queue-set and its parameters. If no queue-set is specified then all queue sets will be displayed.

Syntax `show mls qos queue-set [<1-4>]`

Parameter	Description
<1-4>	Queue Set ID.

Mode User Exec and Privileged Exec

Usage This show output is invalid for ports on the XEM-2XP module.

Example To display `queue-set 1`, use the command:

```
awplus# show mls qos queue-set 1
```

Output Figure 61-14: Example output from the **show mls qos queue-set** command

```
Queue Set 1:
  Description: 1G Defaults

                BandwidthClass   Min           Max           Drop
Probability
  ----------------------------------------------------------------
  Queue 0     | Green            100 KB        125 KB        1
(50%)
              | Yellow           100 KB        125 KB        1
(50%)
              | Red              100 KB        125 KB        1
(50%)
  ----------------------------------------------------------------
  Queue 1     | Green            100 KB        125 KB        1
(50%)
              | Yellow           100 KB        125 KB        1
(50%)
              | Red              100 KB        125 KB        1
(50%)
  ----------------------------------------------------------------
  Queue 2     | Green            100 KB        125 KB        1
(50%)
              | Yellow           100 KB        125 KB        1
(50%)
              | Red              100 KB        125 KB        1
(50%)
  ----------------------------------------------------------------
  Queue 3     | Green            100 KB        125 KB        1
(50%)
              | Yellow           100 KB        125 KB        1
(50%)
              | Red              100 KB        125 KB        1
(50%)
  ----------------------------------------------------------------
  Queue 4     | Green            100 KB        125 KB        1
(50%)
              | Yellow           100 KB        125 KB        1
(50%)
              | Red              100 KB        125 KB        1
(50%)
  ----------------------------------------------------------------
  Queue 5     | Green            100 KB        125 KB        1
(50%)
              | Yellow           100 KB        125 KB        1
(50%)
              | Red              100 KB        125 KB        1
(50%)
  ----------------------------------------------------------------
  Queue 6     | Green            100 KB        125 KB        1
(50%)
              | Yellow           100 KB        125 KB        1
(50%)
              | Red              100 KB        125 KB        1
(50%)
----------------------------------------------------------------
  Queue 7     | Green            100 KB        125 KB        1
(50%)
              | Yellow           100 KB        125 KB        1
(50%)
              | Red              100 KB        125 KB        1
(50%)
  ----------------------------------------------------------------

  Queue Length Averaging Factor
    Queue 0: 9
    Queue 1: 9
    Queue 2: 9
    Queue 3: 9
    Queue 4: 9
    Queue 5: 9
    Queue 6: 9
    Queue 7: 9
```

Table 61-3: Parameters in the output of the **show mls qos queue-set** command

Parameter	Description
`Queue Set`	Queue-set number.
`Description`	Textual description for this queue-set.
`Queue X`	Parameter set for egress queue X.
`BandwidthClass`	Parameter set per-bandwidth-class per-queue.
`Min`	The amount of traffic required in the queue before packets start getting dropped.
`Max`	The amount of traffic required in the queue before all packets are dropped.
`Drop Probability`	The probability that a packet is dropped when the queue length is between the minimum and maximum for the bandwidth-class.
`Averaging Factor`	Determines how quickly the average queue length follows the actual queue length. A small averaging factor will cause the average to follow the actual more quickly and visa versa for a large averaging factor.

Related Commands

mls qos queue-set
mls qos queue-set averaging-factor
mls qos queue-set description
mls qos queue-set drop-probability
mls qos queue-set threshold
show mls qos interface
show mls qos queue-set

show policy-map

Displays the policy-maps configured on the switch. The output also shows whether or not they are connected to a port (attached / detached) and shows their associated class-maps.

Syntax `show policy-map [<name>]`

Parameter	Description
<name>	The name of a specific policy map.

Mode User Exec and Privileged Exec

Example To display a listing of the policy-maps configured on the switch, use the command:

```
awplus# show policy-map
```

Output Figure 61-15: Example output from the **show policy-map** command

```
POLICY-MAP-NAME: general-traffic
  State: attached
    Default class-map action: permit
    CLASS-MAP-NAME: default
    CLASS-MAP-NAME: database-traffic
```

Related Commands no police
service-policy input

storm-action

Sets the action to take when triggered by QoS Storm Protection (QSP). There are three available options:

- portdisable will disable the port in software.
- vlandisable will disable the port from the VLAN matched by the class-map in class-map.
- linkdown will physically bring the port down. The vlandisable requires the match vlan class-map to be present in the class-map.

The no variant of this command will negate the action set by the storm-action command.

Syntax

```
storm-action {portdisable|vlandisable|linkdown}
no storm-action
```

Parameter	Description
portdisable	Disable the port in software.
vlandisable	Disable the VLAN.
linkdown	Shutdown the port physically.

Mode Policy Map Class Configuration

Examples To apply the storm protection of `vlandisable` to the policy map named `pmap2`, and the class-map named `cmap1`, use the following commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap1
awplus(config-pmap-c# storm-action vlandisable
```

To negate the storm protection set on the policy map named `pmap2`, and the class-map named `cmap1`, use the following commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap1
awplus(config-pmap-c# no storm-action
```

Related Commands
storm-downtime
storm-protection
storm-rate
storm-window

storm-downtime

Sets the time to re-enable the port once disabled by QoS Storm Protection (QSP). The time is given in seconds, from a minimum of one second to maximum of 86400 seconds (i.e. one day).

The no variant of this command resets the time to the default value of 10 seconds.

Syntax

```
storm-downtime <1-86400>
no storm-downtime
```

Parameter	Description
<1-86400>	Seconds.

Default 10 seconds

Mode Policy Map Class Configuration

Examples To re-enable the port in 1 minute, use the following commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# storm-downtime 60
```

To re-set the port to the default (10 seconds), use the following commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# no storm-downtime
```

Related Commands

storm-action
storm-protection
storm-rate
storm-window

storm-protection

Use this command to enable the policy-based storm protection (such as QSP - QoS Storm Protection). Storm protection is activated on a port after port state decisions have been made.

The no variant of this command disables Policy Based Storm Protection.

Syntax

```
storm-protection
no storm-protection
```

Default By default, storm protection is disabled.

Mode Policy Map Class Configuration

Usage Before you can configure storm protection, you must first set the silicon profile to either extended or qoscounters. Silicon profiles are hardware-dependent—see the platform silicon-profile command on page 15.34.

Examples To enable QSP on `cmap2` in `pmap2`, use the following commands:

```
awplus# policy-map pmap2
awplus(config-pmap)# class cmap2
awplus(config-pmap-c)# storm-protection
```

To disable QSP on `cmap2` in `pmap2`, use the following commands:

```
awplus# policy-map pmap2
awplus(config-pmap)# class cmap2
awplus(config-pmap-c)# no storm-protection
```

Related Commands

platform silicon-profile
storm-action
storm-downtime
storm-rate
storm-window

storm-rate

Sets the data rate that triggers the storm-action. The rate is in kbps and the range is from 1kbps to 10Gbps.

Note that this setting is made in conjunction with the storm window command.

Use the no variant of this command to negate the storm-rate command.

Syntax

```
storm-rate <1-10000000>
no storm-rate
```

Parameter	Description
<1-10000000>	The range of the storm-rate.

Default No default

Mode Policy Map Class Configuration

Usage This setting is made in conjunction with the storm-window command on page 61.82.

Examples To the limit to 1Mbps, use the following commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap2
awplus(config-pmap-c)# storm-rate 1000
```

To negate the limit set previously, use the following commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap2
awplus(config-pmap-c)# storm-rate 1000
```

Related Commands

storm-action
storm-downtime
storm-protection
storm-window

storm-window

Sets the window size of QoS Storm Protection (QSP). This sets the time to poll the data-rate every given milliseconds. Minimum window size of 100 ms and the maximum is 60 sec.

Use the no variant of this command to negate the storm-window command.

Syntax

```
storm-window <100-60000>
no storm-window
```

Parameter	Description
<100-60000>	The window size, measured in milliseconds.

Default No default

Mode Policy Map Class Configuration

Usage This command should be set in conjunction with the storm-rate command on page 61.81.

Examples To set the QSP window size to `5000` ms, use the following commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap2
awplus(config-pmap-c)# storm-window 5000
```

To negate the QSP window size set previously, use the following commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap2
awplus(config-pmap-c)# storm-window 5000
```

Related Commands

storm-action
storm-downtime
storm-protection
storm-rate

trust dscp

On switch ports other than the XEM-2XP, this command enables the premark-dscp map to replace the bandwidth-class, cos, dscp, and queue of classified traffic based on a lookup DSCP value.

With the no variant of this command, no premark-dscp mapping function will be applied for the selected class-map. QoS components of the packet existing either at ingress, or applied by the class-map, will pass unchanged.

Syntax

```
trust dscp
no trust
```

Mode Policy Map Class Configuration

Usage If the set dscp command has also been specified for the class-map, the set value is used for the lookup of the premark-dscp map. Otherwise the DSCP value in the packet is used for the lookup.

Note that the set bandwidth-class, set cos and set queue are not valid with trust dscp.

Examples To enable the premark-dscp map lookup for policy-map `pmap1`, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# trust dscp
```

To disable the premark-dscp map lookup for policy-map `pmap1`, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# no trust
```

Related Commands
mls qos map premark-dscp to
set bandwidth-class
set cos
set dscp
set queue
trust dscp (XEM-2XP)

trust dscp (XEM-2XP)

On the XEM-2XP module, use this command to enable the premark-dscp map to replace the bandwidth-class, cos, dscp, and queue of classified traffic within a policy-map based on a lookup DSCP value.

With the no variant of this command, no premark-dscp mapping function will be applied for the selected policy-map. QoS components of the packet existing at ingress will pass unchanged.

Syntax

```
trust dscp
no trust
```

Mode Policy Map Configuration

Usage The DSCP value in the packet is used for lookup, regardless of whether the policy-map has any class-map (with an assigned DSCP) attached to it.

Examples To enable the premark-dscp map lookup for policy-map `pmap1`, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# trust dscp
```

To disable the premark-dscp map lookup for policy-map `pmap1`, use the commands:

```
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# no trust
```

Related Commands

mls qos map premark-dscp to
set bandwidth-class
set cos
set dscp
set queue
trust dscp

wrr-queue disable queues

Use this command to disable an egress queue from transmitting traffic.

The no variant of this command enables an egress queue to transmit traffic.

Syntax

```
wrr-queue disable queues [0][1][2][3][4][5][6][7]
no wrr-queue disable queues [0][1][2][3][4][5][6][7]
```

Parameter	Description
[1][2]...[7]	Selects one or more queues numbered 0 to 7.

Mode Interface Configuration

Examples To enable queues 1-3 to transmit traffic, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# no wrr-queue disable queues 1 2 3
```

To disable queues 1-3 from transmitting traffic, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# wrr-queue disable queues 1 2 3
```

Related Commands show mls qos interface

wrr-queue egress-rate-limit queues

Sets a limit on the amount of traffic that can be transmitted per second from these queues. The default unit is in Kb, but Mb or Gb can also be specified. The minimum is 651Kb.

Syntax

```
wrr-queue egress-rate-limit <bandwidth> queues
    {0}[1][2][3][4][5][6][7]

no wrr-queue egress-rate-limit <bandwidth> queues
    {0}[1][2][3][4][5][6][7]
```

Parameter	Description
<bandwidth>	Bandwidth <1-10000000 kbits> (usable units: k, m, g).
{0}[1]...[7]	Selects one or more queues to apply the bandwidth limit to as specified in the preceding *<bandwidth>* parameter. Then apply a priority in the range <0-7> for each selected queue. For example, to apply priorities 1, 2 and 3 to queues 0, 1 and 2 enter queues 1 2 3. {0} [1] . . . [7] indicates a queue for a priority <0-7>.

Mode Interface Configuration

Example To set enable egress rate limiting on queues 0, 1 and 2 with the priorities 1, 2 and 3, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# wrr-queue egress-rate-limit 500M
                   queues 1 2 3
```

Related Commands show mls qos interface

wrr-queue group weight queues

Configures weighted round-robin based scheduling on the specified egress queues on switch port interfaces and static aggregated interfaces.

The queues can be placed into either group 1 or group 2. Both groups are still serviced in a round-robin order according to the specified weights, but all queues in group 1 must be empty before any packets in group 2 can be sent. The weights are specified as ratio's relative to each other.

Note that switch port interfaces or static aggregated interfaces within a round robin group must be contiguous.

Syntax

```
wrr-queue group <1-2> weight <6-255> queues {0}[1][2]3][4][5][6][7]
```

Parameter	Description
<1-2>	WRR group 1 or 2.
<6-255>	Weight.
`{0}[1]...[7]`	Egress queues 0-7 to select and assign a priority in the range <0-7>. The queue number is indicated by the order of entry. For example, queue 1 2 assigns priority 1 and 2 to queues 0 and 1 due to the order of entry. Queue 0 is a required queue.

Mode Interface Configuration for both switch port interfaces and static aggregated interfaces.

Usage Weighted round-robin based scheduling may be applied to switch port interfaces (for example, `awplus(config)#interface port1.0.2`) and to static aggregated interfaces (for example, `awplus(config)#interface sa2`).

Examples To configure wrr-queue group `1` weight `6` queues `0 1 2` on the switch port interface `port1.0.1`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# wrr-queue group 1 weight 6 queues 0 1 2
```

To configure a static aggregated interface `sa2` on switch port interface `port1.0.2` and configure wrr-queue group `2` weight `9` queues `0 1` on interface `sa2`, use these commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# static-channel-group 2
awplus(config-if)# exit
awplus(config)# interface sa2
awplus(config-if)# wrr-queue group 2 weight 9 queues 0 1
```

Related Commands priority-queue
show mls qos interface

wrr-queue queue-limit

Sets the percentages of a ports total buffer pool that each queue is allowed to use. This queue limit is applicable no matter what type of scheduling is configured for the specified queues (i.e. WRR or strict priority).

Syntax

```
wrr-queue queue-limit <1-100> <1-100> <1-100> <1-100> <1-100> <1-100>
    <1-100> <1-100>

no wrr-queue queue-limit
```

Parameter	Description
<1-100>	Queue ratio for Queue 0.
<1-100>	Queue ratio for Queue 1.
<1-100>	Queue ratio for Queue 2.
<1-100>	Queue ratio for Queue 3.
<1-100>	Queue ratio for Queue 4.
<1-100>	Queue ratio for Queue 5.
<1-100>	Queue ratio for Queue 6.
<1-100>	Queue ratio for Queue 7.

Mode Interface Configuration

Usage Note that for ports on the XEM-2XP module, the portion of the port's buffer pool that is assigned to each queue is divided by three, with one third applied to each of the three drop precedence colors, red, green, and yellow.

Where no color metering is applied, the queue limit is effectively reduced to a third of the configured value, because in this situation all traffic is classed as green. For example, if the overall queue size available is 792 frames, and equal portions (12.5% of 792 = 99 frames) are assigned to each queue, then 33 frames are assigned to each of the three drop precedence colors. Where no color metering is applied, all traffic is (by default) defined as green, and so is allocated 33 frames per queue. Tail dropping is then applied when each queue is only one third full.

On ports other than the XEM-2XP, no per precedence queuing is applied; therefore in the above example all 99 frames per queue would be available.

Example To configure a wrr-queue queue-limit on `port1.0.1` to `port1.0.12` for each queue, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1-port1.0.12
awplus(config-if)# wrr-queue queue-limit 12 12 12 12 12 12 12
12
```

Related Commands show mls qos interface

Chapter 62: 802.1X Introduction and Configuration

Introduction 62.2
The 802.1X Implementation 62.2
Configuring 802.1X 62.2

Introduction

The IEEE Standard 802.1X provides a method of restricting access to networks based on authentication information. 802.1X provides port-based network access control for devices connected to the Ethernet. This allows a network controller to restrict external devices from gaining access to the network behind an 802.1X controlled port. External devices that wish to access services via a port under 802.1X control must firstly authenticate themselves and gain authorization before any packets originating from, or destined for, the external device are allowed to pass through the 802.1X controlled port.

The 802.1X Implementation

802.1X port access control is achieved by making devices attached to a controlled port authenticate themselves via communication with an authentication server before these devices are allowed to access the network behind the controlled port.

Authentication is required on a per-port basis. The main components of an 802.1X implementation are:

- the authenticator - the port on this device that wishes to enforce authentication before allowing access to services that are accessible behind it.
- the supplicant - the port that wishes to access services offered by the authenticator's system. The supplicant may be a port on a PC or other device connected to this device.
- the authentication server - a device that uses the authentication credentials supplied by the supplicant, via the authenticator, to determine if the authenticator should grant access to its services.

Configuring 802.1X

The following example explains how to configure 802.1X. In this example, the RADIUS Server keeps the Client information, validating the identity of the Client and updating the switch about the authentication status of the client. The switch is the physical access between the two clients and the server. It requests information from the client, relays information to the server and then back to the client.

To configure 802.1X authentication, first enable authentication on `port1.0.1` and `port1.0.2` and then specify the RADIUS Server IP address and port.

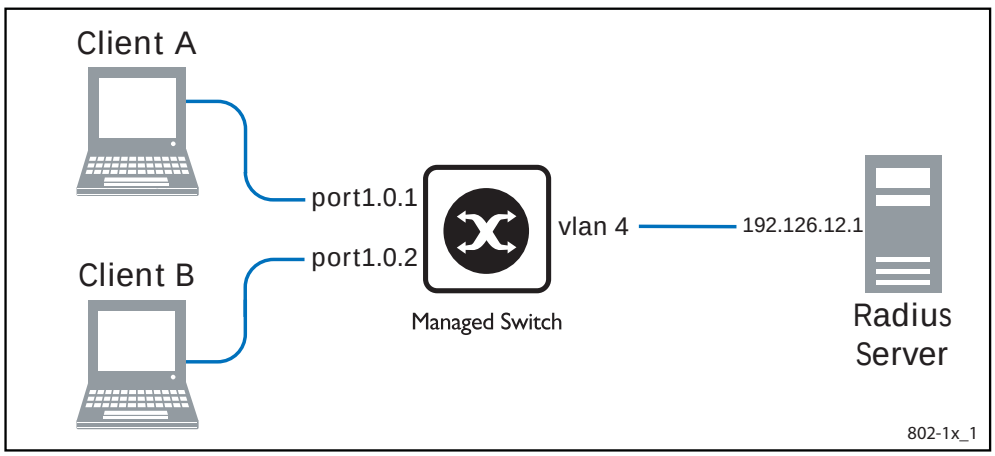


Table 62-1: 802.1X configuration on the switch

awplus#	
configure terminal	Enter the Global Configuration mode.
awplus(config)#	
aaa authentication dot1x default group radius	Enable authentication globally.
awplus(config)#	
interface port1.0.1	Specify the interface (port1.0.1) to be configured and enter the Interface mode.
awplus(config-if)#	
dot1x port-control auto	Enable authentication (via RADIUS) on port1.0.1.
awplus(config-if)#	
dot1x control-direction both	Block traffic in both directions, other than authentication packets, until authentication is complete.
awplus(config-if)#	
exit	Exit the Interface Configuration mode and enter the Global Configuration mode.
awplus(config)#	
interface port1.0.2	Specify the interface (port1.0.2) you are configuring and enter the Interface mode.
awplus(config-if)#	
dot1x port-control auto	Enable authentication (via RADIUS) on port1.0.2.
awplus(config-if)#	
exit	Exit the Interface Configuration mode and enter the Global Configuration mode.
awplus(config)#	
radius-server host 192.126.12.1 auth-port 1812	Specify the RADIUS Server address (192.126.12.1) and authentication port.
awplus(config)#	
radius-server key secret	Specify the shared key secret between the RADIUS server and the client.
awplus(config)#	
interface vlan4	Specify the vlan (vlan4) to be configured and enter the Interface mode.
awplus(config-if)#	
ip address 192.126.12.2/24	Set the IP address on vlan4.

Names of Commands Used

dot1x port-control
radius-server host
radius-server key

Validation Commands

show dot1x
show dot1x interface

Chapter 63: 802.1X Commands

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Command List

This chapter provides an alphabetical reference of commands used to configure 802.1X port access control. For more information, see Chapter 62, 802.1X Introduction and Configuration.

debug dot1x

Use this command to enable 802.1X IEEE Port-Based Network Access Control troubleshooting functions.

Use the no variant of this command to disable this function.

Syntax

```
debug dot1x [all|auth-web|event|nsm|packet|timer]
no debug all dot1x
no debug dot1x [all|auth-web|event|nsm|packet|timer]
```

Parameter	Description
`all`	Used with the no variant of this command exclusively; turns off all debugging for 802.1X.
`auth-web`	Specifies debugging for 802.1X auth-web information.
`events`	Specifies debugging for 802.1X events.
`nsm`	Specifies debugging for NSM messages.
`packet`	Specifies debugging for 802.1X packets.
`timer`	Specifies debugging for 802.1X timers.

Mode Privileged Exec and Global Configuration

Usage This command without any parameters turns on normal 802.1X debug information.

```
awplus# debug dot1x
```

```
awplus# show debugging dot1x
```

```
802.1X debugging status:
  802.1X events debugging is
  802.1X timer debugging is on
  802.1X packets debugging is on
  802.1X NSM debugging is on
```

Examples

```
awplus# debug dot1x
awplus# debug dot1x all
```

Related Commands
show debugging dot1x
undebug dot1x

dot1x control-direction

This command sets the direction of the filter for the unauthorized interface.

If the optional in parameter is specified with this command then packets entering the specified port are discarded. The in parameter discards the ingress packets received from the supplicant.

If the optional both parameter is specified with this command then packets entering (ingress) and leaving (egress) the specified port are discarded. The both parameter discards the packets received from the supplicant and sent to the supplicant.

The no variant of this command sets the direction of the filter to both. The port will then discard both ingress and egress traffic.

Syntax

```
dot1x control-direction {in|both}
no dot1x control-direction
```

Parameter	Description
in	Discard received packets from the supplicant (ingress packets).
both	Discard received packets from the supplicant (ingress packets) and transmitted packets to the supplicant (egress packets).

Default The authentication port direction is set to both by default.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Example To set the port direction to the default (both) for `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no dot1x control-direction
```

To set the port direction to in for `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# dot1x control-direction in
```

Validation Commands
show dot1x
show dot1x interface
show auth-mac interface
show auth-web interface

dot1x eap

This command selects the transmit mode for the EAP packet. If the authentication feature is not enabled then EAP transmit mode is not enabled. The default setting discards EAP packets.

Syntax `dot1x eap {discard|forward|forward-untagged-vlan|forward-vlan}`

Parameter	Description
`discard`	Discard.
`forward`	Forward to all ports on the switch.
`forward-untagged-vlan`	Forward to ports with the same untagged VLAN.
`forward-vlan`	Forward to ports with the same VLAN.

Default The transmit mode is set to `discard` EAP packets by default.

Mode Global Configuration

Example To set the transmit mode of EAP packet to `forward` to forward EAP packets to all ports on the switch, use the following commands:

```
awplus# configure terminal
awplus(config)# dot1x eap forward
```

To set the transmit mode of EAP packet to `discard` to discard EAP packets, use the following commands:

```
awplus# configure terminal
awplus(config)# dot1x eap discard
```

To set the transmit mode of EAP packet to `forward-untagged-vlan` to forward EAP packets to ports with the same untagged vlan, use the following commands:

```
awplus# configure terminal
awplus(config)# dot1x eap forward-untagged-vlan
```

To set the transmit mode of EAP packet to `forward-vlan` to forward EAP packets to ports with the same vlan, use the following commands:

```
awplus# configure terminal
awplus(config)# dot1x eap forward-vlan
```

dot1x eapol-version

This command sets the EAPOL protocol version for EAP packets when 802.1X port authentication is applied.

Use the no variant of this command to set the EAPOL protocol version to 1.

The default EAPOL protocol version is version 1.

Syntax

```
dot1x eapol-version {1|2}
no dot1x eapol-version
```

Parameter	Description
1	EAPOL version.
2	EAPOL version.

Default The EAP version for 802.1X authentication is set to 1 by default.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Example To set the EAPOL protocol version to `2` for `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# dot1x eapol-version 2
```

To set the EAPOL protocol version to the default version (1) for interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no dot1x eapol-version
```

Validation Commands show dot1x
show dot1x interface

dot1x initialize interface

This command initializes the 802.1X status on the specified interface, and attempts reauthentication.

Use this command to unauthorize a port, and attempt reauthentication on the specified interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

Syntax `dot1x initialize interface <interface-list>`

Parameter	Description
<interface-list>	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.

Mode Privileged Exec

Example To initialize 802.1X port authentication on the interface `port1.0.2`, use the following command:

```
awplus# dot1x initialize interface port1.0.2
```

To unauthorize switch `port1.0.1` and attempt reauthentication on switch `port1.0.1` enter:

```
awplus# dot1x initialize interface port1.0.1
```

To unauthorize all switch ports for a 24 switch port device and attempt reauthentication enter:

```
awplus# dot1x initialize interface port1.0.1-port1.0.24
```

dot1x keytransmit

This command enables key transmission on the interface specified previously in Interface mode.

The no variant of this command disables key transmission on the interface specified.

Syntax

```
dot1x keytransmit
no dot1x keytransmit
```

Default Key transmission for port authentication is enabled by default.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Usage Use this command to enable key transmission over an Extensible Authentication Protocol (EAP) packet between the authenticator and supplicant. Use the no variant of this command to disable key transmission.

Example To enable the key transmit feature on interface `port1.0.2`, after it has been disabled by negation, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# dot1x keytransmit
```

To disable the key transmit feature from the default startup configuration on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no dot1x keytransmit
```

Validation Commands show dot1x
show dot1x interface

dot1x max-auth-fail

Use this command to configure the maximum number of login attempts for a supplicant (client device) using the auth-fail vlan feature, when using 802.1X port authentication on an interface.

The no variant of this command resets the maximum login attempts for a supplicant (client device) using the auth-fail vlan feature, to the default configuration of 3 login attempts.

Syntax

```
dot1x max-auth-fail <0-10>
no dot1x max-auth-fail
```

Parameter	Description
<0-10>	Specify the maximum number of login attempts for supplicants on an interface using 802.1X port authentication.

Default The default maximum number of login attempts for a supplicant on an interface using 802.1X port authentication is three (3) login attempts.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Usage This command sets the maximum number of login attempts for supplicants on an interface. The supplicant is moved to the auth-fail VLAN from the Guest VLAN after the number of failed login attempts using 802.1X authentication is equal to the number set with this command.

See the related auth auth-fail vlan command on page 65.3. See also the section "Failed authentication VLAN" on page 64.11 for information about the auth-fail VLAN feature.

See the section "Limitations on allowed feature combinations" on page 64.12 for information about restrictions regarding combinations of authentication enhancements working together.

Examples To configure the maximum number of login attempts for a supplicant on interface `port1.0.2` to a single (`1`) login attempt, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# dot1x max-auth-fail 1
```

To configure the maximum number of login attempts for a supplicant on interface `port1.0.2` to the default number of three (`3`) login attempts, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no dot1x max-auth-fail
```

Validation Commands show running-config

Related Commands auth auth-fail vlan
dot1x max-reauth-req
show dot1x interface

dot1x max-reauth-req

This command sets the number of reauthentication attempts before an interface is unauthorized.

The no variant of this command resets the reauthentication delay to the default.

Syntax

```
dot1x max-reauth-req <1-10>
no dot1x max-reauth-req
```

Parameter	Description
<1-10>	Specify the maximum number of reauthentication attempts for supplicants on an interface using 802.1X port authentication.

Default The default maximum reauthentication attempts for interfaces using 802.1X port authentication is two (2) reauthentication attempts, before an interface is unauthorized.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Usage Use this command to set the maximum reauthentication attempts after failure.

Examples To configure the maximum number of reauthentication attempts for interface `port1.0.2` to a single (1) reauthentication request, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# dot1x max-reauth-req 1
```

To configure the maximum number of reauthentication attempts for interface `port1.0.2` to the default maximum number of two (2) reauthentication attempts, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no dot1x max-reauth-req
```

Validation Commands show running-config

Related Commands dot1x max-auth-fail
show dot1x interface

dot1x port-control

This command enables 802.1X port authentication on the interface specified, and sets the control of the authentication port. When port-control is set to auto, the 802.1X authentication feature is executed on the interface, but only if the aaa authentication dot1x command has been issued.

The no variant of this command disables the port authentication on the interface specified.

Syntax

```
dot1x port-control {force-unauthorized|force-authorized|auto}
no dot1x port-control
```

Parameter	Description
`force-unauthorized`	Force port state to unauthorized. Specify to force a port to always be in an unauthorized state.
`force-authorized`	Force port state to authorized. Specify to force a port to always be in an authorized state.
`auto`	Allow port client to negotiate authentication. Specify to enable authentication on port.

Default 802.1X port control is disabled by default.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Usage Use this command to force a port state. Note that all dot1x commands can only be applied to switch ports. They cannot be applied to dynamic (LACP) or static channel groups.

Example To enable port authentication on the interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# dot1x port-control auto
```

To enable port authentication force authorized on the interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# dot1x port-control force-authorized
```

To disable port authentication on the interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no dot1x port-control
```

Validation Commands show dot1x interface

Related Commands aaa authentication dot1x

dot1x timeout tx-period

This command sets the transmit timeout for the authentication request on the specified interface.

The no variant of this command resets the transmit timeout period to the default (30 seconds).

Syntax

```
dot1x timeout tx-period <1-65535>
no dot1x timeout tx-period
```

Parameter	Description
<1-65535>	Seconds.

Default The default transmit period for port authentication is 30 seconds.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Usage Use this command to set the interval between successive attempts to request an ID.

Example To set the transmit timeout period to 5 seconds on interface `port1.0.2`, use the below commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# dot1x timeout tx-period 5
```

To reset transmit timeout period to the default (30 seconds) on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no dot1x timeout tx-period
```

Validation Commands show dot1x
show dot1x interface

show debugging dot1x

Use this command to display the 802.1X debugging option set.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show debugging dot1x`

Mode User Exec and Privileged Exec

Usage This is a sample output from the `show debugging dot1x` command.

```
awplus# debug dot1x

awplus# show debugging dot1x
```

```
802.1X debugging status:
  802.1X events debugging is on
  802.1X timer debugging is on
  802.1X packets debugging is on
  802.1X NSM debugging is on
```

Example

```
awplus# show debugging dot1x
```

Related Commands debug dot1x

show dot1x

This command shows authentication information for dot1x (802.1X) port authentication.

If you specify the optional all parameter then this command also displays all authentication information for each port available on the switch.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show dot1x [all]`

Parameter	Description
`all`	All.

Mode Privileged Exec

Example

```
awplus# show dot1x all
```

Table 63-1: Example output from the **show dot1x** command

```
awplus# show dot1x all
802.1X Port-Based Authentication Enabled
RADIUS server address: 150.87.18.89:1812
Next radius message id: 5
RADIUS client address: not configured
Authentication info for interface port1.0.12
portEnabled: true - portControl: Auto
portStatus: Authorized
reAuthenticate: disabled
reAuthPeriod: 3600
PAE: quietPeriod: 60 - maxReauthReq: 2 - txPeriod: 30
BE: suppTimeout: 30 - serverTimeout: 30
CD: adminControlledDirections: in
KT: keyTxEnabled: false
critical: disabled
guestVlan: disabled
dynamicVlanCreation: single-dynamic-vlan
    assignFailActionRule: deny
hostMode: multi-supplicant
    maxSupplicant: 1024
dot1x: enabled
    protocolVersion: 1
authMac: enabled
    method: PAP
    reauthRelearning: disabled
authWeb: enabled
    method: PAP
    lockCount: 3
    packetForwarding: disabled
```

Table 63-1: Example output from the **show dot1x** command (cont.)

```
supplicantMac: none
Supplicant name: manager
Supplicant address: 00d0.59ab.7037
    authenticationMethod: 802.1X Authentication
    portStatus: Authorized - currentId: 1
    abort:F fail:F start:F timeout:F success:T
    PAE: state: Authenticated - portMode: Auto
    PAE: reAuthCount: 0 - rxRespId: 0
    PAE: quietPeriod: 60 - maxReauthReq: 2 - txPeriod: 30
    BE: state: Idle - reqCount: 0 - idFromServer: 0
    CD: adminControlledDirections: in - operControlledDirections: in
    CD: bridgeDetected: false
    KR: rxKey: false
    KT: keyAvailable: false - keyTxEnabled: false
    criticalState: off
    dynamicVlanId: 2
802.1X statistics for interface port1.0.12
    EAPOL Frames Rx: 5 - EAPOL Frames Tx: 16
    EAPOL Start Frames Rx: 0 - EAPOL Logoff Frames Rx: 0
    EAP Rsp/Id Frames Rx: 3 - EAP Response Frames Rx: 2
    EAP Req/Id Frames Tx: 8 - EAP Request Frames Tx: 2
    Invalid EAPOL Frames Rx: 0 - EAP Length Error Frames Rx: 0
    EAPOL Last Frame Version Rx: 1 - EAPOL Last Frame Src:  00d0.59ab.7037
Authentication session statistics for interface port1.0.12
    session user name: manager
    session authentication method: Remote server
    session time: 19440 secs
    session terminate cause: Not terminated yet
Authentication Diagnostics for interface port1.0.12
    Supplicant address: 00d0.59ab.7037
    authEnterConnecting: 2
    authEaplogoffWhileConnecting: 1
    authEnterAuthenticating: 2
    authSuccessWhileAuthenticating: 1
    authTimeoutWhileAuthenticating: 1
    authFailWhileAuthenticating: 0
    authEapstartWhileAuthenticating: 0
    authEaplogoggWhileAuthenticating: 0
    authReauthsWhileAuthenticated: 0
    authEapstartWhileAuthenticated: 0
    authEaplogoffWhileAuthenticated: 0
    BackendResponses: 2
    BackendAccessChallenges: 1
    BackendOtherrequestToSupplicant: 3
    BackendAuthSuccess: 1
    BackendAuthFails: 0
```

show dot1x diagnostics

This command shows 802.1X authentication diagnostics for the specified interface (optional), which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

If no interface is specified then authentication diagnostics are shown for all interfaces.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show dot1x diagnostics [interface <interface-list>]`

Parameter	Description
`interface`	Specify a port to show.
`<interface-list>`	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.

Mode Privileged Exec

Example See the sample output below showing 802.1X authentication diagnostics for `port1.0.12`:

```
awplus# show dot1x diagnostics interface port1.0.12
```

Output Figure 63-1: Example output from the **show dot1x diagnostics** command

```
Authentication Diagnostics for interface port1.0.12
    Supplicant address: 00d0.59ab.7037
      authEnterConnecting: 2
      authEaplogoffWhileConnecting: 1
      authEnterAuthenticating: 2
      authSuccessWhileAuthenticating: 1
      authTimeoutWhileAuthenticating: 1
      authFailWhileAuthenticating: 0
      authEapstartWhileAuthenticating: 0
      authEaplogoggWhileAuthenticating: 0
      authReauthsWhileAuthenticated: 0
      authEapstartWhileAuthenticated: 0
      authEaplogoffWhileAuthenticated: 0
      BackendResponses: 2
      BackendAccessChallenges: 1
      BackendOtherrequestToSupplicant: 3
      BackendAuthSuccess: 1
```

show dot1x interface

This command shows the status of 802.1X port-based authentication on the specified interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

Use the optional diagnostics parameter to show authentication diagnostics for the specified interfaces. Use the optional sessionstatistics parameter to show authentication session statistics for the specified interfaces. Use the optional statistics parameter to show authentication diagnostics for the specified interfaces. Use the optional supplicant parameter to show the supplicant state for the specified interfaces.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show dot1x interface <interface-list>
   [diagnostics|sessionstatistics|statistics|supplicant [brief]]
```

Parameter	Description
<interface-list>	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.
`diagnostics`	Diagnostics.
`sessionstatistics`	Session Statistics.
`statistics`	Statistics.
`supplicant`	Supplicant.
`brief`	Brief summary of supplicant state.

Mode Privileged Exec

Example See the sample output below showing 802.1X authentication status for `port1.0.12`:

```
awplus# show dot1x interface port1.0.12
```

Table 63-2: Example output from the **show dot1x interface** command for a port

```
awplus#show dot1x interface port1.0.12
Authentication info for interface port1.0.12
    portEnabled: true - portControl: Auto
    portStatus: Authorized
    reAuthenticate: disabled
    reAuthPeriod: 3600
    PAE: quietPeriod: 60 - maxReauthReq: 2 - txPeriod: 30
    BE: suppTimeout: 30 - serverTimeout: 30
    CD: adminControlledDirections: in
    KT: keyTxEnabled: false
    critical: disabled
    guestVlan: disabled
    dynamicVlanCreation: single-dynamic-vlan
        assignFailActionRule: deny
    hostMode: multi-supplicant
        maxSupplicant: 1024
    dot1x: enabled
        protocolVersion: 1
    authMac: enabled
        method: PAP
        reauthRelearning: disabled
    authWeb: enabled
        method: PAP
        lockCount: 3
        packetForwarding: disabled
    supplicantMac: none
```

See the sample output below showing 802.1X authentication `sessionstatistics` for `port1.0.12`:

```
awplus# show dot1x interface port1.0.12 sessionstatistics
```

```
awplus#show dot1x interface port1.0.12 sessionstatistics
Authentication session statistics for interface port1.0.12
    session user name: manager
        session authentication method: Remote server
        session time: 19440 secs
        session terminat cause: Not terminated yet
```

See sample output below showing 802.1X authentication `diagnostics` for `port1.0.12`:

```
awplus# show dot1x interface port1.0.12 diagnostics
```

```
awplus#show dot1x interface port1.0.12 diagnostics
Authentication Diagnostics for interface port1.0.12
    Supplicant address: 00d0.59ab.7037
        authEnterConnecting: 2
        authEaplogoffWhileConnecting: 1
        authEnterAuthenticating: 2
        authSuccessWhileAuthenticating: 1
        authTimeoutWhileAuthenticating: 1
        authFailWhileAuthenticating: 0
        authEapstartWhileAuthenticating: 0
        authEaplogoggWhileAuthenticating: 0
        authReauthsWhileAuthenticated: 0
        authEapstartWhileAuthenticated: 0
        authEaplogoffWhileAuthenticated: 0
        BackendResponses: 2
        BackendAccessChallenges: 1
        BackendOtherrequestToSupplicant: 3
        BackendAuthSuccess: 1
```

See sample output below showing the `supplicant` on the interface `port1.0.12`:

```
awplus# show dot1x interface port1.0.12 supplicant
```

```
awplus#show dot1x interface port1.0.12 supplicant
authenticationMethod: dot1x
    totalSupplicantNum: 1
    authorizedSupplicantNum: 1
        macBasedAuthenticationSupplicantNum: 0
        dot1xAuthenticationSupplicantNum: 1
        webBasedAuthenticationSupplicantNum: 0
Supplicant name: manager
Supplicant address: 00d0.59ab.7037
    authenticationMethod: dot1x
    portStatus: Authorized - currentId: 4
    abort:F fail:F start:F timeout:F success:T
    PAE: state: Authenticated - portMode: Auto
    PAE: reAuthCount: 0 - rxRespId: 0
    PAE: quietPeriod: 60 - maxReauthReq: 2 - txPeriod: 30
    BE: state: Idle - reqCount: 0 - idFromServer: 3
    BE: suppTimeout: 30 - serverTimeout: 30
    CD: adminControlledDirections: in - operControlledDirections:
in
    CD: bridgeDetected: false
    KR: rxKey: false
    KT: keyAvailable: false - keyTxEnabled: false
```

See sample output below showing 802.1X (`dot1x`) authentication statistics for `port1.0.12`:

```
awplus# show dot1x statistics interface port1.0.12
```

```
awplus#show dot1x statistics interface port1.0.12
802.1X statistics for interface port1.0.12
    EAPOL Frames Rx: 5 - EAPOL Frames Tx: 16
    EAPOL Start Frames Rx: 0 - EAPOL Logoff Frames Rx: 0
    EAP Rsp/Id Frames Rx: 3 - EAP Response Frames Rx: 2
    EAP Req/Id Frames Tx: 8 - EAP Request Frames Tx: 2
    Invalid EAPOL Frames Rx: 0 - EAP Length Error Frames Rx: 0
    EAPOL Last Frame Version Rx: 1 - EAPOL Last Frame
Src:00d0.59ab.7037
```

Table 63-3: Parameters in the output of the **show dot1x interface** command

Parameter	Description
portEnabled	Interface operational status (Up-true/down-false).
portControl	Current control status of the port for 802.1X control.
portStatus	802.1X status of the port (authorized/unauthorized).
reAuthenticate	Reauthentication enabled/disabled status on port.
reAuthPeriod	Value holds meaning only if reauthentication is enabled.
abort	Indicates that authentication should be aborted when set to true.
fail	Indicates failed authentication attempt when set to false.
start	Indicates authentication should be started when set to true.
timeout	Indicates authentication attempt timed out when set to true.
success	Indicates authentication successful when set to true.
state	Current 802.1X operational state of interface.
mode	Configured 802.1X mode.
reAuthCount	Reauthentication count.
quietperiod	Time between reauthentication attempts.
reAuthMax	Maximum reauthentication attempts.
BE	Backend authentication state machine variables and constants.
state	State of the state machine.
reqCount	Count of requests sent to server.
suppTimeout	Supplicant timeout.
serverTimeout	Server timeout.
maxReq	Maximum requests to be sent.
CD	Controlled Directions State machine.
adminControlledDirections	Administrative value (Both/In).
operControlledDirections	Operational Value (Both/In).
KR	Key receive state machine.

Table 63-3: Parameters in the output of the **show dot1x interface** command (cont.)

Parameter	Description
`rxKey`	True when EAPOL-Key message is received by supplicant or authenticator. false when key is transmitted.
`KT`	Ket Transmit State machine.
`keyAvailable`	False when key has been transmitted by authenticator, true when new key is available for key exchange.
`keyTxEnabled`	Key transmission enabled/disabled status.

Related Commands

show auth-web diagnostics
show dot1x sessionstatistics
show dot1x statistics interface
show dot1x supplicant interface

show dot1x sessionstatistics

This command shows authentication session statistics for the specified interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show dot1x sessionstatistics [interface <interface-list>]`

Parameter	Description
`interface`	Specify a port to show.
<interface-list>	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.

Mode Privileged Exec

Example See sample output below showing 802.1X (`dot1x`) authentication session statistics for `port1.0.12`:

```
awplus# show dot1x sessionstatistics interface port1.0.12
```

```
Authentication session statistics for interface port1.0.12
    session user name: manager
        session authentication method: Remote server
        session time: 19440 secs
        session terminat cause: Not terminated yet
```

show dot1x statistics interface

This command shows the authentication statistics for the specified interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show dot1x statistics interface <interface-list>`

Parameter	Description
<interface-list>	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.

Mode Privileged Exec

Example See sample output below showing 802.1X authentication statistics for `port1.0.12`:

```
awplus# show dot1x statistics interface port1.0.12
```

```
802.1X statistics for interface port1.0.12
    EAPOL Frames Rx: 5 - EAPOL Frames Tx: 16
    EAPOL Start Frames Rx: 0 - EAPOL Logoff Frames Rx: 0
    EAP Rsp/Id Frames Rx: 3 - EAP Response Frames Rx: 2
    EAP Req/Id Frames Tx: 8 - EAP Request Frames Tx: 2
    Invalid EAPOL Frames Rx: 0 - EAP Length Error Frames Rx: 0
    EAPOL Last Frame Version Rx: 1 - EAPOL Last Frame
Src:00d0.59ab.7037
```

show dot1x supplicant

This command shows the supplicant state of the authentication mode set for the switch.

This command shows a summary when the optional brief parameter is used.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show dot1x supplicant [<macadd>] [brief]`

Parameter	Description
`<macadd>`	MAC (hardware) address of the Supplicant.
`brief`	Brief summary of the Supplicant state.

Mode Privileged Exec

Example See sample output below showing the 802.1X authenticated supplicant on the switch:

```
awplus# show dot1x supplicant
```

```
authenticationMethod: dot1x
totalSupplicantNum: 1
authorizedSupplicantNum: 1
macBasedAuthenticationSupplicantNum: 0
dot1xAuthenticationSupplicantNum: 1
webBasedAuthenticationSupplicantNum: 0
Supplicant name: manager
Supplicant address: 00d0.59ab.7037
    authenticationMethod: dot1x
    portStatus: Authorized - currentId: 4
    abort:F fail:F start:F timeout:F success:T
    PAE: state: Authenticated - portMode: Auto
    PAE: reAuthCount: 0 - rxRespId: 0
    PAE: quietPeriod: 60 - maxReauthReq: 2 - txPeriod: 30
    BE: state: Idle - reqCount: 0 - idFromServer: 3
    BE: suppTimeout: 30 - serverTimeout: 30
    CD: adminControlledDirections: in - operControlledDirections:
in
    CD: bridgeDetected: false
    KR: rxKey: false
    KT: keyAvailable: false - keyTxEnabled: false
```

See sample output below showing the supplicant on the switch using the `brief` parameter:

```
awplus# show dot1x supplicant 00d0.59ab.7037 brief
```

```
Interface port1.0.12
    authenticationMethod: dot1x
    totalSupplicantNum: 1
    authorizedSupplicantNum: 1
        macBasedAuthenticationSupplicantNum: 0
        dot1xAuthenticationSupplicantNum: 1
        webBasedAuthenticationSupplicantNum: 0
Interface VID Mode MAC Address Status IP Address Username
========= === ==== ============ ======= =========== ========
port1.0.12 2 D 00d0.59ab.7037Authenticated 192.168.2.201 manager
```

Related Commands show dot1x supplicant interface

show dot1x supplicant interface

This command shows the supplicant state of the authentication mode set for the interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

This command shows a summary when the optional brief parameter is used.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show dot1x supplicant interface <interface-list> [brief]`

Parameter	Description
<interface-list>	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.
`brief`	Brief summary of the Supplicant state.

Mode Privileged Exec

Example See sample output below showing the supplicant on the interface `port1.0.19`:

```
awplus# show dot1x supplicant interface port1.0.19
```

```
Interface port1.0.19
 authenticationMethod: dot1x
 totalSupplicantNum: 1
 authorizedSupplicantNum: 1
   macBasedAuthenticationSupplicantNum: 0
   dot1xAuthenticationSupplicantNum: 1
   webBasedAuthenticationSupplicantNum: 0
   otherAuthenticationSupplicantNum: 0

 Supplicant name: VCSPCVLAN10
 Supplicant address: 0000.cd07.7b60
   authenticationMethod: 802.1X
   portStatus: Authorized - currentId: 3
   abort:F fail:F start:F timeout:F success:T
   PAE: state: Authenticated - portMode: Auto
   PAE: reAuthCount: 0 - rxRespId: 0
   PAE: quietPeriod: 60 - maxReauthReq: 2
   BE: state: Idle - reqCount: 0 - idFromServer: 2
   CD: adminControlledDirections:in -
operControlledDirections:in
   CD: bridgeDetected: false
   KR: rxKey: false
   KT: keyAvailable: false - keyTxEnabled: false
```

See sample output below showing the supplicant on the switch using the `brief` parameter:

```
awplus# show dot1x supplicant interface brief
```

```
Interface port1.0.12
    authenticationMethod: dot1x
    totalSupplicantNum: 1
    authorizedSupplicantNum: 1
        macBasedAuthenticationSupplicantNum: 0
        dot1xAuthenticationSupplicantNum: 1
        webBasedAuthenticationSupplicantNum: 0
Interface VID Mode MAC Address    Status         IP Address     Username
========= === ==== ============ =======         ===========    ========
port1.0.12 2   D   00d0.59ab.7037Authenticated 192.168.2.201 manager
```

See the sample output below for static channel group (static aggregator) interface `sa1`:

```
awplus# show dot1x interface sa1 supplicant brief
```

```
awplus#show dot1x interface sa1 supplicant brief
Interface sa1
  authenticationMethod: dot1x
  totalSupplicantNum: 1
  authorizedSupplicantNum: 1
    macBasedAuthenticationSupplicantNum: 0
     dot1xAuthenticationSupplicantNum: 1
     webBasedAuthenticationSupplicantNum: 0
     otherAuthenticationSupplicantNum: 0

Interface   VID  Mode MAC Address    Status            IP Address      Username
=========== ==== ==== ============== ================= =============== ========
sa1         1    D    00d0.59ab.7037 Authenticated     --              test1
```

Related Commands show dot1x supplicant

undebug dot1x

This command applies the functionality of the no debug dot1x command on page 63.2.

Chapter 64: Authentication Introduction and Configuration

Authentication Introduction 64.2
Tri-Authentication Introduction 64.2
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Authentication Introduction

Authentication commands enable you to specify three different types of device authentication: 802.1X authentication, MAC authentication, and Web-authentication. These are collectively called tri-authentication when applied to authenticate any devices connected to switch ports.

Tri-Authentication Introduction

The switch supports three types of authentication for devices that connect to switch ports:

- 802.1X authentication of devices connecting to switch ports
- MAC authentication of devices connecting to switch ports
- Web-authentication of devices connecting to switch ports

All three types can be configured to run simultaneously on a switch port. The simultaneous configuration and authentication of all three types on a port is called tri-authentication.

Tri-Authentication Configuration

Follow the below three steps to configure tri-authentication across a range of switch ports:

Step 1: Define the RADIUS Server:

Define the RADIUS Server where the switch will send authentication requests using the below commands:

```
awplus# configure terminal
awplus(config)# radius-server host <ip-address> key
<key-string>
```

These commands adds the RADIUS Server address and set parameters to the RADIUS server. The key parameter specifies the secret key for the server.

Note

The RADIUS Server, where the switch sends authentication requests, could be the switch's own Local RADIUS Server. For information on how to configure Local RADIUS Server see Chapter 72, Local RADIUS Server Introduction and Configuration.

Step 2: Define the default authentication server lists:

Define the default authentication server lists for 802.1X authentication, Web-based authentication, and MAC-based authentication:

```
awplus# configure terminal
awplus(config)# aaa authentication dot1x default group radius
awplus(config)# aaa authentication auth-web default group
radius
awplus(config)# aaa authentication auth-mac default group
radius
```

Step 3: Configure 802.1X, Web-based, and MAC-based authentication:

Configure 802.1X authentication, Web-authentication, MAC-authentication on switch ports to attach supplicant devices:

```
awplus# configure terminal
awplus(config)# interface <interface-range>
awplus(config-if)# switchport mode access
awplus(config-if)# switchport access vlan 1
awplus(config-if)# auth-web enable
awplus(config-if)# auth-mac enable
awplus(config-if)# dot1x port-control auto
awplus(config-if)# auth dynamic-vlan-creation
```

Configuring a Guest VLAN

You can configure 802.1X to accept a Dynamic VLAN assignment, or fall back to a Guest VLAN upon failure.

If 802.1X authentication has been configured on access ports in the network, you might still want to provide limited network access to those users whose devices do not have 802.1x supplicant enabled, or who have unrecognized authentication credentials.

The mechanism to achieve this is known as a guest VLAN. The idea is that if the users device fails 802.1X authentication, or is not even performing any 802.1X authentication, then its connection port can be put into the Guest VLAN.

To configure a switch to perform 802.1x authentication, and assign VLAN IDs to ports where devices authentication successfully, and put non-authenticated users into a Guest VLAN, proceed as follows:

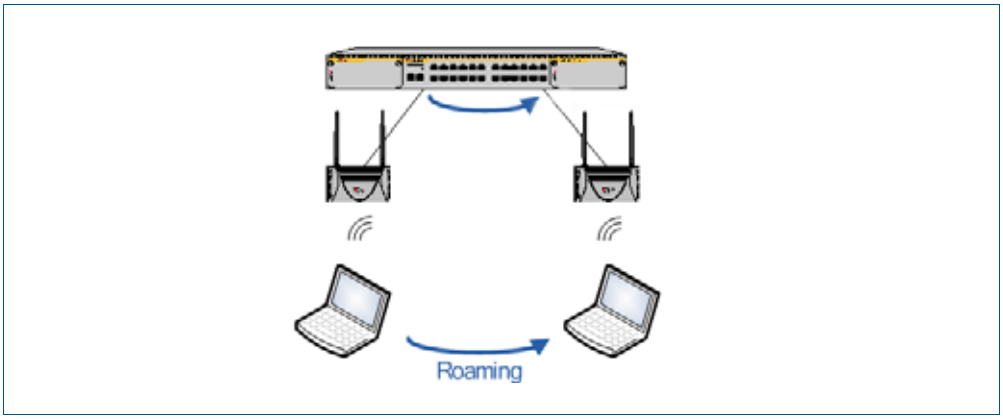
```
awplus# configure terminal
awplus(config)# radius-server host <ip-address> key
<key-string>
awplus(config)# aaa authentication dot1x default group
radius
awplus(config)# interface <interface-range>
awplus(config-if)# switchport mode access
awplus(config-if)# dot1x port-control auto
awplus(config-if)# auth dynamic-vlan-creation
awplus(config-if)# auth guest-vlan 100
```

Roaming Authentication

When network security is required, the usability of network security must be considered. The Roaming Authentication feature improves the usability of network security by enabling users to move within the network without requiring them to re-authenticate each time they move.

If a supplicant (client device) moves from one wireless access point to another wireless access point, and the wireless access points are connected to different ports, then the switch (authenticator) recognizes that the supplicant has been authenticated and accepts the supplicant without requiring re-authentication.

Figure 64-1: Diagram showing Roaming Authentication running on a standalone switch

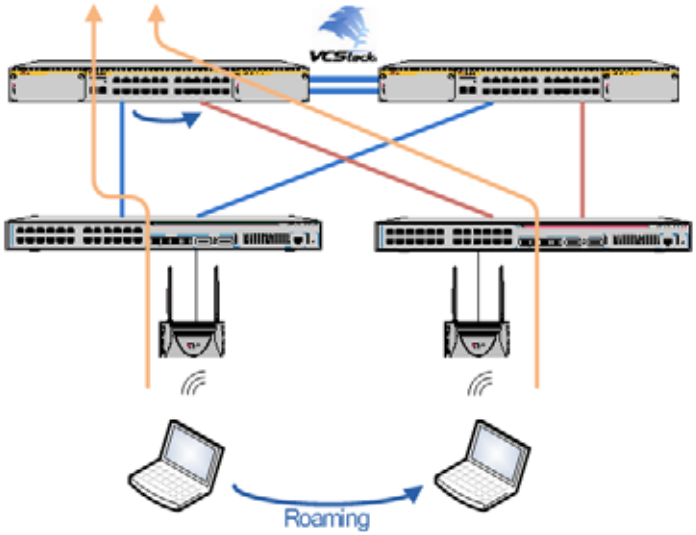


Web and MAC authentication are the authentication methods in a Wireless LAN environment, and 802.1X is the authentication method used for supplicants attached to edge switches.

Roaming Authentication is normally enabled using the auth roaming enable command on page 65.17 command. However, Roaming Authentication has been extended (with the auth roaming disconnected command on page 65.15) to work where an interface is link down. This allows you to enable supplicants to move from authenticated interfaces that are link down, without requiring re-authentication.

Roaming Authentication is available for use with the VCStack feature, and is available on static and dynamic (LACP) channel group interfaces.

Figure 64-2: Diagram showing Roaming Authentication running with VCStack



Roaming Authentication Overview

Without the Roaming Authentication feature enabled, if a supplicant moves from one switch port to another switch port, the supplicant's authenticated status, authentication, and assigned VLAN is deleted and the supplicant is re-authenticated so the supplicant can access the network, and all traffic from the supplicant is dropped while the supplicant is being re-authenticated.

With the Roaming Authentication feature enabled, a switch port inherits the status of a supplicant from the switch port that the supplicant was moved from. If the Roaming Authentication feature is enabled on a switch, then once a supplicant (client device) is authenticated on the switch it does not have to be re-authenticated if it moves between ports of that switch. Supplicant traffic is not dropped because there is no delay for re-authentication, during which the supplicant cannot access the network.

For example, when the Roaming Authentication feature is used in an wireless LAN environment with wireless access points, then the wireless clients can roam between wireless access points connected to different switch ports without re-authentication.

The Roaming Authentication feature also supports VCStack operation and works on defined static channel group (static aggregators) and dynamic channel group (LACP) interfaces. When VCStack and Roaming Authentication features are used together, the status of a supplicant is inherited from one aggregated interface to another aggregated interface over the stack.

See the auth roaming disconnected command on page 65.15 and the auth roaming enable command on page 65.17 for further information about configuring Roaming Authentication.

Roaming Authentication Feature Interactions

When the Roaming Authentication feature is disabled, a supplicant must be re-authenticated on the destination interface when it roams. When the Roaming Authentication is enabled, the following supplicant authentication status and information is inherited from the source interface:

- Authentication status
- Authentication method
- Supplicant MAC address
- Supplicant IP address
  (if an authenticated interface is configured for Web authentication)
- Supplicant name
- Authorized dynamic VLAN ID
- Authorized RADIUS server
- Reauthentication timer
  (if configured using the auth timeout reauth-period command on page 65.22)

Roaming Authentication is only supported between interfaces with the same authentication configuration. If source and destination interfaces have different authentication configuration then the supplicant will be re-authenticated at the destination interface.

When the host mode is set with the auth host-mode command on page 65.11, a supplicant is not authenticated on a destination interface, and the authentication status is deleted on the source interface.

When a supplicant moves from an interface with authentication configured to an interface without authentication configured, the supplicant's authentication status is deleted.

A supplicant is re-authenticated when it moves to a destination interface that is configured on a different VLAN than the VLAN that is configured for the source interface.

See the following Roaming Authentication feature interactions:

- The Roaming Authentication feature will not function with Dynamic VLANs.
- The Roaming Authentication feature will not function with Guest VLANs.

When the Roaming Authentication feature is configured for use on a stack with the VCStack feature, note that supplicants are initialized and re-authenticated if a VCStack failover occurs.

Unauthenticated Supplicant Traffic

When any authentication is configured on a switch port, the question arises as to what the switch does with packets that arrive into the switch port from unauthenticated supplicants.

Unauthenticated supplicants fall into three categories listed below:

- Newly attached supplicants, which are still in the process of their first authentication attempt
- Supplicants that have made an authentication attempt, but have failed authentication
- Supplicants that have been attached, but have not made an authentication attempt. For example, on a port that has only 802.1x authentication enabled, any supplicant that has no 802.1x client software will not be able to attempt 802.1x authentication.

In switches that are running the AlliedWare Plus™ Operating System, packets from all these three categories of unauthenticated supplicants are treated equally; no distinction is made between these three categories. The treatment of the traffic from unauthenticated supplicants does, however, depend on two factors:

- Whether a Guest VLAN has been configured on the switch port to which the supplicant is attached
- Whether Web authentication has been configured on the switch port to which the supplicant is attached

The rules governing the treatment of packets from unauthenticated supplicants are laid out in the table below:.

Table 64-1: Treatment of packets from unauthenticated supplicants

Switch port configuration	No Guest VLAN configured	Guest VLAN configured
Web authentication configured	Packets from unauthenticated supplicants are associated with the Native VLAN of the port. Packets from unauthenticated supplicants are processed according these rules: ■ Packets destined to the WebAuth server IP address/TCP port are forwarded to the server (which may well be the switch itself). ■ DHCP packets are sent to the CPU, to be processed by a local DHCP server, or relayed to another DHCP server, depending on the configuration of the switch. ■ DNS packets are forwarded to the CPU, and then sent on to a DNS server, if the switch is configured with a DNS server address. ■ ARP packets are forwarded to the CPU, and an ARP entry for the supplicant is learnt. ■ If web-auth forwarding is enabled for particular types of packets, then those packets will be forwarded within the Native VLAN ■ All other packets are dropped.	Packets from unauthenticated supplicants are associated with the Guest VLAN of the port. Packets from unauthenticated supplicants are processed according to these rules: ■ Packets destined to the WebAuth server IP address/TCP port are forwarded to the server (which may well be the switch itself). ■ DHCP packets are sent to the CPU, to be processed by a local DHCP server, or relayed to another DHCP server, depending on the configuration of the switch. ■ DNS packets are forwarded to the CPU, and then sent on to a DNS server, if the switch is configured with a DNS server address. ■ ARP packets are forwarded to the CPU, and an ARP entry for the supplicant is learnt. ■ Drop all other packets destined to the IP address of the Guest VLAN. ■ Layer 2 forward packets destined to other addresses within the Guest VLAN. ■ All other packets are dropped.
No Web authentication configured	All non-eap packets from unauthenticated supplicants are dropped.	Packets from unauthenticated supplicants are associated with the Guest VLAN of the port. The packets are processed according to these rules: ■ Drop packets destined to the IP address of the Guest VLAN. ■ Layer 2 forward packets destined to other addresses within the Guest VLAN. ■ Drop all other packets.

Deciding when a supplicant fails authentication

Although the treatment of packets from unauthenticated supplicants does not differentiate between the three categories of supplicant, it is still useful to know for sure when the switch decides that a supplicant has failed authentication.

The rules for deciding that a supplicant has failed authentication are listed below for each type of authentication available:

Deciding when a supplicant fails 802.1X authentication

If the supplicant responds to EAP authentication requests, and the supplicant's authentication information is sent to the RADIUS server, and the RADIUS server replies with an Authentication-Reject, then the supplicant is immediately deemed to have failed authentication.

If the supplicant does not respond to EAP authentication requests, then the switch will resend the authentication requests up to a maximum number of attempts set by the command dot1x max-reauth-req (the default is 2). The interval between the attempts is set by the command dot1x timeout tx-period (the default is 30 seconds). If the supplicant still has not responded after this, it is deemed to have not attempted authentication.

See Chapter 63, 802.1X Commands for 802.1X authentication command information.

Deciding when a supplicant fails Web authentication

As soon as the supplicant attempts any web-browsing, the switch will intercept the web session, and present the supplicant with an authentication request page. If the user enters a username and password, and clicks the login button, then the switch will send the username and password to the RADIUS server. If the RADIUS server replies with an Authentication-Reject, then the supplicant is immediately deemed to have failed authentication.

Until the supplicant has attempted any web-browsing, or has received the authentication request page, but not yet clicked the login button, the supplicant is deemed to be not yet authenticated (as against not able to authenticate).

See Chapter 65, Authentication Commands for Web authentication command information.

Deciding when a supplicant fails MAC authentication

As soon as the supplicant sends any packet, the source MAC address from the packet will be sent to the RADIUS server for authentication. If the RADIUS server replies with an Authentication-Reject, then the supplicant is immediately deemed to have failed authentication.

With MAC auth there really is no concept of not-yet-attempted authentication, because authentication is attempted as soon as a supplicant sends a packet.

See Chapter 65, Authentication Commands for MAC authentication command information.

Authentication Enhancements

The authentication enhancements introduced in this release fall into three areas:

- Web-authentication Enhancements
  Improvements to Web-authentication
- Guest VLAN Enhancements
  Increased flexibility in the operation of the Guest VLAN
- Failed authentication VLAN
  Introduction of the auth-fail VLAN

See the section "Limitations on allowed feature combinations" on page 64.12 for information about restrictions regarding combinations of authentication enhancements working together.

Web-authentication Enhancements

Web-authentication can now operate as seamlessly as 802.1X authentication.

In previous releases there were limitations in the operation of Web-authentication. In particular, the authenticating switch had to be the default gateway for the client PC, or the user on the client PC had to browse explicitly to the IP address of the switch. As as result, previous web-authentication would not reliably interoperate with a client PC that had static IP configuration.

The aim of the enhancements in this release is to ensure that the client PC user is presented with the Web-authentication login page as soon as they start web browsing to any address, irrespective of the IP configuration (whether or not it is static or dynamic) on their client PC.

There are three aspects to the enhancements that have been implemented in order to do this:

- DHCP Server for Web-authentication
- Interception of clients' ARPs
- Proxy DNS response

DHCP Server for Web-authentication

In previous releases, a DHCP service could be configured on the authenticating switch, serving IP addresses in the subnet used on the Guest VLAN. While this did facilitate Web-authentication for client PCs with dynamic IP configuration, it was not an ideal solution, since the DHCP service was shared between Web-authentication clients and Guest VLAN users.

In this release there is now a DHCP server dedicated to serving IP addresses for use by Web-authentication clients.

See the auth-web-server dhcp ipaddress command on page 65.33 and the auth-web-server dhcp lease command on page 65.34 for details about configuring the Web-authentication DHCP Server.

Interception of clients' ARPs

A client PC's IP communications will always be preceded by sending out ARP (Address Resolution Protocol) requests for host addresses in its local subnet, or for its gateway address. If the IP address and gateway address have been statically configured on the client PC, and the subnet used in this static configuration is different to that on the authenticating switch, then the ARP requests will receive no reply, and the PC will not begin IP communications.

So, a switch operating as a Web Authenticator needs a method for replying to arbitrary ARP requests, to enable the client PC to proceed to the HTTP session required to perform Web-authentication.

The Web-authentication server can operate in three modes:

- No interception: only responds to ARP requests for its own IP address (this is the operation of the Web-authentication server in previous versions of AlliedWare Plus™).
- Intercept mode: will respond to ARP requests from any IP address that is in the same subnet as the switch's own IP address, and will provide its own MAC address in the ARP reply, irrespective of what IP address (within its own subnet) was being requested.
- Promiscuous mode: will respond to any ARP request, irrespective of whether the requested IP address is in the same subnet as the switch's IP address or not. It will provide its own MAC address in the ARP reply, irrespective of what IP address was being requested.

The addition of this functionality allows you to configure the Web-authentication server to interoperate with any static IP configuration on a client PC.

See the auth-web-server mode command on page 65.37 for command information about setting the Web-authentication mode.

Proxy DNS response

Typically, an HTTP session from a web browser is preceded by a DNS request for the IP address of the website the user wishes to browse to. If the DNS request does not receive a reply, then the web browser will never proceed to connect an HTTP session.

Hence the Web-authentication server needs a mechanism to reply to DNS requests, so that the Web-authentication session can begin. The Web-authentication modes also control the operation of Proxy DNS replies from the Web-authentication server as listed below:

- No interception: does not respond to DNS requests
- Intercept mode: responds to DNS request whose source IP address is within the same subnet as the IP address on the switch. The IP address provided as the resolution of the DNS lookup is the switch's own IP address, so that the subsequent HTTP traffic will be directed to the switch.
- Promiscuous mode: responds to DNS requests from any source IP address. The IP address provided as the resolution of the DNS lookup is the switch's own IP address, so that the subsequent HTTP traffic will be directed to the switch.

The combination of these enhancements ensure that, irrespective of the IP configuration on the client PC, Web-authentication will proceed smoothly.

See the auth-web-server mode command on page 65.37 for command information about setting the Web-authentication mode.

Guest VLAN Enhancements

In previous releases, traffic from unauthenticated supplicants in the Guest VLAN could only be L2 switched within the Guest VLAN.

As a result, it was not possible for DHCP requests from host in the Guest VLAN to be relayed to a DHCP server in another VLAN. Hence, for hosts in the Guest VLAN to obtain DHCP leases, the DHCP Server needed to have an interface in the Guest VLAN, or the authenticating switch needed to act as a DHCP Server. Either of these options could be inconvenient, or possibly even something of a security risk.

Additionally, supplicants in the Guest VLAN who needed to log into a Domain Controller, as part of becoming integrated into a NAC solution, could not access the Domain Controller if it was in another VLAN.

In this release, there is now an option to enable routing from the Guest VLAN. By default, traffic from unauthenticated supplicants in the Guest VLAN will still only be L2 switched within the Guest VLAN. But, if the routing parameter for the auth guest vlan command is configured, then the switch will route unauthenticated supplicants' traffic to other VLANs if required, and will relay their DHCP requests to servers in other VLANs if required.

See the auth guest-vlan command on page 65.9 for command information about Guest VLAN feature enhancements.

Failed authentication VLAN

The auth-fail VLAN feature allows the Network Administrator to separate the supplicants who attempted authentication, but failed, from the supplicants who did not attempt authentication.

This feature enables the Network Administrator to enact a security policy in which the supplicants who fail authentication are given extremely limited access, or are given access to remedial applications.

If the Guest VLAN and auth-fail VLAN are both configured on a switch, then a newly connected supplicant initially belongs to the Guest VLAN. If newly connected supplicants attempt 802.1X port authentication or Web-authentication and fail, then they are moved from the Guest VLAN to the auth-fail VLAN.

The criteria for how many failed authentication attempts are allowed before the supplicant is moved to the auth-fail VLAN differs, depending on the authentication method used.

If Web-authentication is used, then the supplicant is moved to the auth-fail VLAN after the first failed attempt. If 802.1X port authentication is used, then the supplicant is moved to the auth-fail VLAN after the number of failed attempts is equal to the value configured by the dot1x max-auth-fail command (by default, three failed 802.1X authentication attempts are allowed).

Note that the auth-fail VLAN feature is not applicable for MAC authentication. Supplicants failing MAC authentication remain in the Guest VLAN and will not move to the auth-fail VLAN.

See the auth auth-fail vlan command on page 65.3 and the dot1x max-auth-fail command on page 63.8 for command information about the failed authentication vlan feature when using 802.1X port authentication on an interface.

Limitations on allowed feature combinations

Note that the Web-authentication feature and enhancements cannot be used with the Guest VLAN or auth-fail VLAN features. For further limitation information see the below tables:

Table 64-2: Interoperation of authentication types with Guest VLAN and auth-fail VLAN

Authentication Type:	Guest VLAN (without routing mode)	Guest VLAN (with routing mode)	Failed Authentication VLAN
802.1X Port-based Authentication	No change in functionality from previous releases	Unauthorized supplicant can access Guest VLAN. Use ACL for security on the interface.	Failed authentication supplicant can access auth-fail VLAN. See limitations table below for ACL usage limitation.
MAC Authentication	No change in functionality from previous releases	Unauthorized supplicant can access Guest VLAN. Use ACL for security on the interface.	(Not Available)
Web-based Authentication (without intercept mode)	No change in functionality from previous releases	Unauthorized supplicant can access Guest VLAN. Use ACL for security on the interface.	Failed authentication supplicant can access auth-fail VLAN. See limitations table below for ACL usage limitation.
Web-based Authentication (with intercept mode)	(Not Available)	(Not Available)	(Not Available)

Table 64-3: Interactions between Guest VLAN and auth-fail VLAN

Authentication Feature:	Guest VLAN (without routing mode)	Guest VLAN (with routing mode)	Failed Authentication VLAN
Guest VLAN (without routing mode)	(Not Available)	(Not Available)	Cannot configure ACLs on the Guest VLAN when it is not in routing mode. The Guest VLAN without routing mode has reserved ACLs already attached to it.
Guest VLAN (with routing mode)	(Not Available)	(Not Available)	Configuration of ACLs for additional interface security is recommended.
Failed Authentication VLAN	Cannot configure ACLs on the Guest VLAN when it is not in routing mode. The Guest VLAN without routing mode has reserved ACLs already attached to it.	Configuration of ACLs for additional interface security is recommended.	(Not Available)

Chapter 65: Authentication Commands

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Command List

This chapter provides an alphabetical reference for Authentication commands. For more information, see Chapter 64, Authentication Introduction and Configuration, and Chapter 67, AAA Commands.

auth auth-fail vlan

Use this command to enable the auth-fail vlan feature on the specified vlan interface. This feature assigns supplicants (client devices), which have failed port authentication, to the specified VLAN interface.

Use the no variant of this command to disable the auth-fail vlan feature for a specified VLAN interface.

Syntax

```
auth auth-fail vlan <1-4094>
no auth auth-fail vlan
```

Parameter	Description
<1-4094>	Assigns the VLAN ID to any supplicants that have failed port authentication.

Default The auth-fail vlan feature is disabled by default.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Usage Use the auth-fail vlan feature when using Web-authentication instead of the Guest VLAN feature, when you need to separate networks where one supplicant (client device) requires authentication and another supplicant does not require authentication from the same interface.

This is because the DHCP lease time using the Web authentication feature is shorter, and the auth fail vlan feature enables assignment to a different VLAN if a supplicant fails authentication.

When using 802.1X port authentication, use a dot1x max-auth-fail command to set the maximum number of login attempts. Three login attempts are allowed by default for 802.1X port authentication before supplicants trying to authenticate are moved from the Guest VLAN to the auth-fail VLAN. See the "dot1x max-auth-fail" on page 63.8 for command information.

See the section "Failed authentication VLAN" on page 64.11 in Chapter 64, Authentication Introduction and Configuration for further overview information about the auth-fail VLAN feature, which allows the Network Administrator to separate the supplicants who attempted authentication, but failed, from the supplicants who did not attempt authentication.

See the section "Limitations on allowed feature combinations" on page 64.12 for information about restrictions regarding combinations of authentication enhancements working together.

Use appropriate ACLs (Access Control Lists) on interfaces for extra security if a supplicant allocated to the designated auth-fail vlan can access the same network as a supplicant on the Guest VLAN. For more information about ACL concepts, and configuring ACLs see Chapter 55, Access Control Lists Introduction. For more information about ACL commands see:

- Chapter 56, IPv4 Hardware Access Control List (ACL) Commands
- Chapter 57, IPv4 Software Access Control List (ACL) Commands
- Chapter 58, IPv6 Hardware Access Control List (ACL) Commands
- Chapter 59, IPv6 Software Access Control List (ACL) Commands

Examples

To enable auth-fail vlan for `port1.0.2` and assign VLAN `100`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth auth-fail vlan 100
```

To disable the auth-fail vlan feature for `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth auth-fail vlan
```

Validation Commands

show running-config

Related Commands

dot1x max-auth-fail
show dot1x
show dot1x interface

auth critical

This command enables the critical port feature on the interface. When the critical port feature is enabled on an interface, and all the RADIUS servers are unavailable, then the interface becomes authorized.

The no variant of this command disables critical port feature on the interface.

Syntax

```
auth critical
no auth critical
```

Default The critical port of port authentication is disabled.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Examples To enable the critical port feature on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth critical
```

To disable the critical port feature on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth critical
```

Validation Commands

show auth-web-server
show dot1x
show dot1x interface
show running-config

auth dynamic-vlan-creation

This command enables and disables the Dynamic VLAN assignment feature.

The Dynamic VLAN assignment feature allows a supplicant (client device) to be placed into a specific VLAN based on information returned from the RADIUS server during authentication, on a given interface.

Use the no variant of this command to disable the Dynamic VLAN assignment feature.

Syntax

```
auth dynamic-vlan-creation [rule {deny|permit}]
no auth dynamic-vlan-creation
```

Parameter	Description
`rule`	VLAN assignment rule.
`deny`	Deny a differently assigned VLAN ID. This is the default rule.
`permit`	Permit a differently assigned VLAN ID.

Default By default, the Dynamic VLAN assignment feature is disabled.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Usage If the Dynamic VLAN assignment feature is enabled (disabled by default), VLAN assignment is dynamic. If the Dynamic VLAN assignment feature is disabled then RADUS attributes are ignored and configured VLANs are assigned to ports.

The optional rule parameter specifies the VLAN assignment rule when the second supplicant's VLAN ID is different from VLAN ID from the first supplicant. If the deny value is applied with the command then the second supplicant with a different VLAN ID is rejected. If the permit value is applied with the command then the second supplicant with a different VLAN ID is accepted and assigned to the first supplicant's VLAN.

If you issue an auth dynamic-vlan-creation command without an optional rule parameter and a required deny or permit keyword value then a second supplicant with a different VLAN ID is rejected. It is not assigned to the first supplicant's VLAN. Issuing an auth dynamic-vlan-creation command without an optional rule parameter has the same effect as issuing an auth dynamic-vlan-creation rule deny command rejecting supplicants with differing VIDs.

Examples To enable the Dynamic VLAN assignment feature on interface `port1.0.2`, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth dynamic-vlan-creation
```

To disable the Dynamic VLAN assignment feature on interface `port1.0.2`, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth dynamic-vlan-creation
```

Validation Commands

show dot1x
show dot1x interface
show running-config

Related Commands

auth host-mode

auth guest-vlan

This command enables and configures the Guest VLAN feature on the interface specified by associating a Guest VLAN with an interface. This command does not start authentication. The supplicant's (client device's) traffic is associated with the native VLAN of the interface if its not already associated with another VLAN. The routing option enables routing from the Guest VLAN to another VLAN, so the switch can lease DHCP addresses and accept access to a limited network.

The no variant of this command disables the guest vlan feature on the interface specified.

Syntax

```
auth guest-vlan <1-4094> [routing]
no auth guest-vlan [routing]
```

Parameter	Description
<1-4094>	VLAN ID (VID).
`routing`	Enables routing from the Guest VLAN to other VLANs.

Default The Guest VLAN authentication feature is disabled by default.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Usage The Guest VLAN feature may be used by supplicants (client devices) that have not attempted authentication, or have failed the authentication process. Note that if a port is in multi-supplicant mode with per-port dynamic VLAN configuration, after the first successful authentication, subsequent hosts cannot use the guest VLAN due to the change in VLAN ID. This may be avoided by using per-user dynamic VLAN assignment.

When using the Guest VLAN feature with the multi-host mode, a number of supplicants can communicate via a guest VLAN before authentication. A supplicant's traffic is associated with the native VLAN of the specified switch port. The supplicant must belong to a VLAN before traffic from the supplicant can be associated.

Note that you must first define the VLAN with the vlan command that you will assign as a guest VLAN using this command. Also note that 802.1X must first be enabled on the port.

Guest VLAN authentication cannot be enabled if DHCP snooping is enabled (service dhcp-snooping command on page 78.24), and vice versa.

The Guest VLAN feature in previous releases had some limitations that have been removed. Until this release the Guest VLAN feature could not lease the IP address to the supplicant using DHCP Server or DHCP Relay features unless Web authentication was also applied. When using NAP authentication, the supplicant should have been able to log on to a domain controller to gain certification, but the Guest VLAN would not accept access to another VLAN.

The Guest VLAN routing mode in this release overcomes these issues. With the Guest VLAN routing mode, the switch can lease DHCP addresses and accept access to a limited network.

See the section "Guest VLAN Enhancements" on page 64.10 for further overview information about the enhancements to the Guest VLAN feature.

See the section "Limitations on allowed feature combinations" on page 64.12 for information about restrictions regarding combinations of authentication enhancements working together.

Examples

To define `vlan100` and assign the guest VLAN feature to `vlan100` on interface `port1.0.2`, and enable routing from the guest vlan to other VLANs, use the following commands:

```
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 100
awplus(config-vlan)# exit
awplus(config)# interface port1.0.2
awplus(config-if)# dot1x port-control auto
awplus(config-if)# auth guest-vlan 100 routing
```

To disable the guest vlan feature on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth guest-vlan
```

Validation Commands

show dot1x
show dot1x interface
show running-config

Related Commands

dot1x port-control
vlan

auth host-mode

This command selects host mode on the interface. Multi-host is an extension to IEEE802.1X.

Use the no variant of this command to set host mode to the default setting (single host).

Syntax

```
auth host-mode {single-host|multi-host|multi-supplicant}
no auth host-mode
```

Parameter	Description
`single-host`	Single host mode.
`multi-host`	Multi host mode.
`multi-supplicant`	Multi supplicant (client device) mode.

Default The default host mode for port authentication is for a single host.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Examples To set the host mode to multi-supplicant on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth host-mode multi-supplicant
```

To set the host mode to default (single host) on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth host-mode
```

Validation Commands

show dot1x
show dot1x interface
show running-config

auth log

Use this command to configure the types of authentication feature log messages that are output to the log file.

Use the no variant of this command to remove either specified types or all types of authentication feature log messages that are output to the log file.

Syntax

```
auth log {dot1x|auth-mac|auth-web} {success|failure|logoff|all}
no auth log {do1x|auth-mac|auth-web} {success|failure|logoff|all}
```

Parameter	Description
`dot1x`	Specify only 802.1X authentication log messages are output to the log file.
`auth-mac`	Specify only MAC authentication log messages are output to the log file.
`auth-web`	Specify only Web authentication log messages are output to the log file.
`success`	Specify only successful authentication log messages are output to the log file.
`failure`	Specify only authentication failure log messages are output to the log file.
`logoff`	Specify only authentication logoff messages are output to the log file. Note that link down, age out and expired ping polling messages will be included.
`all`	Specify all types of authentication log messages are output to the log file Note that this is the default behavior for the authentication logging feature.

Default All types of authentication log messages are output to the log file by default.

Mode Interface Configuration

Examples To configure the logging of MAC authentication failures to the log file for supplicants (client devices) connected to interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth log auth-mac failure
```

To configure the logging of all types of authentication log messages to the log file for supplicants (client devices) connected to interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth log all
```

Validation Commands show running-config

auth max-supplicant

This command sets the maximum number of supplicants (client devices) on the interface that can be authenticated. After this value is exceeded supplicants are not authenticated.

The no variant of this command resets the maximum supplicant number to the default (1024).

Syntax

```
auth max-supplicant <2-1024>
no auth max-supplicant
```

Parameter	Description
<2-1024>	Limit number.

Default The max supplicant of port authentication is 1024.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Examples To set the maximum number of supplicants to `10` on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth max-supplicant 10
```

To reset the maximum number of supplicant to default on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth max-supplicant
```

Validation Commands

show dot1x
show dot1x interface
show running-config

auth reauthentication

This command enables re-authentication on the interface specified in the Interface mode, which may be a static channel group (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

Use the no variant of this command to disables reauthentication on the interface.

Syntax

```
auth reauthentication
no auth reauthentication
```

Default Reauthentication of port authentication is disabled by default.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Examples To enable reauthentication on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth reauthentication
```

Validation Commands

show dot1x
show dot1x interface
show running-config

auth roaming disconnected

This command enables the roaming authentication feature on an authenticated interface that is link down. A supplicant (a client device) is not reauthenticated when moved between authenticated interfaces, providing both interfaces have the roaming authentication feature enabled before the supplicant is moved.

Use the auth roaming enable command before using this command. The auth roaming disconnected command on its own will have no effect on the operation of the switch. This command will only come into effect once the base Roaming Authentication feature is enabled, using the auth roaming enable command.

The no variant of this command disables the roaming authentication feature on an interface, and forces a supplicant to be reauthenticated when moving between interfaces.

See "Roaming Authentication" on page 64.4 for further information about this feature.

Syntax

```
auth roaming disconnected

no auth roaming disconnected
```

Default The roaming authentication `disconnected` feature is disabled by default on an interface. Authentication status for a roaming supplicant is deleted by default when an interface goes down.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Usage This command allows a supplicant to move to another authenticating interface without reauthentication, if the link is down for the interface that the supplicant is moved from.

Note that 802.1X port authentication, or MAC authentication, or Web Authentication must first be enabled on an interface to use this feature. The port that the supplicant is moving to must have the same authentication configuration as the port the supplicant is moving from.

Configure auth roaming enable on an interface before configuring auth roaming disconnected if you require auth roaming disconnected configured on an interface for a roaming supplicant.

Roaming authentication cannot be enabled if DHCP snooping is enabled (service dhcp-snooping command on page 78.24), and vice versa.

Examples To enable roaming authentication `disconnected` feature for `port1.0.2`, after enabling 802.1x authentication and enabling roaming authentication `enable`, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# dot1x port-control auto
awplus(config-if)# auth roaming enable
awplus(config-if)# auth roaming disconnected
```

To disable roaming authentication disconnected feature for `port1.0.2`, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth roaming disconnected
```

Validation Commands

show running-config

Related Commands

auth-mac enable
auth roaming enable
auth-web enable
dot1x port-control
show auth-mac interface
show auth-web interface
show dot1x interface

auth roaming enable

This command enables the roaming authentication feature on an authenticated interface that is link up. A supplicant (a client device) is not reauthenticated when moved between authenticated interfaces, providing both interfaces have the roaming authentication feature enabled before the supplicant is moved.

Use the auth roaming enable command before using auth roaming disconnected command. The auth roaming disconnected command on its own will have no effect on the operation of the switch. This command will only come into effect once the base Roaming Authentication feature is enabled, using the auth roaming enable command.

The no variant of this command disables the roaming authentication feature on an interface, and forces a supplicant to be reauthenticated when moving between interfaces.

See "Roaming Authentication" on page 64.4 for further information about this feature.

Syntax

```
auth roaming enable
no auth roaming enable
```

Default The roaming authentication enable feature is disabled by default on an interface. Authentication status for a roaming supplicant is deleted by default when an interface goes down.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Usage This command allows a supplicant to move to another authenticating interface without reauthentication, providing the link is up for the interface that the supplicant is moved from.

Note that 802.1X port authentication, or MAC authentication, or Web Authentication must first be enabled on an interface to use this feature. The port that the supplicant is moving to must have the same authentication configuration as the port the supplicant is moving from.

Configure auth roaming enable on an interface before configuring auth roaming disconnected if you require auth roaming disconnected configured on an interface for a roaming supplicant.

Roaming authentication cannot be enabled if DHCP snooping is enabled (service dhcp-snooping command on page 78.24), and vice versa.

Examples To enable the roaming authentication enable feature for interface `port1.0.4`, after enabling 802.1x authentication, since an authentication method is required, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# dot1x port-control auto
awplus(config-if)# auth roaming enable
```

To disable roaming authentication enable for `port1.0.4`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# no auth roaming enable
```

Validation Commands

show running-config

Related Commands

auth-mac enable
auth roaming disconnected
auth-web enable
dot1x port-control
show auth-mac interface
show auth-web interface
show dot1x interface

auth supplicant-mac

This command adds a supplicant (client device) mac address on a given interface with the parameters as specified in the table below.

Use the no variant of this command to delete the supplicant MAC address added by the auth supplicant-mac command, and resets to the default for the supplicant parameter.

Syntax

```
auth supplicant <mac-addr>
   [max-reauth-req <1-10>]
   [port-control {auto | force-authorized | force-unauthorized}]
   [quiet-period <1-65535>]
   [reauth-period <1-4294967295>]
   [supp-timeout <1-65535>]
   [server-timeout <1-65535>][reauthentication]

no auth supplicant-mac <macadd> [reauthentication]
```

Parameter	Description
<mac-addr>	MAC (hardware) address of the Supplicant entry in HHHH.HHHH.HHHH MAC address hexadecimal format.
`port-control`	Port control commands.
`auto`	Allow port client to negotiate authentication.
`force-authorized`	Force port state to authorized.
`force-unauthorized`	Force port state to unauthorized.
`quiet-period`	Quiet period in the HELD state (default 60 seconds).
<1-65535>	Seconds for quiet period.
`reauth-period`	Seconds between reauthorization attempts (default 3600 seconds).
<1-4294967295>	Seconds for reauthorization attempts (reauth-period).
`supp-timeout`	Supplicant response timeout (default 30 seconds).
<1-65535>	Seconds for supplicant response timeout.
`server-timeout`	Authentication server response timeout (default 30 seconds).
<1-65535>	Seconds for authentication server response timeout.
`reauthentication`	Enable reauthentication on a port.
`max-reauth-req`	No of reauthentication attempts before becoming unauthorized (default 2).
<1-10>	Count of reauthentication attempts.

Default No supplicant MAC address for port authentication exists by default until first created with the auth supplicant-mac command. The defaults for parameters applied are as shown in the table.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Examples To add the supplicant MAC address `0009.41A4.5943` to force authorized port control for interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth supplicant-mac 0009.41A4.5943 port-
control force-authorized
```

To delete the supplicant MAC address `0009.41A4.5943` for interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth supplicant-mac 0009.41A4.5943
```

To reset reauthentication to disable for the supplicant MAC address `0009.41A4.5943`, for interface `port1.0.2` use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth supplicant-mac 0009.41A4.5943
reauthentication
```

Validation Commands show dot1x
show dot1x interface
show running-config

auth timeout quiet-period

This command sets the time period for which the authentication request is not accepted on a given interface, after the authentication request has failed an authentication.

Use the no variant of this command to reset quiet period to the default (60 seconds).

Syntax

```
auth timeout quiet-period <1-65535>
no auth timeout quiet-period
```

Parameter	Description
<1-65535>	Seconds.

Default The quiet period of port authentication is 60 seconds.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Examples To set the quiet period to `10` for interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth timeout quiet-period 10
```

To reset the quiet period to the default (60 seconds) for interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth timeout quiet-period
```

auth timeout reauth-period

This command sets the timer for reauthentication on a given interface. The re-authentication for the supplicant (client device) is executed at this timeout. The timeout is only applied if the auth reauthentication command is applied.

Use the no variant of this command to reset the reauth-period parameter to the default (3600 seconds).

Syntax

```
auth timeout reauth-period <1-4294967295>
no auth timeout reauth-period
```

Parameter	Description
<1-4294967295>	Seconds.

Default The default reauthentication period for port authentication is 3600 seconds, when reauthentication is enabled on the port.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Examples To set the reauthentication period to 1 day for interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth timeout reauth-period 86400
```

To reset the reauthentication period to the default (3600 seconds) for interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth timeout reauth-period
```

Validation Commands
show dot1x
show dot1x interface
show running-config

Related Commands auth reauthentication

auth timeout server-timeout

This command sets the timeout for the waiting response from the RADIUS server on a given interface.

The no variant of this command resets the server-timeout to the default (30 seconds).

Syntax

```
auth timeout server-timeout <1-65535>
no auth timeout server-timeout
```

Parameter	Description
<1-65535>	Seconds.

Default The server timeout for port authentication is 30 seconds.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Examples To set the server timeout to 120 seconds for interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth timeout server-timeout 120
```

To set the server timeout to the default (30 seconds) for interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth timeout server-timeout
```

Validation Commands

show dot1x
show dot1x interface
show running-config

auth timeout supp-timeout

This command sets the timeout of the waiting response from the supplicant (client device) on a given interface.

The no variant of this command resets the supplicant timeout to the default (30 seconds).

Syntax

```
auth timeout supp-timeout <1-65535>
no auth timeout supp-timeout
```

Parameter	Description
<1-65535>	Seconds.

Default The supplicant timeout of port authentication is 30 seconds.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Examples To set the server timeout to 2 seconds for interface port1.0.2, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth timeout supp-timeout 2
```

To reset the server timeout to the default (30 seconds) for interface port1.0.2, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth timeout supp-timeout
```

Validation Commands

show dot1x
show dot1x interface
show running-config

auth-mac enable

This command enables MAC based authentication on the interface specified in the Interface command mode.

Use the no variant of this command to disable MAC based authentication on an interface.

Syntax

```
auth-mac enable
no auth-mac enable
```

Default MAC authentication is disabled by default.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Usage Enabling spanning-tree edgeport on ports after enabling MAC based authentication avoids unnecessary re-authentication when the port state changes, which does not happen when spanning tree edgeport is enabled. Note that re-authentication is correct behavior without spanning-tree edgeport enabled.

Applying switchport mode access on ports is also good practice to set the ports to access mode with ingress filtering turned on, whenever ports for MAC authentication are in a VLAN.

Examples To enable MAC authentication on interface `port1.0.2` and enable spanning tree edgeport to avoid unnecessary re-authentication, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth-mac enable
awplus(config-if)# spanning-tree edgeport
awplus(config-if)# switchport mode access
```

To disable MAC authentication on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth-mac enable
```

Validation Commands
show auth-mac
show auth-mac interface
show running-config

Related Commands
aaa accounting auth-mac default
aaa authentication auth-mac
spanning-tree edgeport (RSTP and MSTP)
switchport mode access

auth-mac method

This command sets the type of authentication method for MAC authentication that is used with RADIUS on the interface specified in the Interface command mode.

The no variant of this command resets the authentication method used to the default method (PAP) as the RADIUS authentication method used by the MAC authentication.

Syntax

```
auth-mac method [eap-md5|pap]
no auth-mac method
```

Parameter	Description
eap-md5	Enable EAP-MD5 of authentication method.
pap	Enable PAP of authentication method.

Default The mac authentication method is PAP.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Examples To set the MAC authentication method to `pap` on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth-mac method pap
```

To set the MAC authentication method to the default on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth-mac method
```

Validation Commands

show auth-mac
show auth-mac interface
show running-config

auth-mac reauth-relearning

This command sets the MAC address learning of the supplicant (client device) to re-learning for re-authentication on the interface specified in the Interface command mode.

Use the no variant of this command to disable the auth-mac re-learning option.

Syntax

```
auth-mac reauth-relearning
no auth-mac reauth-relearning
```

Default Re-learning for port authentication is disabled by default.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Examples To enable the re-authentication re-learning feature on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth-mac reauth-relearning
```

To disable the re-authentication re-learning feature on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth-mac reauth-relearning
```

Validation Commands

show auth-mac
show auth-mac interface
show running-config

auth-web enable

This command enables Web-based authentication in Interface mode on the interface specified.

Use the no variant of this command to disable Web-based authentication on an interface.

Syntax

```
auth-web enable
no auth-web enable
```

Default Web authentication is disabled by default.

Mode Interface Configuration for a static channel or a switch port.

Usage Web-based authentication cannot be enabled if DHCP snooping is enabled (service dhcp-snooping command on page 78.24), and vice versa.

Examples To enable Web authentication on static-channel-group 2, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# static-channel-group 2
awplus(config-if)# exit
awplus(config)# interface sa2
awplus(config-if)# auth-web enable
```

To disable Web authentication on static-channel-group 2, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# static-channel-group 2
awplus(config-if)# exit
awplus(config)# interface sa2
awplus(config-if)# no auth-web enable
```

Validation Commands
show auth-web
show auth-web interface
show running-config

Related Commands
aaa accounting auth-web default
aaa authentication auth-web

auth-web forward

This command enables the web authentication packet forwarding feature on the interface specified. This command also enables ARP forwarding, and adds forwarded packets to the tcp or udp port number specified.

The no variant of this command disables or deletes the packet forwarding feature on the interface.

Syntax

```
auth-web forward {arp|dhcp|dns|tcp <1-65535>|udp <1-65535>}
no auth-web forward [arp|dhcp|dns|tcp <1-65535>|udp <1-65535>]
```

Parameter	Description
arp	Enable forwarding of ARP.
dhcp	Enable forwarding of DHCP (67/udp).
dns	Enable forwarding of DNS (53/udp).
tcp	Enable forwarding of TCP specified port number.
<1-65535>	TCP Port number.
udp	Enable forwarding of UDP specified port number.
<1-65535>	UDP Port number.

Default Packet forwarding for port authentication is disabled by default.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Examples To enable the arp forwarding feature on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth-web forward arp
```

To add the tcp forwarding port 137 on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth-web forward tcp 137
```

To disable the ARP forwarding feature on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth-web forward arp
```

To delete the tcp forwarding port 137 on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth-web forward tcp 137
```

To delete the all of tcp forwarding on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth-web forward tcp
```

Validation Commands

show auth-web
show auth-web interface
show running-config

auth-web max-auth-fail

This command sets the number of authentication failures allowed before rejecting further authentication requests. When the supplicant (client device) fails more than has been set to the maximum number of authentication failures then login requests are refused during the quiet period.

The no variant of this command resets the maximum number of authentication failures to the default (3 authentication failures).

Syntax

```
auth-web max-auth-fail <0-10>
no auth-web max-auth-fail
```

Parameter	Description
<0-10>	Lock count specified.

Default The max-auth-fail lock counter is set to 3 authentication failures by default.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Examples To set the lock count to `5` on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth-web max-auth-fail 5
```

To set the lock count to the default on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth-web max-auth-fail
```

Validation Commands show auth-web
show auth-web interface
show running-config

Related Commands auth timeout quiet-period

auth-web method

This command sets the authentication method of WEB authentication that is used with RADIUS on the interface specified.

The no variant of this command sets the authentication method to PAP for the interface specified when Web authentication is also used with the RADIUS authentication method.

Syntax

```
auth-web method {eap-md5|pap}
no auth-web method
```

Parameter	Description
eap-md5	Enable EAP-MD5 as the authentication method.
pap	Enable PAP as the authentication method.

Default The web authentication method is set to PAP by default.

Mode Interface Configuration for a static channel, a dynamic (LACP) channel group, or a switch port.

Example To set the web authentication method to eap-md5 on interface `port1.0.2`, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# auth-web method eap-md5
```

Validation Commands

show auth-web
show auth-web interface
show running-config

auth-web-server dhcp ipaddress

Use this command to assign an IP address and enable the DHCP service on the web authentication server for supplicants (client devices).

Use the no variant of this command to remove an IP address and disable the DHCP service on the web authentication server for supplicants.

Syntax

```
auth-web-server dhcp ipaddress <ip-address/prefix-length>
no auth-web-server dhcp ipaddress
```

Parameter	Description
<ip-addr/prefix-length>	The IPv4 address and prefix length assigned for the DHCP service on the web authentication server for supplicants.

Default No IP address for the web authentication server is set by default.

Mode Global Configuration

Usage See the section "DHCP Server for Web-authentication" on page 64.9 in Chapter 64, Authentication Introduction and Configuration for further overview information about the Web-authentication enhancements, allowing Web-authentication to work as seamlessly as 802.1X authentication.

See the section "Limitations on allowed feature combinations" on page 64.12 for information about restrictions regarding combinations of authentication enhancements working together.

Examples To assign the IP address `10.0.0.1` to the web authentication server, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server dhcp ip address 10.0.0.1/8
```

To remove an IP address on the web authentication server, use the following commands:

```
awplus# configure terminal
awplus(config)# no auth-web-server dhcp ip address
```

Validation Commands show running-config

Related Commands show auth-web-server
auth-web-server dhcp lease

auth-web-server dhcp lease

Use this command to set the DHCP lease time for supplicants (client devices) using the DHCP service on the web authentication server.

Use the no variant of this command to reset to the default DHCP lease time for supplicants using the DHCP service on the web authentication server.

Syntax

```
auth-web-server dhcp lease <20-60>
no auth-web-server dhcp lease
```

Parameter	Description
<20-60>	DHCP lease time for supplicants using the DHCP service on the web authentication server in seconds.

Default The default DHCP lease time for supplicants using the DHCP service on the web authentication server is set to 30 seconds.

Mode Global Configuration

Usage See the section "DHCP Server for Web-authentication" on page 64.9 in Chapter 64, Authentication Introduction and Configuration for further overview information about the Web-authentication enhancements, allowing Web-authentication to work as seamlessly as 802.1X authentication.

See the section "Limitations on allowed feature combinations" on page 64.12 for information about restrictions regarding combinations of authentication enhancements working together.

Examples To set the DHCP lease time to 1 minute for supplicants using the DHCP service on the web authentication server, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server dhcp lease 60
```

To reset the DHCP lease time to the default setting (30 seconds) for supplicants using the DHCP service on the web authentication server, use the following commands:

```
awplus# configure terminal
awplus(config)# no auth-web-server dhcp lease
```

Validation Commands show running-config

Related Commands show auth-web-server
auth-web-server dhcp ipaddress

auth-web-server http-redirect

This command enables the HTTP redirect feature on every interface on which web-based port authentication is enabled. When the HTTP redirect feature is enabled, any HTTP request received on an unauthorized interface is redirected to the web authentication server automatically.

Use the no variant of this command to disable the HTTP redirect feature.

Syntax

```
auth-web-server http-redirect
no auth-web-server http-redirect
```

Default The HTTP redirect feature is enabled by default.

Mode Global Configuration

Examples To disable the HTTP redirect feature, use the following commands:

```
awplus# configure terminal
awplus(config)# no auth-web-server http-redirect
```

To re-enable the HTTP redirect feature, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server http-redirect
```

Validation Commands

show auth-web
show auth-web-server
show running-config

auth-web-server ipaddress

This command sets the IP address for the web authentication server.

Use the no variant of this command to delete the IP address for the web authentication server.

Syntax

```
auth-web-server ipaddress <ip-address>
no auth-web-server ipaddress
```

Parameter	Description
<ip-address>	Web authentication server dotted decimal IP address in A.B.C.D format.

Default The web authentication server address on the system is not set by default.

Mode Global Configuration

Examples To set the IP address `10.0.0.1` to the web authentication server, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server ipaddress 10.0.0.1
```

To delete the IP address from the web authentication server, use the following commands:

```
awplus# configure terminal
awplus(config)# no auth-web-server ipaddress
```

Validation Commands

show auth-web
show auth-web-server
show running-config

auth-web-server mode

Use this command with required keyword to configure an intercept mode (from the intercept, none, or promiscuous modes available) on the web authentication server for supplicants (client devices). The intercept modes available affect the interception of clients' ARPs and the proxy DNS response when using Web-authentication. These enhancements ensure that Web-authentication will proceed smoothly irrespective of the IP configuration on the client PC.

Use the no variant of this command to disable the intercept mode (either the intercept, none, or promiscuous intercept modes) configured on the web authentication server for supplicants.

Syntax

```
auth-web-server mode {intercept|none|promiscuous}

no auth-web-server mode {intercept|promiscuous}
```

Parameter	Description
`intercept`	Selecting this parameter results in web authentication server on the switch intercepting and replying to ARP and DNS messages from the same interface and IP address.
`none`	Selecting this parameter disables the intercept mode on the web authentication server. No ARP and DNS messages are intercepted and replied to from the switch from any interfaces or from any IP addresses.
`promiscuous`	Selecting this parameter results in the web authentication server on the switch intercepting and replying to any ARP or DNS messages from any IP address.

Default Intercept mode on the web authentication server is set to none by default.

Mode Global Configuration

Usage See the section "Web-authentication Enhancements" on page 64.9 in Chapter 64, Authentication Introduction and Configuration for further overview information about the Web-authentication enhancements, allowing Web-authentication to work as seamlessly as 802.1X authentication.

See the sub-sections "Interception of clients' ARPs" on page 64.9 and "Proxy DNS response" on page 64.10for an details of the associated usage of the available intercept modes.

See the section "Limitations on allowed feature combinations" on page 64.12 for information about restrictions regarding combinations of authentication enhancements working together.

Examples To enable the intercept mode on the web authentication server, resulting in the switch intercepting and replying to ARP and DNS messages from the same interface and IP address, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server mode intercept
```

To disable the intercept mode on the web authentication server, use the following commands:

```
awplus# configure terminal
awplus(config)# no auth-web-server mode intercept
```

To reset the intercept mode to the default setting of none on the web authentication server, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server mode none
```

To enable the promiscuous mode on the web authentication server, resulting in the switch intercepting and replying to any ARP or DNS messages from any IP address, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server mode promiscuous
```

To disable the promiscuous mode on the web authentication server, use the following commands:

```
awplus# configure terminal
awplus(config)# no auth-web-server mode promiscuous
```

Validation Commands show running-config

Related Commands show auth-web-server

auth-web-server ping-poll enable

This command enables the ping polling to the supplicant (client device) that is authenticated by web authentication.

The no variant of this command disables the ping polling to the supplicant that is authenticated by web authentication.

Syntax

```
auth-web-server ping-poll enable
no auth-web-server ping-poll enable
```

Default The ping polling feature for web authentication is disabled by default.

Mode Global Configuration

Examples To enable the ping polling feature for web authentication, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server ping-poll enable
```

To disable the ping polling feature for web authentication, use the following commands:

```
awplus# configure terminal
awplus(config)# no auth-web-server ping-poll enable
```

Validation Commands

show auth-web
show auth-web-server
show running-config

auth-web-server ping-poll failcount

This command sets a fail count for the ping polling feature when used with web authentication. The failcount parameter specifies the number of unanswered pings. A supplicant (client device) is logged off when the number of unanswered pings are greater than the failcount set with this command.

Use the no variant of this command to resets the fail count for the ping polling feature to the default (5 pings).

Syntax

```
auth-web-server ping-poll failcount <1-100>
no auth-web-server ping-poll failcount
```

Parameter	Description
<1-100>	Count.

Default The default failcount for ping polling is 5 pings.

Mode Global Configuration

Examples To set the failcount of ping polling to `10` pings, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server ping-poll failcount 10
```

To set the failcount of ping polling to default, use the following commands:

```
awplus# configure terminal
awplus(config)# no auth-web-server ping-poll failcount
```

Validation Commands

show auth-web
show auth-web-server
show running-config

auth-web-server ping-poll interval

This command is used to change the ping poll interval. The interval specifies the time period between pings when the supplicant (client device) is reachable.

Use the no variant of this command to reset to the default period for ping polling (30 seconds).

Syntax

```
auth-web-server ping-poll interval <1-65535>
no auth-web-server ping-poll interval
```

Parameter	Description
<1-65535>	Seconds.

Default The interval for ping polling is 30 seconds by default.

Mode Global Configuration

Examples To set the interval of ping polling to `60` seconds, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server ping-poll interval 60
```

To set the interval of ping polling to the default (30 seconds), use the following commands:

```
awplus# configure terminal
awplus(config)# no auth-web-server ping-poll interval
```

Validation Commands

show auth-web
show auth-web-server
show running-config

auth-web-server ping-poll reauth-timer-refresh

This command modifies the reauth-timer-refresh parameter for the web-authentication feature. The reauth-timer-refresh parameter specifies whether a re-authentication timer is reset and when the response from a supplicant (a client device) is received.

Use the no variant of this command to reset the reauth-timer-refresh parameter to the default setting (disabled).

Syntax

```
auth-web-server ping-poll reauth-timer-refresh
no auth-web-server ping-poll reauth-timer-refresh
```

Default The `reauth-timer-refresh` parameter is disabled by default.

Mode Global Configuration

Examples To enable the `reauth-timer-refresh` timer, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server ping-poll reauth-timer-refresh
```

To disable the `reauth-timer-refresh` timer, use the following commands:

```
awplus# configure terminal
awplus(config)# no auth-web-server ping-poll reauth-timer-
refresh
```

Validation Commands

show auth-web
show auth-web-server
show running-config

auth-web-server ping-poll timeout

This command modifies the ping poll timeout parameter for the web authentication feature. The timeout parameter specifies the time in seconds to wait for a response to a ping packet.

Use the no variant of this command to reset the timeout of ping polling to the default (1 second).

Syntax

```
auth-web-server ping-poll timeout <1-30>
no auth-web-server ping-poll timeout
```

Parameter	Description
<1-30>	Seconds.

Default The default timeout for ping polling is 1 second.

Mode Global Configuration

Examples To set the timeout of ping polling to 2 seconds, use the command:

```
awplus# configure terminal
awplus(config)# auth-web-server ping-poll timeout 2
```

To set the timeout of ping polling to the default (1 second), use the command:

```
awplus# configure terminal
awplus(config)# no auth-web-server ping-poll timeout
```

Validation Commands

show auth-web
show auth-web-server
show running-config

auth-web-server port

This command sets the HTTP port number for the web authentication server.

Use the no variant of this command to reset the HTTP port number to the default (80).

Syntax

```
auth-web-server port <port-number>
no auth-web-server port
```

Parameter	Description
<port-number>	Set the local web authentication server port within the TCP port number range 1 to 65535.

Default The web authentication server HTTP port number is set to 80 by default.

Mode Global Configuration

Examples To set the HTTP port number `8080` for the web authentication server, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server port 8080
```

To reset to the default HTTP port number `80` for the web authentication server, use the following commands:

```
awplus# configure terminal
awplus(config)# no auth-web-server port
```

Validation Commands

show auth-web
show auth-web-server
show running-config

auth-web-server redirect-url

This command sets a URL for supplicant (client device) authentication. When a supplicant is authorized it will be automatically redirected to the specified URL. Note that if the http redirect feature is used then this command is ignored.

Use the no variant of this command to delete the URL string set previously.

Syntax

```
auth-web-server redirect-url <url>
no auth-web-server redirect-url
```

Parameter	Description
<url>	URL (hostname or dotted IP notation).

Default The redirect URL for the web authentication server feature is not set by default (null).

Mode Global Configuration

Examples To enable and set redirect a URL string `www.alliedtelesis.com` for the web authentication server, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server redirect-url
                http://www.alliedtelesis.com
```

To delete a redirect URL string, use the following commands:

```
awplus# configure terminal
awplus(config)# no auth-web-server redirect-url
```

Validation Commands
show auth-web
show auth-web-server
show running-config

Related Commands auth-web-server http-redirect

auth-web-server session-keep

This command enables the session-keep feature to jump to the original URL after being authorized by web authentication.

Use the no variant of this command to disable the session keep feature.

Syntax

```
auth-web-server session-keep
no auth-web-server session-keep
```

Default The session-keep feature is disabled by default.

Mode Global Configuration

Examples To enable the session-keep feature, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server session-keep
```

To disable the session-keep feature, use the following commands:

```
awplus# configure terminal
awplus(config)# no auth-web-server session-keep
```

Validation Commands

show auth-web
show auth-web-server
show running-config

auth-web-server ssl

This command enables HTTPS functionality for the web authentication server feature.

Use the no variant of this command to disable HTTPS functionality for the web authentication server.

Syntax

```
auth-web-server ssl
no auth-web-server ssl
```

Default HTTPS functionality for the web authentication server feature is disabled by default.

Mode Global Configuration

Examples To enable HTTPS functionality for the web authentication server feature, use the following commands:

```
awplus# configure terminal
awplus(config)# auth-web-server ssl
```

To disable HTTPS functionality for the web authentication server feature, use the following commands:

```
awplus# configure terminal
awplus(config)# no auth-web-server ssl
```

Validation Commands

show auth-web
show auth-web-server
show running-config

auth-web-server sslport

This command sets the HTTPS port number for the web authentication server feature.

Use the no variant of this command to reset the HTTPS port number to the default port number (443) for the web authentication server feature.

Syntax

```
auth-web-server sslport <1-65535>
no auth-web-server sslport
```

Parameter	Description
<1-65535>	Set the local web authentication server port within the TCP port number range 1to 65535.

Default The HTTPS port number for the web authentication server feature is set to 443 by default.

Mode Global Configuration

Examples To set the HTTPS port number to 4433 for the web authentication server, use the command:

```
awplus# configure terminal
awplus(config)# auth-web-server sslport 4433
```

To reset the HTTPS port number for the web authentication server to the default (443), use the command:

```
awplus# configure terminal
awplus(config)# no auth-web-server sslport
```

Validation Commands

show auth-web
show auth-web-server
show running-config

copy web-auth-https-file

Use this command to download the SSL server certificate for web-based authentication. The file must be in PEM (Privacy Enhanced Mail) format, and contain the private key and the server certificate.

Syntax

```
copy <filename> web-auth-https-file
```

Parameter	Description
<filename>	The URL of the server certificate file.

Mode Privileged Exec

Example To download the server certificate file `veriSign_cert.pem` from the TFTP server directory `server`, use the command:

```
awplus# copy tftp://server/veriSign_cert.pem web-auth-https-
file
```

Related Commands

auth-web-server ssl
erase web-auth-https-file
show auth-web-server

erase web-auth-https-file

Use this command to remove the SSL server certificate for web-based authentication.

Syntax `erase web-auth-https-file`

Use this command to remove the SSL server certificate for web-based authentication.

Mode Privileged Exec

Example To remove the SSL server certificate file for web-based authentication use the command:

```
awplus# erase web-auth-https-file
```

Related Commands auth-web-server ssl
copy web-auth-https-file
show auth-web-server

show auth-mac

This command shows authentication information for MAC-based authentication.

Syntax

```
show auth-mac [all]
```

Parameter	Description
`all`	Display all authentication information for each interface available on the switch.

Mode Privileged Exec

Example To display all MAC based authentication information, enter the command:

```
awplus# show auth-mac all
```

Output Figure 65-1: Example output from the **show auth-mac** command

```
802.1X Port-Based Authentication Disabled
MAC-based Port Authentication Enabled
WEB-based Port Authentication Disabled
```

Related Commands

show dot1x
show auth-web

show auth-mac diagnostics

This command shows MAC authentication diagnostics, optionally for the specified interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

If no interface is specified then authentication diagnostics are shown for all interfaces.

Syntax

```
show auth-mac diagnostics [interface <interface-list>]
```

Parameter	Description
`interface`	Specify an interface to show
`<interface-list>`	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.

Mode Privileged Exec

Example To display authentication diagnostics for `port1.0.12`, enter the command:

```
awplus# show auth-mac diagnostics interface port1.0.12
```

Output Figure 65-2: Example output from the **show auth-mac diagnostics** command

```
Authentication Diagnostics for interface port1.0.12
    Supplicant address: 00d0.59ab.7037
        authEnterConnecting: 2
        authEaplogoffWhileConnecting: 1
        authEnterAuthenticating: 2
        authSuccessWhileAuthenticating: 1
        authTimeoutWhileAuthenticating: 1
        authFailWhileAuthenticating: 0
        authEapstartWhileAuthenticating: 0
        authEaplogoggWhileAuthenticating: 0
        authReauthsWhileAuthenticated: 0
        authEapstartWhileAuthenticated: 0
        authEaplogoffWhileAuthenticated: 0
        BackendResponses: 2
        BackendAccessChallenges: 1
        BackendOtherrequestToSupplicant: 3
        BackendAuthSuccess: 1
```

show auth-mac interface

This command shows the status for MAC based authentication on the specified interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

Use the optional diagnostics parameter to show authentication diagnostics for the specified interface. Use the optional sessionstatistics parameter to show authentication session statistics for the specified interface. Use the optional statistics parameter to show authentication diagnostics for the specified interface. Use the optional supplicant (client device) parameter to show the supplicant state for the specified interface.

Syntax

```
show auth-mac interface <interface-list>
   [diagnostics|sessionstatistics|statistics|supplicant [brief]]
```

Parameter	Description
<interface-list>	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.
`diagnostics`	Diagnostics.
`sessionstatistics`	Session statistics.
`statistics`	Statistics.
`supplicant`	Supplicant (client device).
`brief`	Brief summary of supplicant state.

Mode Privileged Exec

Examples To display MAC based authentication status for `port1.0.12`, enter the command:

```
awplus# show auth-mac interface port1.0.2
```

```
% Port-Control not configured on port1.0.2
```

To display MAC authentication diagnostics for `port1.0.12`, enter the command:

```
awplus# show auth-mac interface port1.0.12 diagnostics
```

```
Authentication Diagnostics for interface port1.0.2
    Supplicant address: 00d0.59ab.7037
        authEnterConnecting: 2
        authEaplogoffWhileConnecting: 1
        authEnterAuthenticating: 2
        authSuccessWhileAuthenticating: 1
        authTimeoutWhileAuthenticating: 1
        authFailWhileAuthenticating: 0
        authEapstartWhileAuthenticating: 0
        authEaplogoggWhileAuthenticating: 0
        authReauthsWhileAuthenticated: 0
        authEapstartWhileAuthenticated: 0
        authEaplogoffWhileAuthenticated: 0
        BackendResponses: 2
        BackendAccessChallenges: 1
        BackendOtherrequestToSupplicant: 3
        BackendAuthSuccess: 1
```

To display authentication session statistics for `port1.0.12`, enter the command:

```
awplus# show auth-mac interface port1.0.12 sessionstatistics
```

```
Authentication session statistics for interface port1.0.12
    session user name: manager
        session authentication method: Remote server
        session time: 19440 secs
        session terminat cause: Not terminated yet
```

To display MAC authentication statistics for `port1.0.12`, enter the command:

```
awplus# show auth-mac interface port1.0.12 statistics
```

To display the MAC authenticated supplicant on interface `port1.0.12`, enter the command:

```
awplus# show auth-mac interface port1.0.12 supplicant
```

Related Commands

show auth-web diagnostics
show dot1x sessionstatistics
show dot1x statistics interface
show dot1x supplicant interface

show auth-mac sessionstatistics

This command shows authentication session statistics for the specified interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

Syntax `show auth-mac sessionstatistics [interface <interface-list>]`

Parameter	Description
`interface`	Specify an interface to show.
`<interface-list>`	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.

Mode Privileged Exec

Example To display output displaying MAC authentication session statistics for `port1.0.12`, enter the command:

```
awplus# show auth-mac sessionstatistics interface port1.0.12
```

Output Figure 65-3: Example output from the **show auth-mac sessionstatistics** command

```
Authentication session statistics for interface port1.0.12
    session user name: manager
        session authentication method: Remote server
        session time: 19440 secs
        session terminat cause: Not terminated yet
```

show auth-mac statistics interface

This command shows the authentication statistics for the specified interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

Syntax

```
show auth-mac statistics [interface <interface-list>]
```

Parameter	Description
`interface`	Specify ports to show.
`<interface-list>`	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.

Mode Privileged Exec

Example To display MAC authentication statistics for `port1.0.12`, enter the command:

```
awplus# show auth-mac statistics interface port1.0.12
```

Related Commands show dot1x interface

show auth-mac supplicant

This command shows the supplicant (client device) state when MAC authentication is configured for the switch. This command shows a summary when the optional brief parameter is used.

Syntax `show auth-mac supplicant [<macadd>] [brief]`

Parameter	Description
<macadd>	Mac (hardware) address of the Supplicant Entry format is HHHH.HHHH.HHHH (hexadecimal).
`brief`	Brief summary of the Supplicant state.

Mode Privileged Exec

Example To display the MAC authenticated supplicant for MAC address `00d0.59ab.7037`, enter the command:

```
awplus# show auth-mac supplicant 00d0.59ab.7037
```

show auth-mac supplicant interface

This command shows the supplicant (client device) state for the MAC authenticated interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port. This command shows a summary when the optional brief parameter is used.

Syntax

```
show auth-mac supplicant [interface <interface-list>] [brief]
```

Parameter	Description
`interface`	Specify ports to show.
`<interface-list>`	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.
`brief`	Brief summary of the supplicant state.

Mode Privileged Exec

Examples To display the MAC authenticated supplicant on the interface `port1.0.12`, enter the command:

```
awplus# show auth-mac supplicant interface port1.0.12
```

To display brief summary output for the MAC authenticated supplicant, enter the command:

```
awplus# show auth-mac supplicant brief
```

show auth-web

This command shows authentication information for Web-based authentication.

Syntax

```
show auth-web [all]
```

Parameter	Description
`all`	Display all authentication information for each authenticated interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port, available on the switch.

Mode Privileged Exec

Example To display all Web authentication information, enter the command:

```
awplus# show auth-web all
```

Output Figure 65-4: Example output from the **show auth-web** command

```
802.1X Port-Based Authentication Disabled
MAC-based Port Authentication Disabled
WEB-based Port Authentication Enabled
```

Related Commands

show dot1x
show auth-mac

show auth-web diagnostics

This command shows Web authentication diagnostics, optionally for the specified interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

If no interface is specified then authentication diagnostics are shown for all interfaces.

Syntax

```
show auth-web diagnostics [interface <interface-list>]
```

Parameter	Description
`interface`	Specify ports to show.
<interface-list>	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.

Mode Privileged Exec

Example To display authentication diagnostics for `port1.0.12`, enter the command:

```
awplus# show auth-web diagnostics interface port1.0.12
```

Output Figure 65-5: Example output from the **show auth-web diagnostics** command

```
Authentication Diagnostics for interface port1.0.12
    Supplicant address: 00d0.59ab.7037
        authEnterConnecting: 2
        authEaplogoffWhileConnecting: 1
        authEnterAuthenticating: 2
        authSuccessWhileAuthenticating: 1
        authTimeoutWhileAuthenticating: 1
        authFailWhileAuthenticating: 0
        authEapstartWhileAuthenticating: 0
        authEaplogoggWhileAuthenticating: 0
        authReauthsWhileAuthenticated: 0
        authEapstartWhileAuthenticated: 0
        authEaplogoffWhileAuthenticated: 0
        BackendResponses: 2
        BackendAccessChallenges: 1
        BackendOtherrequestToSupplicant: 3
        BackendAuthSuccess: 1
```

Related Commands show dot1x interface

show auth-web interface

This command shows the status for Web based authentication on the specified interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

Use the optional diagnostics parameter to show authentication diagnostics for the specified interface. Use the optional sessionstatistics parameter to show authentication session statistics for the specified interface. Use the optional statistics parameter to show authentication diagnostics for the specified interface. Use the optional supplicant (client device) parameter to show the supplicant state for the specified interface.

Syntax

```
show auth-web interface <interface-list>
   [diagnostics|sessionstatistics|statistics|supplicant [brief]]
```

Parameter	Description
<interface-list>	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.
`diagnostics`	Diagnostics.
`sessionstatistics`	Session statistics.
`statistics`	Statistics.
`supplicant`	Supplicant (client device).
`brief`	Brief summary of supplicant state.

Mode Privileged Exec

Example To display the Web based authentication status for `port1.0.12`, enter the command:

```
awplus# show auth-web interface port1.0.2
```

```
% Port-Control not configured on port1.0.2
```

To display Web authentication diagnostics for `port1.0.12`, enter the command:

```
awplus# show auth-web interface port1.0.12 diagnostics
```

```
Authentication Diagnostics for interface port1.0.2
    Supplicant address: 00d0.59ab.7037
        authEnterConnecting: 2
        authEaplogoffWhileConnecting: 1
        authEnterAuthenticating: 2
        authSuccessWhileAuthenticating: 1
        authTimeoutWhileAuthenticating: 1
        authFailWhileAuthenticating: 0
        authEapstartWhileAuthenticating: 0
        authEaplogoggWhileAuthenticating: 0
        authReauthsWhileAuthenticated: 0
        authEapstartWhileAuthenticated: 0
        authEaplogoffWhileAuthenticated: 0
        BackendResponses: 2
        BackendAccessChallenges: 1
        BackendOtherrequestToSupplicant: 3
        BackendAuthSuccess: 1
```

To display Web authentication session statistics for `port1.0.12`, enter the command:

```
awplus# show auth-web interface port1.0.12 sessionstatistics
```

```
Authentication session statistics for interface port1.0.12
    session user name: manager
        session authentication method: Remote server
        session time: 19440 secs
        session terminat cause: Not terminated yet
```

To display Web authentication statistics for `port1.0.12`, enter the command:

```
awplus# show auth-web statistics interface port1.0.12
```

To display the Web authenticated supplicant on interface `port1.0.12`, enter the command:

```
awplus# show auth-web interface port1.0.12 supplicant
```

Related Commands

show auth-web diagnostics
show dot1x sessionstatistics
show dot1x statistics interface
show dot1x supplicant interface

show auth-web sessionstatistics

This command shows authentication session statistics for the specified interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

Syntax `show auth-web sessionstatistics [interface <interface-list>]`

Parameter	Description
`interface`	Specify ports to show.
<interface-list>	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.

Mode Privileged Exec

Example To display authentication statistics for `port1.0.12`, enter the command:

```
awplus# show auth-web sessionstatistics interface port1.0.12
```

Output Figure 65-6: Example output from the **show auth-web sessionstatistics** command

```
Authentication session statistics for interface port1.0.12
    session user name: manager
        session authentication method: Remote server
        session time: 19440 secs
        session terminat cause: Not terminated yet
```

show auth-web statistics interface

This command shows the authentication statistics for the specified interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port.

Syntax `show auth-web statistics interface <interface-list>`

Parameter	Description
<interface-list>	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.

Mode Privileged Exec

Example To display Web authentication statistics for `port1.0.12`, enter the command:

```
awplus# show dot1x statistics interface port1.0.12
```

Related Commands show dot1x interface

show auth-web supplicant

This command shows the supplicant (client device) state when Web authentication is configured for the switch. This command shows a summary when the optional brief parameter is used.

Syntax `show auth-web supplicant [<macadd>] [brief]`

Parameter	Description
<macadd>	Mac (hardware) address of the supplicant Entry format is HHHH.HHHH.HHHH (hexadecimal).
`brief`	Brief summary of the supplicant state.

Mode Privileged Exec

Examples To display Web authenticated supplicant information on the switch, enter the command:

```
awplus# show auth-web supplicant
```

To display brief summary output for the Web authenticated supplicant on the switch, enter the command:

```
awplus# show auth-web supplicant brief
```

show auth-web supplicant interface

This command shows the supplicant (client device) state for the Web authenticated interface, which may be a static channel (or static aggregator) or a dynamic (or LACP) channel group or a switch port. This command shows a summary when the optional brief parameter is used.

Syntax

```
show auth-web supplicant interface <interface-list> [brief]
```

Parameter	Description
<interface-list>	The interfaces or ports to configure. An interface-list can be: ■ an interface (e.g. `vlan2`), a switch port (e.g. `port1.0.12`), a static channel group (e.g. `sa3`) or a dynamic (LACP) channel group (e.g. `po4`) ■ a continuous range of interfaces, ports, static channel groups or dynamic (LACP) channel groups separated by a hyphen; e.g. `vlan2-8`, or `port1.0.1-1.0.24`, or `sa2-4`, or `po1-3` ■ a comma-separated list of the above; e.g. `port1.0.1,port1.0.8-1.0.24`. Do not mix interface types in a list The specified interfaces must exist.
`brief`	Brief summary of the supplicant state.

Mode Privileged Exec

Examples To display the Web authenticated supplicant on the interface `port1.0.12`, enter the command:

```
awplus# show auth-web supplicant interface port1.0.12
```

To display brief summary output for the Web authenticated supplicant, enter the command:

```
awplus# show auth-web supplicant brief
```

show auth-web-server

This command shows the web authentication server configuration and status on the switch.

Syntax `show auth-web-server`

Mode Privileged Exec

Example To display web authentication server configuration and status, enter the command:

```
awplus# show auth-web-server
```

Output Figure 65-7: Example output from the **show auth-web-server** command

```
Web authentication server
    Server status: enabled
    Server address: -
    HTTP Port No: 80
    Security: enabled
    Certification: default
    SSL Port No: 443
    Redirect URL:
    HTTP Redirect: disabled
    Session keep: disabled
    PingPolling: disable
    PingInterval: 30
    Timeout: 1
    FailCount: 5
    ReauthFresh: disabled
```

Related Commands
auth-web-server http-redirect
auth-web-server ipaddress
auth-web-server port
auth-web-server redirect-url
auth-web-server session-keep
auth-web-server ssl
auth-web-server sslport

Chapter 66: AAA Introduction and Configuration

AAA Introduction 66.2
- Available functions and server types 66.2
- Server Groups and Method Lists 66.3

Configuring AAA Login Authentication 66.5
- AAA Configuration Tasks 66.5

Sample Authentication Configurations 66.7
- Sample 802.1X Authentication Configuration 66.7
- Sample MAC Authentication Configuration 66.8
- Sample Web-Authentication Configuration 66.9
- Sample Tri-Authentication Configuration 66.10

AAA Introduction

AAA is the collective title for the three related functions of Authentication, Authorization and Accounting. These function can be applied in a variety of methods with a variety of servers. The purpose of the AAA commands is to map instances of the AAA functions to sets of servers.

The Authentication function can be performed in multiple contexts, such as authentication of users logging in at a console, or 802.1x authentication of devices connecting to Ethernet ports.

For each of these contexts, you may want to use different sets of servers for examining the proffered authentication credentials and deciding if they are valid. AAA Authentication commands enable you to specify which servers will be used for different types of authentication.

Available functions and server types

Authentication, Authorization and Accounting functions are available.

Authentication is performed in the following contexts:

- Login authentication of user shell sessions on the console port, and via telnet/SSH
- Enable password authentication for user shell sessions on the console port, and via telnet/SSH (TACACS+ only)
- 802.1x authentication of devices connecting to switch ports
- MAC authentication of devices connecting to switch ports
- Web-based authentication of devices connecting to switch ports

Authorization is performed in the following context:

- TACACS+ login authentication. Note that with the AlliedWare Plus TACACS+ implementation:
  - « authorization cannot be performed independently of the login authentication process
  - « authorization will not be attempted if enable password authentication is configured
  - « there are no authorization commands available

Accounting is performed in the following contexts:

- Accounting of console, telnet, and SSH login sessions
- Accounting of commands executed within user shell sessions (TACACS+ only)
- Accounting of 802.1x-authenticated connections
- Accounting of MAC-authenticated connections
- Accounting of Web-authenticated connections

The three types of servers that can be used are:

- Local user database
- RADIUS servers
- TACACS+ servers

Server Groups and Method Lists

There are two constructs that underlie the structure of the AAA commands:

- Server groups are lists of RADIUS servers
- Method Lists are lists of server types

Server Groups

A server group is defined by the command aaa group server. This command puts you into Server Group configuration mode. Once in that mode you can add servers to the group by using the command server auth-port.

Any number of servers can be added to a group. Typically, you will add servers which have already been configured by the command radius-server host. If you add a server that has not yet been configured by the command radius-server host, you will receive a warning that the server has not yet been configured, but the command will be accepted.

There is one server group that is always present on the switch by default that cannot be removed. It is the group simply named radius that comprises all servers that have been configured using the command radius-server host. As soon as a server is configured by the command radius-server host, it is automatically a member of the server group radius and cannot be removed from it.

Method Lists

A method list defines the set of server types that you want to be used for authenticating a user/device, and the order in which you want the server types to be used.

- You may want the usernames proffered for logging in at the console to be checked for in the local user database. You can create a server list that specifies local.
- You may want to check the TACACS+ servers first, and resort to the local user database if none of the TACACS+ servers respond. You can create a server list that specifies group tacacs+ first, followed by local.
- You may want to check the RADIUS servers first, and resort to the local user database if none of the RADIUS servers respond. You can create a server list that specifies group radius first, followed by local.

A method list defines the servers where authentication requests are sent. The first server listed is used to authenticate users; if that server fails then the next authentication server type in the method list is selected. This process continues until there is a successful authentication or until all server types fail.

When a user attempts to log in, the switch sends an authentication request to the first authentication server in the method list. If the first server in the list is reachable and it contains a username and password matching the authentication request, the user is authenticated and the login succeeds. If the authentication server denies the authentication request because of an incorrect username or password, the user login fails. If the first server in the method list is unreachable, the switch sends the request to the next server in the list, and so on.

For example, if the method list specifies `group tacacs+ local`, and a user attempts to log in with a password that does not match a user entry in the first TACACS+ server, if this TACACS+ server denies the authentication request, then the switch does not try any other TACACS+ servers not the local user database; the user login fails.

Default Method Lists

For every authentication or accounting type, it is always possible to define a method list called default. For most of the authentication and accounting types, the only method list that can be defined is default.

As soon as the default method list is defined for a given authentication or accounting type, it is automatically applied as the method list to be used for any instance of that type of authentication or accounting, except for instances to which another named method list has been specifically applied.

Configuring AAA Login Authentication

To configure AAA authentication, create default or a named method list for different authentication types. In the case of login authentication, the named method lists are then applied to consoles or VTY lines.

AAA Configuration Tasks

To define how a given accounting or authentication type will be applied to a given port or line:

- either create a server group using the aaa group server command (RADIUS only),
- or create a method list for the authentication or accounting type as required,
- then apply that method list to the port or line as required.

Step 1: Define a group of RADIUS Servers:

Create a server group using the aaa group server command.

To create a RADIUS server group named `GROUP1` with hosts `192.168.1.1`, `192.168.2.1` and `192.168.3.1`, use the commands:

```
awplus(config)# aaa group server radius GROUP1
awplus(config-sg)# server 192.168.1.1 auth-port 1812 acct-port 1813
awplus(config-sg)# server 192.168.2.1 auth-port 1812 acct-port 1813
awplus(config-sg)# server 192.168.3.1 auth-port 1812 acct-port 1813
```

Step 2: Specify the login authentication or accounting Method List:

Create a method list for the authentication (aaa authentication login) or accounting (aaa accounting login) type as required.

To configure a user login authentication method list called `USERS` to use first all available RADIUS servers for user login authentication and then the local user database, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa authentication login default group radius local
```

To configure RADIUS accounting for login shell sessions, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa accounting login default start-stop group radius
```

To configure a user login authentication method list called `USERS` to use first the TACACS+ servers for user login authentication and then the local user database, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa authentication login USERS group tacacs+
local
```

Step 3: Apply Method List to Interface Port or Line:

Apply that method list to the port or line as required.

```
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# login authentication USERS
```

For most Authentication and Accounting types, the only possible server list is default, and the only server that can be put into it is radius. You will typically use all RADIUS servers, so group radius can be used, rather than having to create a specific user group. Often the configuration of a given Authentication or Accounting type will consist of a single command, the command that defines the default server list, which contains just one server.

AAA 802.1x Authentication Configuration:

AAA 802.1x authentication will typically be configured with the following commands.

To enable 802.1x Authentication globally for all RADIUS servers, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa authentication dot1x default group radius
```

Sample Authentication Configurations

Sample 802.1X Authentication Configuration

See the below sample configuration script for a sample 802.1X authentication configuration. Copy and paste then edit the sample 802.1X authentication configuration in your config file. See the edit command in the Chapter 7, File Management Commands for further information.

Output

Figure 66-1: Sample 802.1X Authentication Configuration

```
!
 radius-server host 127.0.0.1 key awplus-local-radius-server
!
 aaa authentication dot1x default group radius
!
 radius-server local
 server enable
 nas 127.0.0.1 key awplus-local-radius-server
 user guest password guest!
!
 no spanning-tree rstp enable
!
 interface port1.0.1
 switchport
 switchport mode access
 dot1x port-control auto
!
 interface vlan1
 ip address 192.168.1.120/24
!
```

The 802.1X authentication feature needs the aaa authentication dot1x command and the dot1x port-control command configured on an interface. See Chapter 67, AAA Commands and Chapter 63, 802.1X Commands for command information to edit this configuration.

Local RADIUS Server has been configured to use 802.1X authentication in this sample configuration. See the radius-server local and server enable commands in Chapter 73, Local RADIUS Server Commands for command information to edit this sample configuration.

This sample configuration enables 802.1X authentication on interface `vlan1` with IP address `192.168.1.120`. Change the VLAN ID and IP address as required for your configuration.

Sample MAC Authentication Configuration

See the below sample configuration script for a sample MAC authentication configuration. Copy, paste, and edit the sample MAC authentication configuration in the config file. See the edit command in the Chapter 7, File Management Commands for further information.

Output

Figure 66-2: Sample MAC Authentication Configuration

```
!
 radius-server host 127.0.0.1 key awplus-local-radius-server
!
 aaa authentication auth-mac default group radius
!
 radius-server local
 server enable
 nas 127.0.0.1 key awplus-local-radius-server
 user 00-d0-59-ab-70-37 password 00-d0-59-ab-70-37
!
 no spanning-tree rstp enable
!
 interface port1.0.1
 switchport
 switchport mode access
 auth-mac enable
!
 interface vlan1
 ip address 192.168.1.120/24
!
```

The MAC authentication feature needs the aaa authentication auth-mac and the auth-mac enable commands configured on an interface. See Chapter 67, AAA Commands and Chapter 65, Authentication Commands for command information to edit this configuration.

Local RADIUS Server has been configured to use MAC authentication in this sample configuration. See the radius-server local and server enable commands in Chapter 73, Local RADIUS Server Commands for command information to edit this sample configuration.

See the user (RADIUS server) command in Chapter 73, Local RADIUS Server Commands for command information to edit the MAC address of the supplicant for use with local RADIUS server as the RADIUS user name and the user password, as shown in the above configuration.

This configuration enables MAC authentication on `vlan1` with IP address `192.168.1.120`. Change the interface VLAN ID, MAC, and IP addresses as needed in your configuration.

Sample Web-Authentication Configuration

See the below sample configuration script for a sample Web-authentication configuration. Copy, paste, and edit the sample Web-authentication configuration for your config file. See the edit command in the Chapter 7, File Management Commands for further information.

Output

Figure 66-3: Sample Web-Authentication Configuration

```
!
 radius-server host 127.0.0.1 key awplus-local-radius-server
!
 aaa authentication auth-web default group radius
!
 radius-server local
 server enable
 nas 127.0.0.1 key awplus-local-radius-server
 user guest encrypted password
 l+lWcLjLm29bCAXwWRPHXK0PFlsA7gNpR+P7wO4kwQQ=
!
 no spanning-tree rstp enable
!
 interface port1.0.1
 switchport
 switchport mode access
 auth-web enable
!
 interface vlan1
 ip address 192.168.1.120/24
!
```

The Web-authentication feature needs the aaa authentication auth-web and the auth-web enable commands configured on an interface. See Chapter 67, AAA Commands and Chapter 65, Authentication Commands for command information to edit this configuration.

Local RADIUS Server has been configured to use Web-authentication in this sample configuration. See the radius-server local and server enable commands in Chapter 73, Local RADIUS Server Commands for command information to edit this sample configuration.

The above sample Web-authentication configuration requires the user name '`guest`' with password '`guest!`' on IP address `192.168.1.120` from interface `port1.0.1`.

Sample Tri-Authentication Configuration

See the below sample configuration script for a sample tri-authentication configuration that configures 802.1X authentication, MAC authentication, and Web-authentication on the same interface. Copy, paste, and edit the sample tri-authentication configuration for your config file. See the edit command in the Chapter 7, File Management Commands for further information.

Output

Figure 66-4: Sample Tri-Authentication Configuration

```
!
 radius-server host 127.0.0.1 key awplus-local-radius-server
!
 aaa authentication dot1x default group radius
 aaa authentication auth-mac default group radius
 aaa authentication auth-web default group radius
!
 radius-server local
 server enable
 nas 127.0.0.1 key awplus-local-radius-server
 user guest password guest!
 user 00-d0-59-ab-70-37 password 00-d0-59-ab-70-37
!
 no spanning-tree rstp enable
!
 interface port1.0.1
 switchport
 switchport mode access
 dot1x port-control auto
 auth-mac enable
 auth-web enable
!
 interface vlan1
 ip address 192.168.1.120/24
!
```

The 802.1X authentication feature needs the aaa authentication dot1x command and the dot1x port-control command configured on an interface. See Chapter 67, AAA Commands and Chapter 63, 802.1X Commands for command information to edit this configuration.

The MAC authentication feature needs the aaa authentication auth-mac and the auth-mac enable commands configured on an interface. See Chapter 67, AAA Commands and Chapter 65, Authentication Commands for command information to edit this configuration.

The Web-authentication feature needs the aaa authentication auth-web and the auth-web enable commands configured on an interface. See Chapter 67, AAA Commands and Chapter 65, Authentication Commands for command information to edit this configuration.

Local RADIUS Server has been configured to use tri-authentication in this sample configuration. See the radius-server local and server enable commands in Chapter 73, Local RADIUS Server Commands for command information to edit this sample configuration.

This sample tri-authentication configuration requires a user name '`guest`' with password '`guest!`' on IP address `192.168.1.120` from `port1.0.1`. Note this sample also configures 802.1X and MAC authentication on `vlan1` with IP address `192.168.1.120`. Change the interface VLAN ID, MAC and IP address as needed for your configuration.

Note that when tri-authentication is applied to the same interface then the order of execution is MAC authentication first, then 802.1X or Web-authentication, if MAC authentication fails.

Chapter 67: AAA Commands

Command List 67.2
aaa accounting auth-mac default 67.2
aaa accounting auth-web default 67.4
aaa accounting commands 67.6
aaa accounting dot1x 67.8
aaa accounting login 67.10
aaa accounting update 67.12
aaa authentication auth-mac 67.13
aaa authentication auth-web 67.14
aaa authentication dot1x 67.15
aaa authentication enable default group tacacs+ 67.16
aaa authentication enable default local 67.18
aaa authentication login 67.19
aaa group server 67.21
aaa local authentication attempts lockout-time 67.22
aaa local authentication attempts max-fail 67.23
accounting login 67.24
clear aaa local user lockout 67.25
debug aaa 67.26
login authentication 67.27
show debugging aaa 67.28
undebug aaa 67.28

Command List

This chapter provides an alphabetical reference for AAA commands for Authentication, Authorization and Accounting. For more information, see Chapter 66, AAA Introduction and Configuration.

aaa accounting auth-mac default

This command configures a default accounting method list for MAC-based Authentication. The default accounting method list specifies what type of accounting messages are sent and specifies which RADIUS Servers the accounting messages are sent to. The default accounting method list is automatically applied to interfaces with MAC-based Authentication enabled.

Use the no variant of this command to disable AAA accounting for MAC-based Authentication globally.

Syntax

```
aaa accounting auth-mac default {start-stop|stop-only|none}
   group {<group-name>|radius}

no aaa accounting auth-mac default
```

Parameter	Description
`start-stop`	Start and stop records to be sent.
`stop-only`	Stop records to be sent.
`none`	No accounting record to be sent.
`<group-name>`	Server group name.
`radius`	Use all RADIUS servers

Default RADIUS accounting for MAC-based Authentication is disabled by default

Mode Global Configuration

Usage There are two ways to define servers where RADIUS accounting messages are sent:

- group radius : use all RADIUS servers configured by radius-server host command
- group <*group-name*> : use the specified RADIUS server group configured with the aaa group server command

The accounting event to send to the RADIUS server is configured with the following options:

- start-stop : sends a start accounting message at the beginning of a session and a stop accounting message at the end of the session.
- stop-only : sends a stop accounting message at the end of a session.
- none : disables accounting.

Examples To enable RADIUS accounting for MAC-based Authentication, and use all available RADIUS Servers, use the commands:

```
awplus# configure terminal
awplus(config)# aaa accounting auth-mac default start-stop
group radius
```

To disable RADIUS accounting for MAC-based Authentication, use the commands:

```
awplus# configure terminal
awplus(config)# no aaa accounting auth-mac default
```

Related Commands aaa authentication auth-mac

aaa accounting auth-web default

This command configures a default accounting method list for Web-based Port Authentication. The default accounting method list specifies what type of accounting messages are sent and specifies which RADIUS Servers the accounting messages are sent to. The default accounting method list is automatically applied to interfaces with Web-based Authentication enabled.

Use the no variant of this command to disable AAA accounting for Web-based Port Authentication globally.

Syntax

```
aaa accounting auth-web default {start-stop|stop-only|none}
   group {<group-name>|radius}

no aaa accounting auth-web default
```

Parameter	Description
`start-stop`	Start and stop records to be sent.
`stop-only`	Stop records to be sent.
`none`	No accounting record to be sent.
`<group-name>`	Server group name.
`radius`	Use all RADIUS servers.

Default RADIUS accounting for WEB-based Port Authentication is disabled by default.

Mode Global Configuration

Usage There are two ways to define servers where RADIUS accounting messages are sent:

- group radius : use all RADIUS servers configured by radius-server host command
- group <*group-name*> : use the specified RADIUS server group configured with the aaa group server command

Configure the accounting event to be sent to the RADIUS server with the following options:

- start-stop : sends a start accounting message at the beginning of a session and a stop accounting message at the end of the session.
- stop-only : sends a stop accounting message at the end of a session.
- none : disables accounting.

Examples To enable RADIUS accounting for Web-based Authentication, and use all available RADIUS Servers, use the commands:

```
awplus# configure terminal
awplus(config)# aaa accounting auth-web default start-stop
                group radius
```

To disable RADIUS accounting for Web-based Authentication, use the commands:

```
awplus# configure terminal
awplus(config)# no aaa accounting auth-web default
```

Related Commands aaa authentication auth-web

aaa accounting commands

Use this command to configure and enable TACACS+ command accounting. When command accounting is enabled, information about a command entered at a specified privilege level on a device is sent to a TACACS+ server. To account for all commands entered on a device you need to configure command accounting for each discrete privilege level. A command accounting record includes the command as entered for the specified privilege level, the date and time each command execution finished, and the username of the user who executed the command.

This command creates a default method list that is applied to every console and vty line. The stop-only parameter indicates that an accounting message is sent to the TACACS+ server when a command has stopped executing.

Note that up to four TACACS+ servers can be configured for accounting. The servers are checked for reachability in the order they are configured and only the first reachable server is used. If no server is found the accounting message is dropped.

Use the no variant of this command to disable command accounting.

Syntax

```
aaa accounting commands <1-15> default stop-only group tacacs+

no aaa accounting commands <1-15> default
```

Parameter	Description
<1-15>	The privilege level, in the range 1 to 15.

Default TACACS+ command accounting is disabled by default.

Mode Global Configuration

Usage When command accounting is enabled, the command as entered is included in the accounting packets sent to the TACACS+ accounting server.

You cannot enable command accounting if a trigger is configured. An error message is displayed if you attempt to enable command accounting and a trigger is configured.

The show tech-support command runs a number of commands and each command is accounted separately.

When the copy <*filename*> running-config command is executed all the commands of a configuration file copied into the running-config are accounted separately.

Examples To configure command accounting for privilege level 15 commands, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa accounting commands 15 default stop-only
group tacacs+
```

To disable command accounting for privilege level 15 commands, use the following commands:

```
awplus# configure terminal
awplus(config)# no aaa accounting commands 15 default
```

Related Commands

aaa authentication login
aaa accounting login
accounting login
tacacs-server host

aaa accounting dot1x

This command configures the default accounting method list for IEEE 802.1x-based Authentication. The default accounting method list specifies what type of accounting messages are sent and specifies which RADIUS Servers the accounting messages are sent to. The default accounting method list is automatically applied to interfaces with IEEE 802.1x-based Authentication enabled.

Use the no variant of this command to disable AAA accounting for 802.1x-based Port Authentication globally.

Syntax

```
aaa accounting dot1x default {start-stop|stop-only|none}
   group {<group-name>|radius}

no aaa accounting dot1x default
```

Parameter	Description
`start-stop`	Start and stop records to be sent.
`stop-only`	Stop records to be sent.
`none`	No accounting record to be sent.
`<group-name>`	Server group name.
`radius`	Use all RADIUS servers.

Default RADIUS accounting for 802.1X-based Port Authentication is disabled by default. (There is no default server set by default).

Mode Global Configuration

Usage There are two ways to define servers where RADIUS accounting messages will be sent:

- group radius : use all RADIUS servers configured by radius-server host command
- group <*group-name*> : use the specified RADIUS server group configured with the aaa group server command

The accounting event to send to the RADIUS server is configured by the following options:

- start-stop : sends a start accounting message at the beginning of a session and a stop accounting message at the end of the session.
- stop-only : sends a stop accounting message at the end of a session.
- none : disables accounting.

Example To enable RADIUS accounting for 802.1x-based Authentication, and use all available RADIUS Servers, use the commands:

```
awplus# configure terminal
awplus(config)# aaa accounting dot1x default start-stop group
radius
```

To disable RADIUS accounting for 802.1x-based Authentication, use the commands:

```
awplus# configure terminal
awplus(config)# no aaa accounting dot1x default
```

Related Commands

aaa accounting update
aaa authentication dot1x
aaa group server
dot1x port-control
radius-server host

aaa accounting login

This command configures RADIUS and TACACS+ accounting for login shell sessions. The specified method list name can be used by the accounting login command in the Line Configuration mode. If the default parameter is specified, then this creates a default method list that is applied to every console and vty line, unless another accounting method list is applied on that line.

Note that unlimited RADIUS servers and up to four TACACS+ servers can be configured and consulted for accounting. The first server configured is regarded as the primary server and if the primary server fails then the backup servers are consulted in turn. A backup server is consulted if the primary server fails, i.e is unreachable.

Use the no variant of this command to remove an accounting method list for login shell sessions configured by an aaa accounting login command. If the method list being deleted is already applied to a console or vty line, accounting on that line will be disabled. If the default method list name is removed by this command, it will disable accounting on every line that has the default accounting configuration.

Syntax

```
aaa accounting login {default|<list-name>}
   {start-stop|stop-only|none} {group {radius|tacacs+|<group-name>}}

no aaa accounting login {default|<list-name>}
```

Parameter	Description
`default`	Default accounting method list.
`<list-name>`	Named accounting method list.
`start-stop`	Start and stop records to be sent.
`stop-only`	Stop records to be sent.
`none`	No accounting record to be sent.
`group`	Specify the servers or server group where accounting packets are sent.
`radius`	Use all RADIUS servers configured by the radius-server host command on page 69.6.
`tacacs+`	Use all TACACS+ servers configured by the tacacs-server host command.
`<group-name>`	Use the specified RADIUS server group, as configured by the aaa group server command.

Default Accounting for login shell sessions is disabled by default.

Mode Global Configuration

Usage This command enables you to define a named accounting method list. The items that you define in the accounting options are:

- the types of accounting packets that will be sent
- the set of servers to which the accounting packets will be sent

You can define a default method list with the name `default` and any number of other named method lists. The `<list-name>` for any method list that you define can then be used as the `<list-name>` parameter in the accounting login command available from Line Configuration mode.

If the method list name already exists, the command will replace the existing configuration with the new one.

There are two ways to define servers where RADIUS accounting messages are sent:

- group radius : use all RADIUS servers configured by radius-server host command
- group **<*group-name*>** : use the specified RADIUS server group configured with the aaa group server command

There is one way to define servers where TACACS+ accounting messages are sent:

- group tacacs+ : use all TACACS+ servers configured by tacacs-server host command

The accounting event to send to the RADIUS or TACACS+ server is configured with the following options:

- start-stop : sends a start accounting message at the beginning of a session and a stop accounting message at the end of the session.
- stop-only : sends a stop accounting message at the end of a session.
- none : disables accounting.

Examples To configure RADIUS accounting for login shell sessions, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa accounting login default start-stop group
radius
```

To configure TACACS+ accounting for login shell sessions, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa accounting login default start-stop group
tacacs+
```

To reset the configuration of the default accounting list, use the following commands:

```
awplus# configure terminal
awplus(config)#  no aaa accounting login default
```

Related Commands
aaa accounting commands
aaa authentication login
aaa accounting login
aaa accounting update
accounting login
radius-server host
tacacs-server host

aaa accounting update

This command enables periodic accounting reporting to either the RADIUS or TACACS+ accounting server(s) wherever login accounting has been configured.

Note that unlimited RADIUS servers and up to four TACACS+ servers can be configured and consulted for accounting. The first server configured is regarded as the primary server and if the primary server fails then the backup servers are consulted in turn. A backup server is consulted if the primary server fails, i.e is unreachable.

Use the no variant of this command to disable periodic accounting reporting to the accounting server(s).

Syntax

```
aaa accounting update [periodic <1-65535>]
no aaa accounting update
```

Parameter	Description
`periodic`	Send accounting records periodically.
<1-65535>	The interval to send accounting updates (in minutes). The default is 30 minutes.

Default Periodic accounting update is disabled by default.

Mode Global Configuration

Usage Use this command to enable the device to send periodic AAA login accounting reports to the accounting server. When periodic accounting report is enabled, interim accounting records are sent according to the interval specified by the periodic parameter. The accounting updates are start messages.

If the no variant of this command is used to disable periodic accounting reporting, any interval specified by the periodic parameter is reset to the default of 30 minutes when accounting reporting is reenabled, unless this interval is specified.

Example To configure the switch to send period accounting updates every 30 minutes, the default period, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa accounting update
```

To configure the switch to send period accounting updates every 10 minutes, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa accounting update periodic 10
```

To disable periodic accounting update wherever accounting has been configured, use the following commands:

```
awplus# configure terminal
awplus(config)# no aaa accounting update
```

Related Commands
aaa accounting auth-mac default
aaa accounting auth-web default
aaa accounting dot1x
aaa accounting login

aaa authentication auth-mac

This command enables MAC-based Port Authentication globally and allows you to specify an authentication method list. It is automatically applied to every interface running MAC-based Port Authentication.

Use the no variant of this command to globally disable MAC-based Port Authentication.

Syntax

```
aaa authentication auth-mac default group {<group-name>|radius}
no aaa authentication auth-mac default
```

Parameter	Description
<group-name>	Server group name.
radius	Use all RADIUS servers.

Default MAC-based Port Authentication is disabled by default.

Mode Global Configuration

Usage There are two ways to define servers where RADIUS accounting messages are sent:

- group radius : use all RADIUS servers configured by radius-server host command
- group **<*group-name*>** : use the specified RADIUS server group configured with the aaa group server command

All configured RADIUS Servers are automatically members of the server group radius. If a server is added to a named group **<*group-name*>**, it also remains a member of the group radius.

Example To enable MAC-based Port Authentication globally for all RADIUS servers, and use all available RADIUS servers, use the commands:

```
awplus# configure terminal
awplus(config)# aaa authentication auth-mac default group
radius
```

To disable MAC-based Port Authentication, use the commands:

```
awplus# configure terminal
awplus(config)# no aaa authentication auth-mac default
```

Related Commands
aaa accounting auth-mac default
auth-mac enable

aaa authentication auth-web

This command enables Web-based Port Authentication globally and allows you to enable an authentication method list (in this case, a list of RADIUS Servers). It is automatically applied to every interface running Web-based Port Authentication.

Use the no variant of this command to globally disable Web-based Port Authentication.

Syntax

```
aaa authentication auth-web default group {<group-name>|radius}
no aaa authentication auth-web default
```

Parameter	Description
<group-name>	Server group name.
radius	Use all RADIUS servers.

Default Web-based Port Authentication is disabled by default.

Mode Global Configuration

Usage There are two ways to define servers where RADIUS accounting messages are sent:

- group radius : use all RADIUS servers configured by radius-server host command
- group ***<group-name>*** : use the specified RADIUS server group configured with the aaa group server command

Example To enable Web-based Port Authentication globally for all RADIUS servers, and use all available RADIUS servers, use the commands:

```
awplus# configure terminal
awplus(config)# aaa authentication auth-web default group
radius
```

To disable Web-based Port Authentication, use the commands:

```
awplus# configure terminal
awplus(config)# no aaa authentication auth-web default
```

Related Commands aaa accounting auth-web default
auth-mac enable

aaa authentication dot1x

This command enables 802.1X-based Port Authentication globally and allows you to enable an authentication method list. It is automatically applied to every interface running 802.1X-based Port Authentication.

Use the no variant of this command to globally disable 802.1X-based Port Authentication.

Syntax

```
aaa authentication dot1x default group {<group-name>|radius}
no aaa authentication dot1x default
```

Parameter	Description
`radius`	Use all RADIUS servers.
<group-name>	Server group name.

Default 802.1x-based Port Authentication is disabled by default.

Mode Global Configuration

Usage Use this command to specify the default method list to use for authentication on all switch ports with 802.1X enabled. Use the no variant of this command to reset the default authentication method list for 802.1X, to its default, that is, to use the group radius, containing all RADIUS servers configured by the radius-server host command.

There are two ways to define servers where RADIUS accounting messages are sent:

- group radius : use all RADIUS servers configured by radius-server host command
- group **<*group-name*>** : use the specified RADIUS server group configured with the aaa group server command

Example To enable 802.1X-based Port Authentication globally with all RADIUS servers, and use all available RADIUS servers, use the command:

```
awplus# configure terminal
awplus(config)# aaa authentication dot1x default group radius
```

To disable 802.1X-based Port Authentication, use the command:

```
awplus# configure terminal
awplus(config)# no aaa authentication dot1x default
```

Related Commands
aaa accounting dot1x
aaa group server
dot1x port-control
radius-server host

aaa authentication enable default group tacacs+

This command enables AAA authentication to determine the privilege level a user can access for passwords authenticated against the TACACS+ server.

Use the no variant of this command to disable privilege level authentication.

Syntax

```
aaa authentication enable default group tacacs+ [local] [none]
no aaa authentication enable default
```

Parameter	Description
`local`	Use the locally configured enable password (enable password command) for authentication.
`none`	No authentication.

Default Local privilege level authentication is enabled by default (aaa authentication enable default local command).

Mode Global Configuration

Usage A user is configured on a TACACS+ server with a maximum privilege level. When they enter the enable (Privileged Exec mode) command they are prompted for an enable password which is authenticated against the TACACS+ server. If the password is correct and the specified privilege level is equal to or less than the users maximum privilege level, then they are granted access to that level. If the user attempts to access a privilege level that is higher than their maximum configured privilege level, then the authentication session will fail and they will remain at their current privilege level.

Note If both local and none are specified, you must always specify local first.

If the TACACS+ server goes offline, or is not reachable during enable password authentication, and command level authentication is configured as:

- aaa authentication enable default group tacacs+
  then the user is never granted access to Privileged Exec mode.
- aaa authentication enable default group tacacs+ local
  then the user is authenticated using the locally configured enable password, which if entered correctly grants the user access to Privileged Exec mode. If no enable password is locally configured (enable password command), then the enable authentication will fail until the TACACS+ server becomes available again.
- aaa authentication enable default group tacacs+ none
  then the user is granted access to Privileged Exec mode with no authentication. This is true even if a locally configured enable password is configured.
- aaa authentication enable default group tacacs+ local none
  then the user is authenticated using the locally configured enable password. If no enable password is locally configured, then the enable authentication will grant access to Privileged Exec mode with no authentication.

If the password for the user is not successfully authenticated by the server, then the user is again prompted for an enable password when they enter enable via the CLI.

Example To enable a privilege level authentication method that will not allow the user to access Privileged Exec mode if the TACACS+ server goes offline, or is not reachable during enable password authentication, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa authentication enable default group tacacs+
```

To enable a privilege level authentication method that will allow the user to access Privileged Exec mode if the TACACS+ server goes offline, or is not reachable during enable password authentication, and a locally configured enable password is configured, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa authentication enable default group tacacs+
local
```

To disable privilege level authentication, use the following commands:

```
awplus# configure terminal
awplus(config)# no aaa authentication enable default
```

Related Commands
aaa authentication login
aaa authentication enable default local
enable (Privileged Exec mode)
enable password
enable secret
tacacs-server host

aaa authentication enable default local

This command enables AAA authentication to determine the privilege level a user can access for passwords authenticated locally.

Syntax `aaa authentication enable default local`

Default Local privilege level authentication is enabled by default.

Mode Global Configuration

Usage The privilege level configured for a particular user in the local user database is the privilege threshold above which the user is prompted for an enable (Privileged Exec mode) command.

Example To enable local privilege level authentication command, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa authentication enable default local
```

To disable privilege level authentication, use the following commands:

```
awplus# configure terminal
awplus(config)# no aaa authentication enable default
```

Related Commands
aaa authentication enable default group tacacs+
aaa authentication login
enable (Privileged Exec mode)
enable password
enable secret
tacacs-server host

aaa authentication login

Use this command to create an ordered list of methods to use to authenticate user login, or to replace an existing method list with the same name. Specify one or more of the options local or group, in the order you want them to be applied. If the default method list name is specified, it is applied to every console and VTY line immediately unless another method list is applied to that line by the login authentication command. To apply a non-default method list, you must also use the login authentication command.

Use the no variant of this command to remove an authentication method list for user login. The specified method list name is deleted from the configuration. If the method list name has been applied to any console or VTY line, user login authentication on that line will fail.

Note that the no aaa authentication login default command does not remove the default method list. This will return the default method list to its default state (local is the default).

Syntax

```
aaa authentication login {default|<list-name>}
   {[local] [group {radius|tacacs+|<group-name>}]}

no aaa authentication login {default|<list-name>}
```

Parameter	Description
`default`	Set the default authentication server for user login.
`<list-name>`	Name of authentication server.
`local`	Use the local username database.
`group`	Use server group.
`radius`	Use all RADIUS servers configured by the radius-server host command on page 69.6.
`tacacs+`	Use all TACACS+ servers configured by the tacacs-server host command.
`<group-name>`	Use the specified RADIUS server group, as configured by the aaa group server command.

Default If the default server is not configured using this command, user login authentication uses the local user database only.

If the default method list name is specified, it is applied to every console and VTY line immediately unless a named method list server is applied to that line by the login authentication command.

local is the default state for the default method list unless a named method list is applied to that line by the login authentication command. Reset to the default method list using the no aaa authentication login default command.

Mode Global Configuration

Usage When a user attempts to log in, the switch sends an authentication request to the first authentication server in the method list. If the first server in the list is reachable and it contains a username and password matching the authentication request, the user is authenticated and the login succeeds. If the authentication server denies the authentication request because of an incorrect username or password, the user login fails. If the first server in the method list is unreachable, the switch sends the request to the next server in the list, and so on.

For example, if the method list specifies group tacacs+ local, and a user attempts to log in with a password that does not match a user entry in the first TACACS+ server, if this TACACS+ server denies the authentication request, then the switch does not try any other TACACS+ servers not the local user database; the user login fails.

Examples To configure the default authentication method list for user login to use first all available RADIUS servers for user login authentication and then the local user database, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa authentication login default group radius
local
```

To configure a user login authentication method list called `USERS` to use first the RADIUS server group `RAD_GROUP1` for user login authentication and then the local user database, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa authentication login USERS group
RAD_GROUP1 local
```

To configure a user login authentication method list called `USERS` to use first the TACACS+ servers for user login authentication and then the local user database, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa authentication login USERS group tacacs+
local
```

To return to the default method list (local is the default server), use the following commands:

```
awplus# configure terminal
awplus(config)# no aaa authentication login default
```

To delete an existing authentication method list `USERS` created for user login authentication, use the following commands:

```
awplus# configure terminal
awplus(config)# no aaa authentication login USERS
```

Related Commands aaa accounting commands
aaa authentication enable default group tacacs+
login authentication

aaa group server

This command configures a RADIUS server group. A server group can be used to specify a subset of RADIUS servers in aaa commands. The group name radius is predefined, which includes all RADIUS servers configured by the radius-server host command.

RADIUS servers are added to a server group using the server command. Each RADIUS server should be configured using the radius-server host command.

Use the no variant of this command to remove an existing RADIUS server group.

Syntax

```
aaa group server radius <group-name>
no aaa group server radius <group-name>
```

Parameter	Description
<group-name>	Server group name.

Mode Global Configuration

Usage Use this command to create an AAA group of RADIUS servers, and to enter Server Group Configuration mode, in which you can add servers to the group. Use a server group to specify a subset of RADIUS servers in AAA commands. Each RADIUS server must be configured by the radius-server host command. To add RADIUS servers to a server group, use the server command.

Example To create a RADIUS server group named `GROUP1` with hosts `192.168.1.1`, `192.168.2.1` and `192.168.3.1`, use the commands:

```
awplus(config)# aaa group server radius GROUP1
awplus(config-sg)# server 192.168.1.1 auth-port 1812 acct-
port 1813
awplus(config-sg)# server 192.168.2.1 auth-port 1812 acct-
port 1813
awplus(config-sg)# server 192.168.3.1 auth-port 1812 acct-
port 1813
```

To remove a RADIUS server group named `GROUP1` from the configuration, use the command:

```
awplus(config)# no aaa group server radius GROUP1
```

Related Commands

aaa accounting auth-mac default
aaa accounting auth-web default
aaa accounting dot1x
aaa accounting login
aaa authentication auth-mac
aaa authentication auth-web
aaa authentication dot1x
aaa authentication login
radius-server host
server (Server Group)

aaa local authentication attempts lockout-time

This command configures the duration of the user lockout period.

Use the no variant of this command to restore the duration of the user lockout period to its default of 300 seconds (5 minutes).

Syntax

```
aaa local authentication attempts lockout-time <lockout-tiime>
no aaa local authentication attempts lockout-time
```

Parameter	Description
<lockout-time>	<0-10000>. Time in seconds to lockout the user.

Mode Global Configuration

Default The default for the lockout-time is 300 seconds (5 minutes).

Usage While locked out all attempts to login with the locked account will fail. The lockout can be manually cleared by another privileged account using the clear aaa local user lockout command.

Example To configure the lockout period to 10 minutes (600 seconds), use the commands:

```
awplus# configure terminal
awplus(config)# aaa local authentication attempts lockout-time
600
```

To restore the default lockout period of 5 minutes (300 seconds), use the commands:

```
awplus# configure terminal
awplus(config)# no aaa local authentication attempts
lockout-time
```

Related Commands aaa local authentication attempts max-fail

aaa local authentication attempts max-fail

This command configures the maximum number of failed login attempts before a user account is locked out. Every time a login attempt fails the failed login counter is incremented.

Use the no variant of this command to restore the maximum number of failed login attempts to the default setting (5 failed login attempts).

Syntax

```
aaa local authentication attempts max-fail <failed-logins>
no aaa local authentication attempts max-fail
```

Parameter	Description
<failed-logins>	<1-32>. Number of login failures allowed before locking out a user.

Mode Global Configuration

Default The default for the maximum number of failed login attempts is 5 failed login attempts.

Usage When the failed login counter reaches the limit configured by this command that user account is locked out for a specified duration configured by the aaa local authentication attempts lockout-time command.

When a successful login occurs the failed login counter is reset to 0. When a user account is locked out all attempts to login using that user account will fail.

Example To configure the number of login failures that will lock out a user account to 2 login attempts, use the commands:

```
awplus# configure terminal
awplus(config)# aaa local authentication attempts max-fail 2
```

To restore the number of login failures that will lock out a user account to the default number of login attempts (5 login attempts), use the commands:

```
awplus# configure terminal
awplus(config)# no aaa local authentication attempts max-fail
```

Related Commands aaa local authentication attempts lockout-time
clear aaa local user lockout

accounting login

This command applies a login accounting method list to console or vty lines for user login. When login accounting is enabled using the aaa accounting login command, logging events generate an accounting record to the accounting server configured using aaa accounting login.

The accounting method list must be configured first using the aaa accounting login command. If an accounting method list is specified that has not been created by the aaa accounting login command then accounting will be disabled on the specified lines.

The no variant of this command resets AAA (Authentication, Authorization, Accounting) Accounting applied to console or vty lines for local or remote login. default login accounting is applied after issuing the no accounting login command. Accounting is disabled with default.

Syntax

```
accounting login {default|<list-name>}
no accounting login
```

Parameter	Description
`default`	Default accounting method list.
<list-name>	Named accounting method list.

Default By default login accounting is disabled in the default accounting server. No accounting will be performed until accounting is enabled using the aaa accounting login command beforehand.

Mode Line Configuration

Example To apply the accounting server `USERS` to all vty lines use the following commands:

```
awplus# configure terminal
awplus(config)# line vty 0 32
awplus(config-line)# accounting login USERS
```

To reset accounting for login sessions on the console, use the following commands:

```
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# no accounting login
```

Related Commands aaa accounting commands
aaa accounting login

clear aaa local user lockout

Use this command to clear the lockout on a specific user account or all user accounts.

Syntax

```
clear aaa local user lockout {username <username>|all}
```

Parameter	Description
`username`	Clear lockout for the specified user.
<username>	Specifies the user account.
`all`	Clear lockout for all user accounts.

Mode Privileged Exec

Examples To unlock the user account '`bob`' use the following command:

```
awplus# clear aaa local user lockout username bob
```

To unlock all user accounts use the following command:

```
awplus# clear aaa local user lockout all
```

Related Commands aaa local authentication attempts lockout-time

debug aaa

This command enables AAA debugging.

Use the no variant of this command to disable AAA debugging.

Syntax

```
debug aaa [accounting|all|authentication|authorization]
no debug aaa [accounting|all|authentication|authorization]
```

Parameter	Description
`accounting`	Accounting debugging.
`all`	All debugging options are enabled.
`authentication`	Authentication debugging.
`authorization`	Authorization debugging.

Default AAA debugging is disabled by default.

Mode Privileged Exec

Example To enable authentication debugging for AAA, use the command:

```
awplus# debug aaa authentication
```

To disable authentication debugging for AAA, use the command:

```
awplus# no debug aaa authentication
```

Related Commands show debugging aaa
undebug aaa

login authentication

Use this command to apply an AAA server for authenticating user login attempts from a console or remote logins on these console or VTY lines. The authentication method list must be specified by the aaa authentication login command. If the method list has not been configured by the aaa authentication login command, login authentication will fail on these lines.

Use the no variant of this command to reset AAA Authentication configuration to use the default method list for login authentication on these console or VTY lines.

Command Syntax

```
login authentication {default|<list-name>}
no login authentication
```

Parameter	Description
`default`	The default authentication method list. If the default method list has not been configured by the aaa authentication login command, the local user database is used for user login authentication.
<list-name>	Named authentication server.

Default The default login authentication method list, as specified by the aaa authentication login command, is used to authenticate user login. (If this has not been specified, the default is to use the local user database.)

Mode Line Configuration

Examples To apply the authentication method list called `CONSOLE` to the console port terminal line (asyn 0), use the following commands:

```
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# login authentication CONSOLE
```

To reset user authentication configuration on all VTY lines, use the following commands:

```
awplus# configure terminal
awplus(config)# line vty 0 32
awplus(config-line)# no login authentication
```

Related Commands aaa authentication login
line

show debugging aaa

This command displays the current debugging status for AAA (Authentication, Authorization, Accounting).

Syntax `show debugging aaa`

Mode User Exec and Privileged Exec

Example To display the current debugging status of AAA, use the command:

```
awplus# show debug aaa
```

Output Figure 67-1: Example output from the **show debug aaa** command

```
AAA debugging status:
    Authentication debugging is on
    Accounting debugging is off
```

undebug aaa

This command applies the functionality of the no debug aaa command on page 67.26.

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Introduction

The main purpose of RADIUS (Remote Authentication Dial In User Service) is to enable the authentication of network users stored in a database on a server known as a RADIUS Server.

When users connect to the network, the switch the users connect to can challenge the users for authentication, and pass on the authentication to the RADIUS server to check. Based on the result of the check against the database, the RADIUS Server informs the switch whether or not to allow the connected user access to the network.

A RADIUS Server can do more than allow or deny access to the network. A RADIUS Server can send back parameters to the connected users, such as an IP address for the user, or a VLAN for the user, or a privilege level for a session. RADIUS also provides an accounting service. Switches can inform the RADIUS Server how long a user has been connected to the network, and how much traffic the user has sent and received while connected to the network.

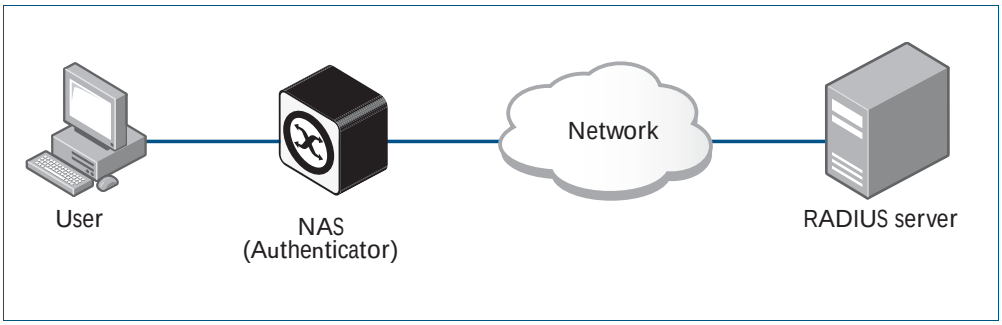
The original use for RADIUS was for the authentication of users dialling into an ISP (Internet Service Provider). A PPP (Point-to-Point Protocol) connection would be established between the remote client and the ISP's access switch. The ISP's access switch would receive the client's username and password using PAP (Password Authentication Protocol) or using CHAP (Challenge Handshake Authentication Protocol) and pass on the client's username and password to the RADIUS server to authenticate the client. The RADIUS Server's response to the authentication request would be sent back to the client as a PAP or CHAP allow or deny.

RADIUS has been adapted to network access authentication applications. Network access authentication using RADIUS follows a similar method to the PPP dial-up application for ISPs. For general network access authentication there is the RADIUS Server where the database of user authentication data is stored and a NAS (Network Access Server), which is the switch that user connects to first. The RADIUS Server and the NAS communicate with each other through exchanging attributes. Usernames and passwords are treated as attributes in RADIUS packets to and from a RADIUS Server and a NAS. The RADIUS Server is configured with a list of valid NASs that are allowed to send authentication requests to the RADIUS Server.

The RADIUS Server will not accept authentication requests from a NAS that is not on the list of valid NASs. Each NAS has a shared secret, which is a shared key with the RADIUS Server that is used to authenticate requests. The RADIUS Server has access to a list of user authentication data, stored within the RADIUS Server or accessed from another server.

Communication between the NAS and RADIUS Server uses the RADIUS protocol. The RADIUS protocol uses UDP packets. There are two UDP ports used as the destination port for RADIUS authentication packets (ports 1645 and 1812). Note that port 1812 is in more common use than port 1645 for authentication packets. UDP ports (ports 1646 and 1813) are used for RADIUS accounting separately from the ports used for RADIUS authentication.

Figure 68-1: Example showing a User to a NAS to a RADIUS Server network connection



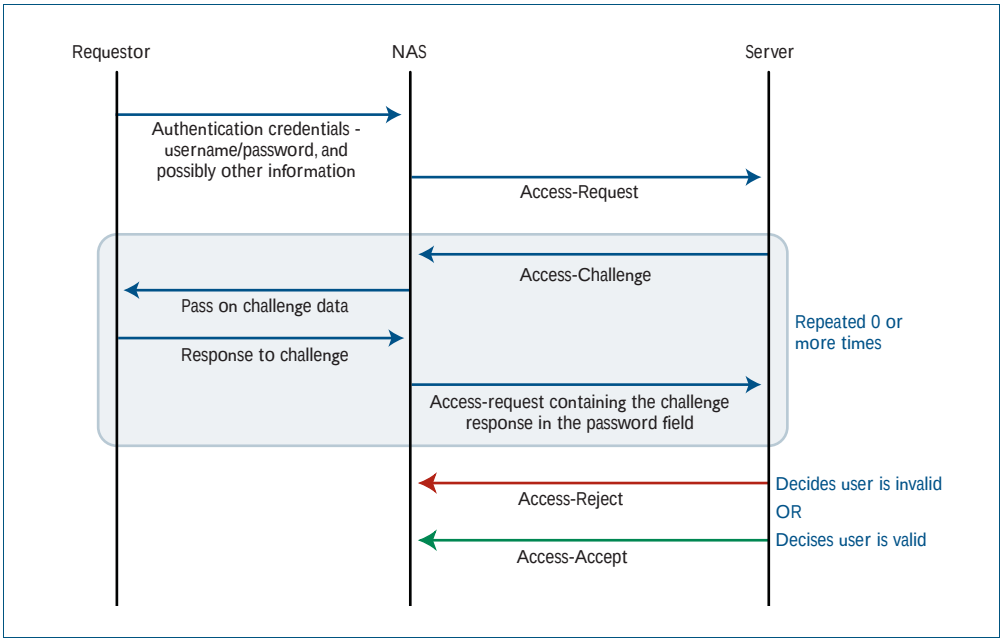
RADIUS Packets

The RADIUS RFCs define the RADIUS packet types and attributes. RADIUS authentication is defined by RFC2058, RFC2138, RFC2865, and RFC2868. RADIUS accounting is defined by RFC2059, RFC2139, RFC2866, and RFC2867. These RADIUS RFCs define over fifty attributes and six packets types (`Access-Request, Access-Accept, Access-Reject, Accounting-Request, Accounting-Response, Access-Challenge`).

A RADIUS exchange is initiated by the NAS when a user requests access to the NAS. The NAS obtains the user authentication data adds them into a RADIUS `Access-Request` packet type and sends the RADIUS `Access-Request` packet to the RADIUS Server.

- If a RADIUS Server has not been configured for authentication request from a NAS then it will silently discard an `Access-Request` packet from it.
- If the RADIUS Server accepts the request from the NAS it considers the authentication date provided in the `Access-Request` packet. The RADIUS Server may verify the user from its own database or it may connect to other servers to verify.
- If the RADIUS Server decides that the user is not allowed access to the NAS it responds to the NAS with an `Access-Reject` packet and the NAS will block the user.
- If the RADIUS Server decides that the user is valid but needs more information to verify that the user is not an imposter, it may send an `Access-Challenge` packet to the NAS that the NAS forwards to the user. The NAS forwards the user response to the `Access-Challenge` packet in an `Access-Request` packet to the RADIUS Server to accept or reject to allow or deny NAS user access.
- If the RADIUS Server rejects the user it sends an `Access-Reject` packet to the NAS.
- If the RADIUS Server accepts the user it sends an `Accept-Accept` packet to the NAS. The `Accept-Accept` packet to the NAS contains attributes that the NAS can apply.

Figure 68-2: Example showing an exchange from a Requestor to a NAS to a RADIUS Server



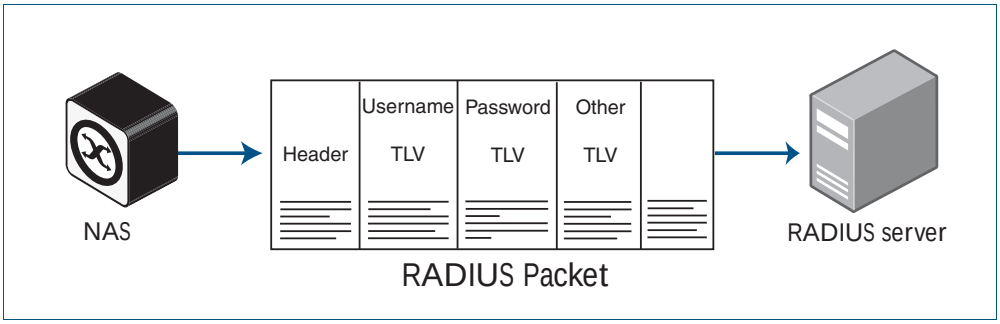
RADIUS Attributes

Each attribute is identified by its RFC-defined name, followed by its attribute ID in parenthesis.

- User-name(1)
  User-names are strings of at least three characters and have a maximum of 253 characters, which is the upper limit on all RADIUS attributes.
- User-password(2)
  User-passwords are encrypted using an MD5 hash of the password, the NAS's shared secret with the RADIUS Server, and a request authenticator value. User-passwords can either be used at the initial authentication attempt or in response to an Access-Challenge packet type from the RADIUS Server to the NAS.
- CHAP-password(3)
  CHAP-passwords are used if the NAS is using CHAP to authenticate the user, and doesn't receive the use the user's password but sends the CHAP response to the RADIUS Server instead. The CHAP password is an encrypted string that is an MD5 hash of the password and challenge value sent by the user.
- Framed-IP-Address(8)
  Used for dial-in user making PPP connections to the NAS who are dynamically allocated an IP address that they can use for the duration of their connect. The RADIUS Server sends the Framed-IP-Address to the NAS to allocate.
- Service-Type(6)
  Used when the NAS is authenticating a user who wants to open a management session on the NAS, and is sent by the RADIUS Server back to the NAS in an Access-Accept type packet to indicate the level of access the NAS gives a user. Service-Type(6) is mapped to a Privileged management session for AlliedWare Plus.
- NAS-Port-Type(61)
  Identifies the type of port on which the user is accessing the NAS. The NAS-Port-Type(61) attribute is sent by the NAS to the RADIUS Server in Access-Request type packet, so the RADIUS Server may use it to choose access type. For 802.1X sessions, the NAS-Port-Type sent by the NAS is Ethernet (15).
- 802.1X VLAN assignment uses:
  Tunnel-Type(64), Tunnel-Medium-Type(65), Tunnel-Private-Group-ID(81), Egress-VLANID(56), and Egress-VLAN-Name(58) attributes (specified in RFC4675 used to specify 802.1Q tagged and untagged VLAN assignments with LLDP-MED/Voice-VLAN).

Attributes are carried within RADIUS packets in the form of TLVs (Type Length Values). Every attribute has an attribute ID number in the Type field of the TLV. The Length field holds a one-byte number that represents then length of the TLV. The Value field holds the value of the attribute.

Figure 68-3: Example showing **TLVs** in a RADIUS Packet from a NAS to a RADIUS Server



RADIUS Security

RADIUS is used for network security and carries user authentication information, so can be a target for security attacks. To counter threats there are three elements to RADIUS security:

- Shared secret
- Authenticator
- Password Encryption

Shared Secret

Every NAS and server are configured with a pre-shared key, called the “shared secret”, which is a key string, with no particular format of at least 16 characters.

The protocol has no method for choosing and sharing the secret between the NAS and the server. The secret must be manually generated and separately configured on the NAS and on the server.

The shared secret itself never appears in any RADIUS packets. It is used as an input to the algorithms used for creating encrypted values that are carried in the packets.

Authenticator

The authenticator is a random 16-byte value generated by the NAS. The NAS creates a new authenticator value for each `Access-Request` that it sends.

The response packets that come back from the server contain a value called the Response Authenticator. This is a value that is created by performing an MD5 hash on a string that is created by concatenating the packet type identifier, Session ID, Authenticator sent in the request packet, Attribute fields in the packet, Shared secret that the server shares with the NAS to which it is responding.

When the NAS receives the response packet, it performs the same hash on the same values, and verifies that it comes up with the same result. If not, then it must assume that the response packet has been spoofed, and silently discards it.

Password Encryption

The value placed in the user-password TLV of an `Access-Request` packet is not simply an exact copy of the password sent from the requestor to the NAS.

The NAS concatenates together the shared secret and the authenticator that it has randomly generated for this request and then performs manipulations (MD5, XOR) on that concatenation, and the password to create the value to go into password TLV.

When the server validates the `Access-Request`, it retrieves the user’s password from the user credentials database, and performs the same manipulation upon that password. If the result matches the value in the user-password field of the `Access-Request`, then the password sent by the requestor is deemed to be correct.

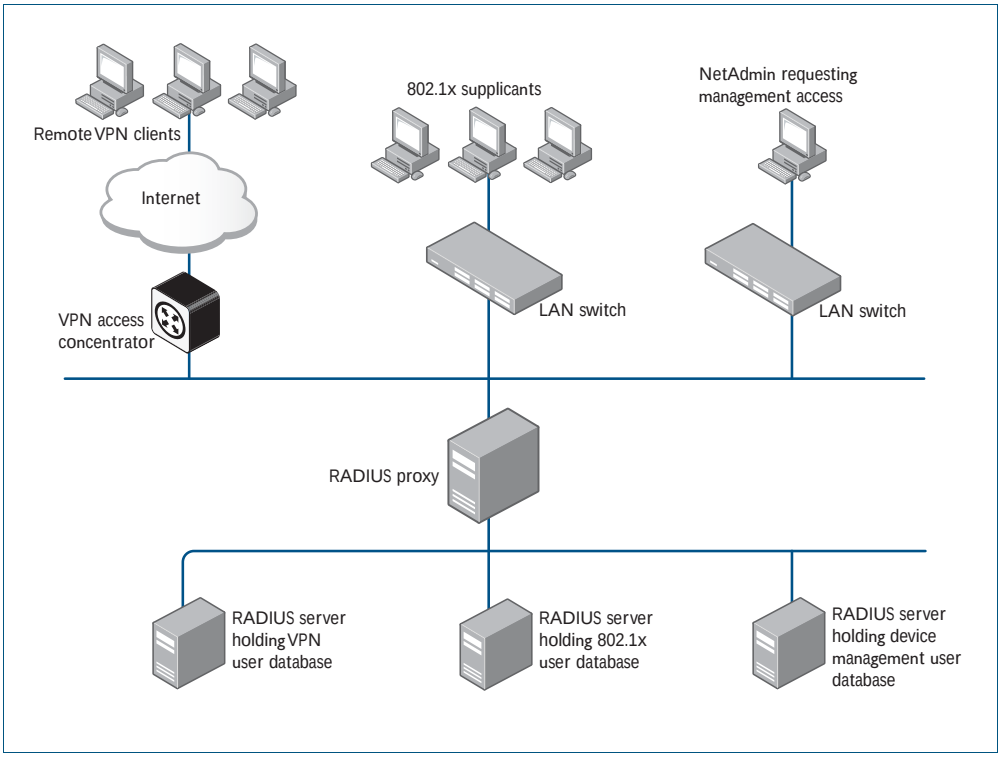
RADIUS Proxy

The user database, which user credentials sent to a RADIUS server are looked up in, may not reside on the RADIUS server itself. The external user database may reside on another RADIUS server, and the communication to that server uses RADIUS. In the case where a RADIUS server communicates with a NAS, but also acts as a client to another RADIUS server, is said to be acting as a RADIUS proxy.

There are a variety of situations where RADIUS proxy is useful. Multiple RADIUS servers could have been set up, holding user databases for different purposes such as Authentication, Switch management sessions, Authenticating VPN connections, and Authenticating 802.1X sessions.

But it is convenient for there to be just one address that all the NASs in the network use as their RADIUS server. That one RADIUS server that the NASs send their requests to, can act as a proxy for all the servers holding the different user databases.

Figure 68-4: Example showing RADIUS Proxy



RADIUS Accounting

There are only two types of RADIUS accounting packet: `Accounting-Request` and `Accounting-Response`.

The `Accounting-Request` packets are always sent from the NAS to the server. The `Accounting-Response` packets are always sent from the server to the NAS, and are effectively ACKs of the `Accounting-Request` packets.

The `Accounting-Request` packets always carry the attribute `Acct-Status-Type`. The most commonly used values of this attribute are:

- Start – which denotes a packet marking that a session is beginning
- Stop – which denotes a packet marking that a session is ending
- Interim update – packets sent periodically during the session to give update reports on the statistics that are being collected.

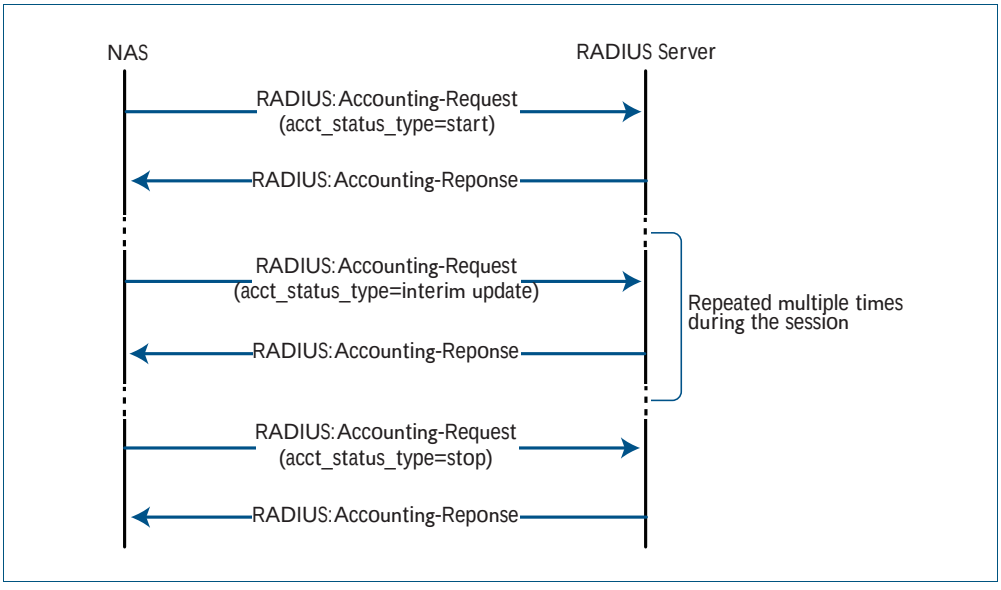
The statistics that can be exchanged in the session are:

- Input Octets
- Input Packets
- Output Octets
- Output Packets
- Session Duration

There is no requirement to exchange all these statistics – NAS implementations are at liberty to choose which statistics they will send. Each of these statistics has a corresponding attribute type. The attributes are sent in Interim-Update and Stop accounting request packets.

Each accounting session has a unique session ID, which is chosen by the NAS. The session ID is carried in an `Acct-Session-Id` attribute, that should be present in every packet involved in the session. The accounting packets typically do not use the same UDP port as the authentication packets. The default port for RADIUS accounting is 1813.

Figure 68-5: Example showing RADIUS Accounting between a NAS and a RADIUS Server



RADIUS Configuration

This section describes how to configure RADIUS with the available AAA commands. For a description of AAA commands, refer to the AAA Commands chapter. For a description of the RADIUS commands used, refer to the RADIUS Commands chapter.

RADIUS is often used in a variety of networks that need high security while maintaining access for remote users. RADIUS is suitable for the following networks that require access security:

- Networks with multiple-vendor access servers, each supporting RADIUS. For example, access servers from several vendors use a single RADIUS server-based security database.
- Networks in which a user may access a single service. Using RADIUS, you can control user access to a single host, or to a single utility such as Telnet.
- Networks that require accounting. You can use RADIUS accounting independent of RADIUS authentication. The RADIUS accounting functions allow data to be sent at the start and end of services, indicating the amount of resources (time, packets, bytes) used.

Switch Configuration Tasks

To configure RADIUS on your switch or access server, you must perform the following tasks:

- Use the aaa authentication command to define method lists for RADIUS authentication. For information about this command, refer to the AAA Commands chapter.
- Use authentication commands to enable the defined method lists to be used. For more information, refer to the Authentication Commands chapter.

The following configuration tasks are optional:

- You can use the aaa group server command to group selected RADIUS hosts for specific services. For detailed information about this command, refer to the AAA Server Groups Configuration section in this chapter and refer to the AAA Commands chapter.
- You can use the aaa accounting login command to enable accounting for RADIUS connections. For information about this command, refer to the AAA Commands chapter.

This section describes how to set up RADIUS for authentication and accounting on your network, and includes the following sections:

- Switch to RADIUS Server Communication (Required)
- Configuring AAA Server Groups (Optional)
- Configuring AAA Server Groups with Deadtime (Optional)
- Specifying RADIUS Authentication
- Specifying RADIUS Accounting (Optional)

For RADIUS configuration examples using the commands in this chapter, refer to the section RADIUS Configuration Examples at the end of this chapter.

Switch to RADIUS Server Communication

The RADIUS host is normally a multiuser system running RADIUS server software from a software provider. Switch to RADIUS server communication has several components:

- Host name or IP address
- Authentication destination port
- Accounting destination port
- Timeout period
- Retransmission value
- Key string

RADIUS security servers are identified on the basis of their host name or IP address, host name and specific UDP port numbers, or IP address and specific UDP port numbers. The combination of the IP address and UDP port number creates a unique identifier, allowing different ports to be individually defined as RADIUS hosts providing a specific AAA service. This unique identifier enables RADIUS requests to be sent to multiple UDP ports on a server at the same IP address.

A RADIUS server and a switch use a shared secret text string to encrypt passwords and exchange responses. To configure RADIUS using the AAA security commands, you must specify the host running the RADIUS server daemon and a secret text string that it shares with the switch, which you can specify using the key parameter in the radius-server host command.

The timeout, retransmission, and encryption key values are configurable globally for all RADIUS servers, on a per-server basis, or in some combination of global and per-server settings. To apply these settings globally to all RADIUS servers communicating with the switch, use the three global commands: radius-server timeout, radius-server retransmit, and radius-server key. To apply these values on a specific RADIUS server, use the radius-server host command.

Note

You can configure both global and per-server timeout, retransmission, and key value commands simultaneously on the same Network Access Server.

If both global and per-server functions are configured on a switch, the per-server timer, retransmission, and key value commands override global timer, retransmission, and key value commands.

To configure per-server RADIUS server communication, use the following command in the Global Configuration mode:

Mode and Command	Command Purpose

`awplus(config)#`
`radius-server host`
`{<hostname>|`
`<ip-address>}`
`[auth-port <port-number>]`
`[acct-port <port-number>]`
`[timeout <seconds>]`
`[retransmit <retries>]`
`[key <string>]`
	Specifies the IP address or host name of the remote RADIUS server host and assigns authentication and accounting destination UDP port numbers.
	Use the `auth-port <port-number>` option to configure a specific UDP port on this RADIUS server to be used solely for authentication.
	Use the `acct-port <port-number>` option to configure a specific UDP port on this RADIUS server to be used solely for accounting.
	To configure the network access server to recognize more than one host entry associated with a single IP address, simply repeat this command as many times as necessary, making sure that each UDP port number is different.
	Set the timeout, retransmit, and encryption key values to use with the specific RADIUS host. If no timeout is set, the global value is used; otherwise, enter a value in the range 1 to 1000.
	If no retransmit value is set, the global value is used; otherwise enter a value in the range 1 to 1000. If no key string is specified, the global value is used.

To configure global communication settings between the switch and a RADIUS server, use the following radius-server commands in the Global Configuration mode:

Mode and Command	Command Purpose
`awplus(config)#` `radius-server key <key>`	Specifies the shared secret text string used between the switch and a RADIUS server (no default is set).

`awplus(config)#`
`radius-server retransmit`
`<retries>`
	Specifies how many times the switch transmits each RADIUS request to the RADIUS server before giving up (the default is 3).

`awplus(config)#`
`radius-server timeout`
`<seconds>`
	Specifies for how many seconds a switch waits for a reply to a RADIUS request before retransmitting the request.

`awplus(config)#`
`radius-server deadtime`
`<minutes>`
	Specifies for how many minutes a RADIUS server that is not responding to authentication requests is passed over by requests for RADIUS authentication.

AAA Server Groups Configuration

Configuring the switch to use AAA server groups provides a way to group existing server hosts. This allows you to select a subset of the configured server hosts and use them for a particular service. A server group is used in conjunction with a global server-host list. The server group lists the IP addresses of the selected server hosts.

Server groups also can include multiple host entries for the same server, as long as each entry has a unique identifier. The combination of an IP address and a UDP port number creates a unique identifier, allowing different ports to be individually defined as RADIUS hosts providing a specific AAA service.

To define a server host with a server group name, enter the following commands in the Global Configuration mode. The listed RADIUS server must exist in the Global Configuration mode:

Mode and Command	Command Purpose
awplus(config)# radius-server host {*<hostname>*| *<ip-address>*} [auth-port *<port-number>*] [acct-port *<port-number>*] [timeout *<seconds>*] [retransmit *<retries>*] [key *<string>*]	Specifies and defines the IP address of the server host before configuring the AAA server-group. Refer to the section Switch to RADIUS Server Communication of this chapter for more information on the radius-server host command.
awplus(config-if)# aaa group server *<group-name>*	Defines the AAA server group with a group name. This command puts the switch in server group sub configuration mode.
awplus(config-sg)# server {*<hostname>*|*<ip-address>*} [auth-port *<port-number>*] [acct-port *<port-number>*]	Associates a particular RADIUS server with the defined server group. Each security server is identified by its IP address and UDP port number. Repeat this step for each RADIUS server in the AAA server group. Each server in the group must be defined previously using the radius-server host command.

Configuring AAA Server Groups with Deadtime

After you have configured a server host with a server name, you can use the deadtime (RADIUS server group) command to configure each server per server group. Configuring deadtime within a server group allows you to direct AAA traffic to separate groups of servers that have different operational characteristics.

Configuring deadtime is no longer limited to a global configuration. A separate timer has been attached to each server host in every server group. When a server is found to be unresponsive after numerous retransmissions and time-outs, the server is assumed to be dead. The timers attached to each server host in all server groups are triggered. In essence, the timers are checked and subsequent requests to a server, once it is assumed to be dead, are directed to alternate servers, if configured. When the network access server receives a reply from the server, it checks and stops all configured timers, if running, for that server in all server groups.

If the timer has expired, only the server to which the timer is attached is assumed to be alive. This becomes the only server that can be tried for later AAA requests using the server groups to which the timer belongs.

Note

Since one server has different timers and may have different deadtime values configured in the server groups, the same server may in the future have different states, dead and alive, at the same time. To change the state of a server, you must start and stop all configured timers in all server groups.

The size of the server group will be increased because of the addition of new timers and the deadtime attribute. The overall impact of the structure depends on the number and size of the server groups and how the servers are shared among server groups in a specific configuration.

To configure deadtime within a server group, use the following commands beginning in the Global Configuration mode:

Mode and Command	Command Purpose
`awplus(config)# aaa group server radius group1`	Defines a RADIUS type server group.
`awplus(config-sg)# deadtime 1`	Configures and defines a deadtime value in minutes.
`awplus(config-sg)# exit`	Exits server group configuration mode.

Specifying RADIUS Authentication

After you have identified the RADIUS server and defined the RADIUS authentication key, you must define method lists for RADIUS authentication. Because RADIUS authentication is facilitated through AAA, you must enter the aaa authentication login command, specifying RADIUS as the authentication method. For detailed aaa authentication login command information, refer to the AAA Commands chapter.

Specifying RADIUS Accounting

The AAA accounting feature enables you to track the services users are accessing as well as the amount of network resources they are consuming. Because RADIUS accounting is facilitated through AAA, you must issue the aaa accounting login command, specifying RADIUS as the accounting method. For detailed aaa accounting login command information, refer to the AAA Commands chapter.

Monitoring and Maintaining RADIUS

To monitor and maintain RADIUS, use the following commands in Privileged Exec mode:

Mode and Command	Command Purpose
`awplus#` `debug radius`	Displays information associated with RADIUS. For detailed debug radius command information, refer to the RADIUS Commands chapter.
`awplus#` `show radius statistics`	Displays the RADIUS statistics for accounting and authentication packets. For detailed show radius statistics command information, refer to the RADIUS Commands chapter.

RADIUS Configuration Examples

The following sections provide RADIUS configuration examples:

- RADIUS Authentication
- Single RADIUS Server Configuration
- Multiple RADIUS Server Configuration
- RADIUS Server Group Configuration
- RADIUS Server Configuration using Server Groups

RADIUS Authentication

Example The following example shows how to configure the switch to authenticate using RADIUS:

Figure 68-6: Sample RADIUS Authentication to configure the switch to authenticate users

```
!
radius-server host 172.10.10.1
radius-server key radiuspass
username newuser password newpass
aaa authentication login admin
!
```

The lines in this example RADIUS authentication and accounting configuration are defined as follows:

- The radius-server host command defines the IP address of the RADIUS server host.
- The radius-server key command defines the shared secret text string between the network access server and the RADIUS server host.
- The aaa authentication login command defines a method list named admin for login authentication.

Example The following example shows how to configure the switch to authenticate logins using RADIUS:

Figure 68-7: Sample RADIUS Authentication to authenticate logins

```
!
aaa authentication login radius-login group radius
!
```

This sample RADIUS authentication configuration is defined as follows:

- The aaa authentication login radius-login group radius command configures the switch to use RADIUS for authentication at the login prompt.

Example The following example shows how to configure the authentication method to verify a username and password at login. In this example, if a username is entered at the username prompt, that username is used for authentication.

Figure 68-8: Sample RADIUS Authentication to verify a username and password

```
!
aaa authentication login default group radius
radius-server host 172.10.10.1 auth-port 1812 acct-port 1813
!
```

The lines in this sample RADIUS authentication configuration are defined as follows:

- The aaa authentication login default group radius command specifies that the username and password are verified by RADIUS.
- The radius-server host 172.10.10.1 auth-port 1812 acct-port 1813 command specifies the IP address of the RADIUS server host, the UDP destination port for authentication requests, and the UDP destination port for accounting requests.

Single RADIUS Server Configuration

Example The following example shows how to configure server-specific timeout, retransmit, and key values for the RADIUS server with IP address 172.2.2.2:

Figure 68-9: Single RADIUS Server sample configuration

```
!
radius-server host 172.2.2.2 timeout 5 retransmit 5 key 10
!
```

Multiple RADIUS Server Configuration

Example The following example shows how to configure two RADIUS servers with specific timeout, retransmit, and key values. The radius-server retransmit command changes the global retransmission value to 4 for all RADIUS servers. The radius-server host command configures specific timeout, retransmission, and key values for the RADIUS server hosts with IP addresses `172.2.2.2` and `172.1.1.1`

Figure 68-10: Multiple RADIUS Server sample configuration

```
!
! Enable and configure radius authentication and accounting
! services on the switch:
!
aaa authentication login default group radius
aaa accounting default start-stop group radius
!
! Change the retransmission value for all RADIUS servers:
!
radius-server retransmit 4
!
! Configure per-server specific timeout, retransmission, and
! key values. Change the default auth-port and acct-port
! values.
!
radius-server host 172.2.2.2 auth-port 1645 acct-port 1646
timeout 3 retransmit 3 key radkey
!
! Configure per-server specific timeout and key values. This
! server uses the global retransmission value.
!
radius-server host 172.1.1.1 timeout 6 key rad123
!
```

RADIUS Server Group Configuration

Example The following example shows how to create server group `group2` with three RADIUS server members, each with the same IP address but with unique authentication and accounting ports:

Figure 68-11: RADIUS Server Group sample configuration using the same IP address

```
!
aaa group server radius group2
  server 172.1.1.1 auth-port 1645 acct-port 1646
  server 172.1.1.1 auth-port 1812 acct-port 1813
  server 172.1.1.1 auth-port 2000 acct-port 2001
!
```

RADIUS Server Configuration using Server Groups

The following example shows how to configure the network access server to recognize two different RADIUS server groups.

One of these groups, `group1`, has two different host entries on the same RADIUS server configured for the same services. The second host entry configured acts as fail over backup to the first one. Each group is individually configured for `deadtime`; `deadtime` for `group1` is one minute, and `deadtime` for `group2` is two minutes.

Figure 68-12: Multiple RADIUS Servers using Server Groups sample configuration

```
!
! The following command configures default RADIUS parameters:
!
aaa authentication login default group group1
!
! The following commands define the group1 RADIUS server group
! and associate servers with it and configures a deadtime of
! one minute:
!
aaa group server radius group1
  server 172.1.1.1 auth-port 1645 acct-port 1646
  server 172.2.2.2 auth-port 1812 acct-port 1813
  deadtime 1
!
! The following commands define the group2 RADIUS server group
! and associate servers with it and configures a deadtime of
! two minutes:
!
aaa group server radius group2
  server 172.2.2.2 auth-port 1812 acct-port 1813
  server 172.3.3.3 auth-port 2000 acct-port 2001
  deadtime 2
!
! The following commands configure the RADIUS attributes
! for each host entry associated with one of the defined
! server groups:
!
radius-server host 172.1.1.1 auth-port 1645 acct-port 1646
radius-server host 172.2.2.2 auth-port 1812 acct-port 1813
radius-server host 172.3.3.3 auth-port 2000 acct-port 2001
!
```

Chapter 69: RADIUS Commands

Command List 69.2
deadtime (RADIUS server group) 69.2
debug radius 69.3
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Command List

This chapter provides an alphabetical reference for commands used to configure the device to use RADIUS servers.

deadtime (RADIUS server group)

Use this command to configure the deadtime parameter for the RADIUS server group. This command overrides the global dead-time configured by the radius-server deadtime command on page 69.5. The configured deadtime is the time period in minutes to skip a RADIUS server for authentication or accounting requests if the server is “dead”. Note that a RADIUS server is considered “dead” if there is no response from the server within a defined time period.

Use the no variant of this command to reset the deadtime configured for the RADIUS server group. If the global deadtime for RADIUS server is configured the value will be used for the servers in the group. The global deadtime for the RADIUS server is set to 0 minutes by default.

Syntax

```
deadtime <0-1440>
no deadtime
```

Parameter	Description
<0-1440>	Amount of time in minutes.

Default The deadtime is set to 0 minutes by default.

Mode Server Group Configuration

Usage If the RADIUS server does not respond to a request packet, the packet is retransmitted the number of times configured for the retransmit parameter (after waiting for a timeout period to expire). The server is then marked “dead”, and the time is recorded. The deadtime parameter configures the amount of time to skip a dead server; if a server is dead, no request message is sent to the server for the deadtime period.

Examples To configure the deadtime for 5 minutes for the RADIUS server group "GROUP1", use the command:

```
awplus(config)# aaa group server radius GROUP1
awplus(config-sg)# server 192.168.1.1
awplus(config-sg)# deadtime 5
```

To remove the deadtime configured for the RADIUS server group "GROUP1", use the command:

```
awplus(config)# aaa group server radius GROUP1
awplus(config-sg)# no deadtime
```

Related Commands aaa group server
radius-server deadtime

debug radius

This command enables RADIUS debugging. If no option is specified, all debugging options are enabled.

Use the no variant of this command to disable RADIUS debugging. If no option is specified, all debugging options are disabled.

Syntax

```
debug radius [packet|event|all]
no debug radius [packet|event|all]
```

Parameter	Description
`packet`	Debugging for RADIUS packets is enabled or disabled.
`event`	Debugging for RADIUS events is enabled or disabled.
`all`	Enable or disable all debugging options.

Default RADIUS debugging is disabled by default.

Mode Privileged Exec

Examples To enable debugging for RADIUS packets, use the command:

```
awplus#  debug radius packet
```

To enable debugging for RADIUS events, use the command:

```
awplus#  debug radius event
```

To disable debugging for RADIUS packets, use the command:

```
awplus# no debug radius packet
```

To disable debugging for RADIUS events, use the command:

```
awplus# no debug radius event
```

Related Commands show debugging radius
undebug radius

ip radius source-interface

This command configures the source IP address of every outgoing RADIUS packet to use a specific IP address or the IP address of a specific interface. If the specified interface is down or there is no IP address on the interface, then the source IP address of outgoing RADIUS packets depends on the interface the packets leave.

Use the no variant of this command to remove the source interface configuration. The source IP address in outgoing RADIUS packets will be the IP address of the interface from which the packets are sent.

Syntax

```
ip radius source-interface {<interface>|<ip-address>}
no ip radius source-interface
```

Parameter	Description
<interface>	Interface name.
<ip-address>	IP address in the dotted decimal format A.B.C.D.

Default Source IP address of outgoing RADIUS packets depends on the interface the packets leave.

Mode Global Configuration

Examples To configure all outgoing RADIUS packets to use the IP address of the interface "vlan1" for the source IP address, use the following commands:

```
awplus# configure terminal
awplus(config)# ip radius source-interface vlan1
```

To configure the source IP address of all outgoing RADIUS packets to use 192.168.1.10, use the following commands:

```
awplus# configure terminal
awplus(config)# ip radius source-interface 192.168.1.10
```

To reset the source interface configuration for all outgoing RADIUS packets, use the following commands:

```
awplus# configure terminal
awplus(config)# no ip radius source-interface
```

Related Commands radius-server host
show radius statistics

radius-server deadtime

Use this command to specify the global deadtime for all RADIUS servers. If a RADIUS server is considered dead, it is skipped for the specified deadtime. This command specifies for how many minutes a RADIUS server that is not responding to authentication requests is passed over by requests for RADIUS authentication.

Use the no variant of this command to reset the global deadtime to the default of 0 seconds, so that RADIUS servers are not skipped even if they are dead.

Syntax

```
radius-server deadtime <minutes>
no radius-server deadtime
```

Parameter	Description
<minutes>	RADIUS server deadtime in minutes in the range 0 to 1440 (24 hours).

Default The default RADIUS deadtime configured on the system is 0 seconds.

Mode Global Configuration

Usage The RADIUS client considers a RADIUS server to be dead if it fails to respond to a request after it has been retransmitted as often as specified globally by the radius-server retransmit command or for the server by the radius-server host command. To improve RADIUS response times when some servers may be unavailable, set a deadtime to skip dead servers.

Examples To set the dead time of the RADIUS server to 60 minutes, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server deadtime 60
```

To disable the dead time of the RADIUS server, use the following commands:

```
awplus# configure terminal
awplus(config)# no radius-server deadtime
```

Related Commands

deadtime (RADIUS server group)
radius-server host
radius-server retransmit
show radius statistics

radius-server host

Use this command to specify a remote RADIUS server host for authentication or accounting, and to set server-specific parameters. The parameters specified with this command override the corresponding global parameters for RADIUS servers. This command specifies the IP address or host name of the remote RADIUS server host and assigns authentication and accounting destination UDP port numbers.

This command adds the RADIUS server address and sets parameters to the RADIUS server. The RADIUS server is added to the running configuration after you issue this command. If parameters are not set using this command then common system settings are applied.

Use the no variant of this command to remove the specified server host as a RADIUS authentication and/or accounting server and set the destination port to the default RADIUS server port number (1812).

Syntax

```
radius-server host {<host-name>|<ip-address>} [acct-port <0-65535>]
   [auth-port <0-65535>] [key <key-string>] [retransmit <0-100>]
   [timeout <1-1000>]

no radius-server host {<host-name>|<ip-address>}
   [acct-port <0-65535>] [auth-port <0-65535>]
```

Parameter	Description
<host-name>	Server host name. The DNS name of the RADIUS server host.
<ip-address>	The IP address of the RADIUS server host.
acct-port	Accounting port. Specifies the UDP destination port for RADIUS accounting requests. If 0 is specified, the server is not used for accounting. The default UDP port for accounting is 1813.
<0-65535>	UDP port number (Accounting port number is set to 1813 by default) Specifies the UDP destination port for RADIUS accounting requests. If 0 is specified, the host is not used for accounting.
auth-port	Authentication port. Specifies the UDP destination port for RADIUS authentication requests. If 0 is specified, the server is not used for authentication. The default UDP port for authentication is 1812.
<0-65535>	UDP port number (Authentication port number is set to 1812 by default) Specifies the UDP destination port for RADIUS authentication requests. If 0 is specified, the host is not used for authentication.
timeout	Specifies the amount of time to wait for a response from the server. If this parameter is not specified the global value configured by the radius-server timeout command is used.
<1-1000>	Time in seconds to wait for a server reply (timeout is set to 5 seconds by default) The time interval (in seconds) to wait for the RADIUS server to reply before retransmitting a request or considering the server dead. This setting overrides the global value set by the radius-server timeout command. If no timeout value is specified for this server, the global value is used.

Parameter(cont.)	Description(cont.)
`retransmit`	Specifies the number of retries before skip to the next server. If this parameter is not specified the global value configured by the radius-server retransmit command is used.
<0-100>	Maximum number of retries (maximum number of retries is set to 3 by default) The maximum number of times to resend a RADIUS request to the server, if it does not respond within the timeout interval, before considering it dead and skipping to the next RADIUS server. This setting overrides the global setting of the radius-server retransmit command. If no retransmit value is specified, the global value is used.
`key`	Set shared secret key with RADIUS servers
`<key-string>`	Shared key string applied Specifies the shared secret authentication or encryption key for all RADIUS communications between this device and the RADIUS server. This key must match the encryption used on the RADIUS daemon. All leading spaces are ignored, but spaces within and at the end of the string are used. If spaces are used in the string, do not enclose the string in quotation marks unless the quotation marks themselves are part of the key. This setting overrides the global setting of the radius-server key command. If no key value is specified, the global value is used.

Default The RADIUS client address is not configured (null) by default. No RADIUS server is configured.

Mode Global Configuration

Usage Multiple radius-server host commands can be used to specify multiple hosts. The software searches for hosts in the order they are specified. If no host-specific timeout, retransmit, or key values are specified, the global values apply to that host. If there are multiple RADIUS servers for this client, use this command multiple times—once to specify each server.

If you specify a host without specifying the auth port or the acct port, it will by default be configured for both authentication and accounting, using the default UDP ports. To set a host to be a RADIUS server for authentication requests only, set the acct-port parameter to 0; to set the host to be a RADIUS server for accounting requests only, set the auth-port parameter to 0.

A RADIUS server is identified by IP address, authentication port and accounting port. A single host can be configured multiple times with different authentication or accounting ports. All the RADIUS servers configured with this command are included in the predefined RADIUS server group radius, which may be used by AAA authentication, authorization and accounting commands. The client transmits (and retransmits, according to the retransmit and timeout parameters) RADIUS authentication or accounting requests to the servers in the order you specify them, until it gets a response.

Examples To add the RADIUS server `10.0.0.20`, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server host 10.0.0.20
```

To set the secret key to allied on the RADIUS server `10.0.0.20`, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server host 10.0.0.20 key allied
```

To delete the RADIUS server `10.0.0.20`, use the following commands:

```
awplus# configure terminal
awplus(config)# no radius-server host 10.0.0.20
```

To configure `rad1.company.com` for authentication only, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server host rad1.company.com
acct-port 0
```

To remove the RADIUS server `rad1.company.com` configured for authentication only, use the following commands:

```
awplus# configure terminal
awplus(config)# no radius-server host rad1.company.com
acct-port 0
```

To configure `rad2.company.com` for accounting only, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server host rad2.company.com
auth-port 0
```

To configure 192.168.1.1 with authentication port 1000, accounting port 1001 and retransmit count 5, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server host 192.168.1.1 auth-port 1000
acct-port 1001 retransmit 5
```

Related Commands

aaa group server
radius-server key
radius-server retransmit
radius-server timeout
show radius statistics

radius-server key

This command sets a global secret key for RADIUS authentication on the switch. The shared secret text string is used for RADIUS authentication between the switch and a RADIUS server.

Note that if no secret key is explicitly specified for a RADIUS server, the global secret key will be used for the shared secret for the server.

Use the no variant of this command to reset the secret key to the default (null).

Syntax

```
radius-server key <key>
no radius-server key
```

Parameter	Description
<key>	Shared secret among radius server and 802.1X client.

Default The RADIUS server secret key on the system is not set by default (null).

Mode Global Configuration

Usage Use this command to set the global secret key shared between this client and its RADIUS servers. If no secret key is specified for a particular RADIUS server using the radius-server host command, this global key is used.

After enabling AAA authentication with the aaa authentication login command, set the authentication and encryption key using the radius-server key command so the key entered matches the key used on the RADIUS server.

Examples To set the global secret key to allied for RADIUS server, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server key allied
```

To set the global secret key to secret for RADIUS server, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server key secret
```

To delete the global secret key for RADIUS server, use the following commands:

```
awplus# configure terminal
awplus(config)# no radius-server key
```

Related Commands radius-server host
show radius statistics

radius-server retransmit

This command sets the retransmit counter to use RADIUS authentication on the switch. This command specifies how many times the switch transmits each RADIUS request to the RADIUS server before giving up.

This command configures the retransmit parameter for RADIUS servers globally. If the retransmit parameter is not specified for a RADIUS server by the radius-server host command then the global configuration set by this command is used for the server instead.

Use the no variant of this command to reset the re-transmit counter to the default (3).

Syntax

```
radius-server retransmit <retries>
no radius-server retransmit
```

Parameter	Description
<retries>	RADIUS server retries in the range <0-100> The number of times a request is resent to a RADIUS server that does not respond, before the server is considered dead and the next server is tried. If no retransmit value is specified for a particular RADIUS server using the radius-server host command, this global value is used.

Default The default RADIUS retransmit count on the switch is 3.

Mode Global Configuration

Examples To set the RADIUS retransmit count to 1, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server retransmit 1
```

To set the RADIUS retransmit count to the default (3), use the following commands:

```
awplus# configure terminal
awplus(config)# no radius-server retransmit
```

To configure the RADIUS retransmit count globally with 5, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server retransmit 5
```

To disable retransmission of requests to a RADIUS server, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server retransmit 0
```

Related Commands

radius-server deadtime
radius-server host
show radius statistics

radius-server timeout

Use this command to specify the RADIUS global timeout value. This is how long the device waits for a reply to a RADIUS request before retransmitting the request, or considering the server to be dead. If no timeout is specified for the particular RADIUS server by the radius-server host command, it uses this global timeout value.

Note that this command configures the timeout parameter for RADIUS servers globally.

The no variant of this command resets the transmit timeout to the default (5 seconds).

Syntax

```
radius-server timeout <seconds>
no radius-server timeout
```

Parameter	Description
<seconds>	RADIUS server timeout in seconds in the range 1 to 1000. The global time in seconds to wait for a RADIUS server to reply to a request before retransmitting the request, or considering the server to be dead (depending on the radius-server retransmit command).

Default The default RADIUS transmit timeout on the system is 5 seconds.

Mode Global Configuration

Examples To globally set the device to wait 20 seconds before retransmitting a RADIUS request to unresponsive RADIUS servers, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server timeout 20
```

To set the RADIUS timeout parameter to 1 second, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server timeout 1
```

To set the RADIUS timeout parameter to the default (5 seconds), use the following commands:

```
awplus# configure terminal
awplus(config)# no radius-server timeout
```

To configure the RADIUS server timeout period globally with 3 seconds, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server timeout 3
```

To reset the global timeout period for RADIUS servers to the default, use the following command:

```
awplus# configure terminal
awplus(config)# no radius-server timeout
```

Related Commands

radius-server deadtime
radius-server host
radius-server retransmit
show radius statistics

server (Server Group)

This command adds a RADIUS server to a server group in Server-Group Configuration mode. The RADIUS server should be configured by the radius-server host command.

The server is appended to the server list of the group and the order of configuration determines the precedence of servers. If the server exists in the server group already, it will be removed before added as a new server.

The server is identified by IP address and authentication and accounting UDP port numbers. So a RADIUS server can have multiple entries in a group with different authentication and/or accounting UDP ports. The auth-port specifies the UDP destination port for authentication requests to the server. To disable authentication for the server, set `auth-port` to 0. If the authentication port is missing, the default port number is 1812. The acct-port specifies the UDP destination port for accounting requests to the server. To disable accounting for the server, set `acct-port` to 0. If the accounting port is missing, the default port number is 1812.

Use the no variant of this command to remove a RADIUS server from the server group.

Syntax

```
server {<hostname>|<ip-address>}
    [auth-port <0-65535>][acct-port <0-65535>]

no server {<hostname>|<ip-address>}
    [auth-port <0-65535>][acct-port <0-65535>]
```

Parameter	Description
`<hostname>`	Server host name
`<ip-address>`	Server IP address The server is identified by IP address, authentication and accounting UDP port numbers. So a RADIUS server can have multiple entries in a group with different authentication and/or accounting UDP ports.
`auth-port`	Authentication port The auth-port specifies the UDP destination port for authentication requests to the server. To disable authentication for the server, set auth-port to 0. If the authentication port is missing, the default port number is 1812.
`<0-65535>`	UDP port number (default: 1812)
`acct-port`	Accounting port The acct-port specifies the UDP destination port for accounting requests to the server. To disable accounting for the server, set acct-port to 0. If the accounting port is missing, the default port number is 1813.
`<0-65535>`	UDP port number (default: 1813)

Default The default Authentication port number is 1812 and the default Accounting port number is 1813.

Mode Server Group Configuration

Usage The RADIUS server to be added must be configured by the radius-server host command. In order to add or remove a server, the auth-port and acct-port parameters in this command must be the same as the corresponding parameters in the radius-server host command.

Examples To create a RADIUS server group RAD_AUTH1 for authentication, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa group server radius RAD_AUTH1
awplus(config-sg)# server 192.168.1.1 acct-port 0
awplus(config-sg)# server 192.168.2.1 auth-port 1000
acct-port 0
```

To create a RADIUS server group RAD_ACCT1 for accounting, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa group server radius RAD_ACCT1
awplus(config-sg)# server 192.168.2.1 auth-port 0
acct-port 1001
awplus(config-sg)# server 192.168.3.1 auth-port 0
```

To remove server 192.168.3.1 from the existing server group GROUP1, use the following commands:

```
awplus# configure terminal
awplus(config)# aaa group server radius GROUP1
awplus(config-sg)# no server 192.168.3.1
```

Related Commands
aaa accounting auth-mac default
aaa accounting auth-web default
aaa accounting dot1x
aaa accounting login
aaa authentication auth-mac
aaa authentication auth-web
aaa authentication login
aaa group server
radius-server host

show debugging radius

This command displays the current debugging status for the RADIUS servers.

Syntax `show debugging radius`

Mode User Exec and Privileged Exec

Example To display the current debugging status of RADIUS servers, use the command:

```
awplus# show debugging radius
```

Output Figure 69-1: Example output from the **show debugging radius** command

```
RADIUS debugging status:
RADIUS event debugging is off
RADIUS packet debugging is off
```

show radius

This command displays the current RADIUS server configuration and status.

Syntax `show radius`

Mode User Exec and Privileged Exec

Example To display the current status of RADIUS servers, use the command:

```
awplus# show radius
```

Output Figure 69-2: Example output from the **show radius** command showing RADIUS servers

```
RADIUS Global Configuration
Source Interface : not configured
Secret Key : secret
Timeout : 5 sec
Retransmit Count : 3
Deadtime : 20 min
Server Host : 192.168.1.10
Authentication Port : 1812
Accounting Port : 1813
Secret Key : secret
Timeout : 3 sec
Retransmit Count : 2
Server Host : 192.168.1.11
Authentication Port : 1812
Accounting Port : not configured
Server Name/Auth Acct Auth Acct
IP Address Port Port Status Status
-------------------------------------------------------------
192.168.1.10 1812 1813 Alive Alive
192.168.1.11 1812 N/A Alive N/A
```

Example See the sample output below showing RADIUS client status and RADIUS configuration:

```
awplus# show radius
```

Output Figure 69-3: Example output from the **show radius** command showing RADIUS client status

```
RADIUS global interface name: awplus
Secret key:
Timeout: 5
Retransmit count: 3
Deadtime: 0

Server Address: 150.87.18.89
Auth destination port: 1812
Accounting port: 1813
Secret key: swg
Timeout: 5
Retransmit count: 3
Deadtime: 0show radius local-server group
```

Output Parameter	Meaning	
Source Interface	The interface name or IP address to be used for the source address of all outgoing RADIUS packets.	
Secret Key	A shared secret key to a radius server.	
Timeout	A time interval in seconds.	
Retransmit Count	The number of retry count if a RADIUS server does not response.	
Deadtime	A time interval in minutes to mark a RADIUS server as “dead”.	
Interim-Update	A time interval in minutes to send Interim-Update Accounting report.	
Group Deadtime	The deadtime configured for RADIUS servers within a server group.	
Server Host	The RADIUS server hostname or IP address.	
Authentication Port	The destination UDP port for RADIUS authentication requests.	
Accounting Port	The destination UDP port for RADIUS accounting requests.	
Auth Status	The status of the authentication port. The status ("dead", “error”, or "alive") of the RADIUS authentication server and, if dead, how long it has been dead for.	
	Alive	The server is alive.
	Error	The server is not responding.
	Dead	The server is detected as dead and it will not be used for deadtime period. The time displayed in the output shows the server is in dead status for that amount of time.
	Unknown	The server is never used or the status is unknown.
Acct Status	The status of the accounting port. The status ("dead", “error”, or "alive") of the RADIUS accounting server and, if dead, how long it has been dead for.	

show radius statistics

This command shows the RADIUS client statistics for the switch.

Syntax `show radius statistics`

Mode User Exec and Privileged Exec

Example See the sample output below showing RADIUS client statistics and RADIUS configuration:

```
awplus# show radius statistics
```

Output Figure 69-4: Example output from the **show radius** statistics command:

```
RADIUS statistics for Server: 150.87.18.89
Access-Request Tx : 5 - Retransmit : 0
Access-Accept Rx : 1 - Access-Reject Rx : 2
Access-Challenge Rx : 2
Unknown Type : 0 - Bad Authenticator: 0
Malformed Access-Resp: 0 - Wrong Identifier: 0
Bad Attribute : 0 - Packet Dropped : 0
TimeOut : 0 - Dead count : 0
Pending Request: 0
```

undebug radius

This command applies the functionality of the no debug radius command on page 69.3.

Chapter 70: TACACS+ Introduction and Configuration

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Introduction

This chapter provides information about the AlliedWare Plus implementation of TACACS+ and how to configure it on this switch. For detailed descriptions of the commands used to configure TACACS+, see Chapter 71, TACACS+ Commands. For information about Authentication, Authorization and Accounting (AAA), see Chapter 66, AAA Introduction and Configuration and Chapter 67, AAA Commands.

TACACS+ Overview

TACACS+ (Terminal Access Controller Access-Control System Plus) provides a method for securely managing multiple network access points from a single management service.

TACACS+ is a TCP-based access control protocol, utilizing TCP port 49, that allows a device to forward a user's username and password to an authentication server to determine whether access can be allowed. In addition to this authentication service, TACACS+ can also provide authorization and accounting services.

One of the features of TACACS+ is the ability to separate authentication, authorization and accounting so that these functions can be provided independently on separate servers. Authentication involves identifying a user, typically by requiring the user to supply a valid username and password before access is granted. Following authentication, the user must gain authorization to perform tasks. For example, after logging into a switch, a user may try to issue configuration commands. The authorization process determines whether the user has the authority to issue these commands. Authorization is always preceded by authentication.

The AlliedWare Plus TACACS+ Implementation

The AlliedWare Plus TACACS+ implementation provides authentication, authorization, and accounting. Note that:

- Authorization cannot be performed independently of the authentication process. There are no authorization commands available.
- Authentication and authorization must be configured on the same server.
- Authorization is only applicable if enable password authentication has not been configured with the aaa authentication enable default group tacacs+ command.

With the AlliedWare Plus TACACS+ implementation, all traffic that passes between the TACACS+ client and the TACACS+ servers on the network is encrypted. TACACS+ encrypts the entire payload of packets, which means that it encrypts the user's password between the client and the server.

A TACACS+ client is available on your switch. You need a system running TACACS+ server software from a software provider to use the TACACS+ functionality on your switch.

Authentication

The TACACS+ protocol can forward many types of username and password information. The AlliedWare Plus TACACS+ implementation supports username and password login authentication, as well as enable password authentication. This information is encrypted over the network with MD5 (Message Digest 5).

When TACACS+ login authentication is enabled on the switch with the aaa authentication login command and at least one TACACS+ server is configured and reachable, all user login authentications are authenticated against the TACACS+ server. No local login or other means of authentication is allowed or accepted by the switch unless the switch has been configured to use another authentication method as a backup, and the TACACS+ server is not reachable.

When TACACS+ enable password authentication is enabled on the switch with the aaa authentication enable default group tacacs+ command and at least one TACACS+ server is configured and reachable, all user attempts to access a higher privilege level using the enable (Privileged Exec mode) command are authenticated against the TACACS+ server. If TACACS+ enable password authentication is enabled and the TACACS+ server is not reachable, then the user is only granted access to the desired privilege level if a backup authentication method is also configured.

Note

If TACACS+ login authentication is enabled on the switch, and enable password authentication is configured as default with the aaa authentication enable default local command, then a local enable password must be configured for each privilege level that needs to be accessible to users.

Authorization

In the AlliedWare Plus TACACS+ implementation, authorization cannot be performed independently of the authentication process. Authorization is concerned with what users are allowed to do once they have gained access to the managed device. This involves the passing of Attribute Value pairs (AV pairs) from the TACACS+ server to the managed device. An AV pair is made up of two pieces of information: the attribute that identifies the parameter to be set, and the value that specifies the value to assign to that parameter. These AV pairs are configured on a per-user or per-group basis on the TACACS+ server. The AV pairs that are supported by the AlliedWare Plus TACACS+ implementation are:

- Privilege Level

  Privilege levels range from 1 to 15, with 15 being the highest. For information about privilege levels see "How to Add and Remove Users" on page 1.32 and the username command on page 5.37.

- Timeout

  The value assigned to this attribute specifies the length of time that the session can exist. After this value has expired, the session will either be disconnected, or have the privilege of the user reduced. The valid range of timeout values is 0 to 65535 (minutes).

- Idletime

  If no input or output traffic is received or sent in the period specified by the value for this attribute, the session is disconnected. The valid idletime range is 0 to 65535 (minutes).

Note

In the AlliedWare Plus TACACS+ implementation, authorization for privilege level, timeout, and idletime AV pairs is only attempted if enable password authentication (aaa authentication enable default group tacacs+ command) is not configured. If enable password authentication is configured then the privilege level a user is granted access to is determined during the enable password authentication session.

Accounting

TACACS+ accounting usually takes place after authentication and authorization. However, because TACACS+ separates these three functions, neither authentication nor authorization are required for accounting to function. TACACS+ accounting provides the following two distinct functions:

- a record of services used for billing purposes
- an audit trail for user exec sessions

The AlliedWare Plus TACACS+ accounting implementation supports an audit trail for user exec sessions only. This includes the ability to configure accounting for user logins and logouts, and accounting of any commands executed by the user while they are logged into the switch.

TACACS+ accounting includes three different types of accounting records:

- start records that indicate a service is about to start
- stop records that indicate a service has just ended
- update records that indicate a service is still in progress

Configuration

This section describes how to set up TACACS+ for login authentication, enable password authentication, and accounting.

The TACACS+ server is normally a multiuser system running TACACS+ server software from a software provider. TACACS+ servers are identified on the basis of their host name or IP address. A TACACS+ server and a switch use a shared secret text string to encrypt passwords and exchange responses. To configure TACACS+, you must specify the host running the TACACS+ server software and a secret text string that it shares with the switch.

Configure TACACS+

Table 70-1: General configuration procedure for TACACS+ authentication and accounting

Specify a remote TACACS+ server and the shared secret key	
`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`tacacs-server host {<host-name>|<ip-address>} [key [8]<key-string>]`	Specify the IP address or host name of the remote TACACS+ server host and the shared secret key to use with the specified TACACS+ server. Specify 8 if you are entering a password as a string that has already been encrypted instead of entering a plain text password. As many as four TACACS+ servers can be configured and consulted for authentication and accounting. The first server configured is regarded as the primary server and if the primary server fails then the backup servers are consulted in turn.
`awplus(config)#`	
`tacacs-server key [8] <key-string>`	Specify the global shared secret text string used between the switch and all TACACS+ servers. Specify `8` if you are entering a password as a string that has already been encrypted instead of entering a plain text password. If no secret key is explicitly specified for a TACACS+ server with the tacacs-server host command, the global secret key will be used.
Specify the timeout value	
`awplus(config)#`	
`tacacs-server timeout <seconds>`	Specify for how many seconds a switch waits for a reply to a TACACS+ request before considering the TACACS+ server dead.
Define the method list for TACACS+ login authentication	
`awplus(config)#`	
`aaa authentication login {default|<list-name>} {[local] [group {radius|tacacs+|<group-name>}]}`	This method list defines the AAA server type used for login authentication. The server types are always used in the order specified with this command. If the first server in the method list is unreachable, the switch sends the request to the next server in the list. If the authentication server denies the authentication request because of an incorrect username or password then the user login fails.

Table 70-1: General configuration procedure for TACACS+ authentication and accounting(cont.)

Define the method list for TACACS+ enable password authentication	
`awplus(config)#`	
`aaa authentication enable default group tacacs+ [local] [none]`	This method list defines the authentication method used to determine the privilege command level a user can access. Specify local to use the locally configured enable password and none to grant access to Privileged Exec mode with no authentication, if the TACACS+ server goes offline, or is not reachable during enable password authentication.
Define the method for TACACS+ login accounting	
`awplus(config)#`	
`aaa accounting login {default|<list-name>} {start-stop|stop-only|none} {group {radius|tacacs+|<group-name>}}`	You can only define one method for login accounting, either RADIUS or TACACS+. Specify start-stop to send both start and stop login accounting records, stop-only to send only stop login accounting records, or none to disable the sending of login accounting records.
Configure TACACS+ command accounting	
`awplus(config)#`	
`aaa accounting commands <1-15> default stop-only group tacacs+`	TACACS+ command accounting is configured per privilege level and only commands of the specified privilege level are accounted. Therefore, if you require that all commands are accounted to the TACACS+ server, you must configure command accounting for each privilege level separately. Commands are accounted to the TACACS+ server after they have successfully executed.
Troubleshooting TACACS+	
`awplus(config)#`	
`show tacacs+`	Display the current TACACS+ server configuration and status.
`awplus#`	
`debug aaa authentication`	Enable debug output for TACACS+ authentication.
`awplus#`	
`debug aaa authorization`	Enable debug output for TACACS+ authorization.
`awplus#`	
`debug aaa accounting`	Enable debug output for TACACS+ accounting.

TACACS+ Configuration Example

Example The following example shows how to configure the switch to authenticate and account using TACACS+.

Figure 70-1: Sample TACACS+ authentication and accounting to configure the switch to authenticate and account user exec sessions

```
!
tacacs-server host 172.10.10.1
tacacs-server key tacacspass
aaa authentication login admin group tacacs+ local
aaa authentication enable default group tacacs+ local
aaa accounting login admin start-stop group tacacs+
aaa accounting commands 1 default stop-only group tacacs+
aaa accounting commands 7 default stop-only group tacacs+
aaa accounting commands 15 default stop-only group tacacs+

line console 0
login authentication admin
accounting login admin
!
```

The lines in this example TACACS+ authentication and accounting configuration are defined as follows:

- The tacacs-server host command defines the IP address of the TACACS+ server host.
- The tacacs-server key command defines the global shared secret text string between the network access server and the TACACS+ server host.
- The aaa authentication login command defines a method list named admin to use first the TACACS+ servers and then the local user database for user login authentication.
- The aaa authentication enable default group tacacs+ command defines a method list to use first the TACACS+ servers and then the local enable passwords, set with the enable password command, for user enable password authentication.
- The aaa accounting login command defines a method named admin to use TACACS+ servers for login accounting.
- The aaa accounting commands command specifies the privilege level of the commands that will be accounted.
- The login authentication command specifies that this method list will be used for authenticating users logging in on the asynchronous console port.
- The accounting login command specifies that this method list will be used for accounting users logging in on the asynchronous console port.

Chapter 71: TACACS+ Commands

Command List 71.2
tacacs-server host 71.2
tacacs-server key 71.4
tacacs-server timeout 71.5
show tacacs+ 71.6

Command List

This chapter provides an alphabetical reference for commands used to configure the device to use TACACS+ servers. For more information about TACAC+, see Chapter 70, TACACS+ Introduction and Configuration.

tacacs-server host

Use this command to specify a remote TACACS+ server host for authentication, authorization and accounting, and to set the shared secret key to use with the TACACS+ server. The parameters specified with this command override the corresponding global parameters for TACACS+ servers.

Use the no variant of this command to remove the specified server host as a TACACS+ authentication and authorization server.

Syntax

```
tacacs-server host {<host-name>|<ip-address>} [key [8]<key-string>]
no tacacs-server host {<host-name>|<ip-address>}
```

Parameter	Description
<host-name>	Server host name. The DNS name of the TACACS+ server host.
<ip-address>	The IP address of the TACACS+ server host, in dotted decimal notation A.B.C.D.
key	Set shared secret key with TACACS+ servers.
8	Specifies that you are entering a password as a string that has already been encrypted instead of entering a plain text password. The running config displays the new password as an encrypted string even if password encryption is turned off.
<key-string>	Shared key string applied, a value in the range 1 to 64 characters. Specifies the shared secret authentication or encryption key for all TACACS+ communications between this device and the TACACS+ server. This key must match the encryption used on the TACACS+ server. This setting overrides the global setting of the tacacs-server key command. If no key value is specified, the global value is used.

Default No TACACS+ server is configured by default.

Mode Global Configuration

Usage A TACACS+ server host cannot be configured multiple times like a RADIUS server.

As many as four TACACS+ servers can be configured and consulted for login authentication, enable password authentication and accounting. The first server configured is regarded as the primary server and if the primary server fails then the backup servers are consulted in turn. A backup server is consulted if the primary server fails, not if a login authentication attempt is rejected. The reasons a server would fail are:

- it is not network reachable
- it is not currently TACACS+ capable
- it cannot communicate with the switch properly due to the switch and the server having different secret keys

Examples To add the server `tac1.company.com` as the TACACS+ server host, use the following commands:

```
awplus# configure terminal
awplus(config)# tacacs-server host tac1.company.com
```

To set the secret key to `secret` on the TACACS+ server `192.168.1.1`, use the following commands:

```
awplus# configure terminal
awplus(config)# tacacs-server host 192.168.1.1 key secret
```

To remove the TACACS+ server `tac1.company.com`, use the following commands:

```
awplus# configure terminal
awplus(config)# no tacacs-server host tac1.company.com
```

Related Commands
aaa accounting commands
aaa authentication login
tacacs-server key
tacacs-server timeout
show tacacs+

tacacs-server key

This command sets a global secret key for TACACS+ authentication, authorization and accounting. The shared secret text string is used for TACACS+ communications between the switch and all TACACS+ servers.

Note that if no secret key is explicitly specified for a TACACS+ server with the tacacs-server host command, the global secret key will be used for the shared secret for the server.

Use the no variant of this command to remove the global secret key.

Syntax

```
tacacs-server key [8] <key-string>
no tacacs-server key
```

Parameter	Description
8	Specifies a string in an encrypted format instead of plain text. The running config will display the new password as an encrypted string even if password encryption is turned off.
<key-string>	Shared key string applied, a value in the range 1 to 64 characters. Specifies the shared secret authentication or encryption key for all TACACS+ communications between this device and all TACACS+ servers. This key must match the encryption used on the TACACS+ server.

Mode Global Configuration

Usage Use this command to set the global secret key shared between this client and its TACACS+ servers. If no secret key is specified for a particular TACACS+ server using the tacacs-server host command, this global key is used.

Examples To set the global secret key to `secret` for TACACS+ server, use the following commands:

```
awplus# configure terminal
awplus(config)# tacacs-server key secret
```

To delete the global secret key for TACACS+ server, use the following commands:

```
awplus# configure terminal
awplus(config)# no tacacs-server key
```

Related Commands tacacs-server host
show tacacs+

tacacs-server timeout

Use this command to specify the TACACS+ global timeout value. The timeout value is how long the device waits for a reply to a TACACS+ request before considering the server to be dead.

Note that this command configures the timeout parameter for TACACS+ servers globally.

The no variant of this command resets the transmit timeout to the default (5 seconds).

Syntax

```
tacacs-server timeout <seconds>
no tacacs-server timeout
```

Parameter	Description
<seconds>	TACACS+ server timeout in seconds, in the range 1 to 1000.

Default The default timeout value is 5 seconds.

Mode Global Configuration

Examples To set the timeout value to 3 seconds, use the following commands:

```
awplus# configure terminal
awplus(config)# tacacs-server timeout 3
```

To reset the timeout period for TACACS+ servers to the default, use the following commands:

```
awplus# configure terminal
awplus(config)# no tacacs-server timeout
```

Related Commands

tacacs-server host
show tacacs+

show tacacs+

This command displays the current TACACS+ server configuration and status.

Syntax `show tacacs+`

Mode User Exec and Privileged Exec

Example To display the current status of TACACS+ servers, use the command:

```
awplus# show tacacs+
```

Output Figure 71-1: Example output from the **show tacacs+** command

```
TACACS+ Global Configuration
  Timeout              : 5 sec

Server Host/       Server
IP Address         Status
------------------------------------------------------------
192.168.1.10       Alive
192.168.1.11       Unknown
```

Table 71-1: Parameters in the output of the **show tacacs+** command

Output Parameter	Meaning	
`Timeout`	A time interval in seconds.	
`Server Host/IP Address`	TACACS+ server hostname or IP address.	
`Server Status`	The status of the authentication port.	
	`Alive`	The server is alive.
	`Dead`	The server has timed out.
	`Error`	The server is not responding or there is an error in the key string entered.
	`Unknown`	The server is never used or the status is unkown.
	`Unreachable`	The server is unreachable.
	`Unresolved`	The server name can not be resolved.

Chapter 72: Local RADIUS Server Introduction and Configuration

Local RADIUS Server Introduction 72.2
- Enable the Local RADIUS Server 72.2
- Add the Local RADIUS Server as a RADIUS Server 72.3
- Add authenticators to the list of authenticators 72.3
- Configure the Local RADIUS Server User Database 72.4
- Authenticating login sessions 72.5
- RADIUS Authentication with User Privileges 72.5
- Creating certificates for single users and all users 72.7

Defined RADIUS attributes list 72.8

Local RADIUS Server Introduction

Local RADIUS Server provides a user authentication service feature. This feature must be enabled on the switch, because it is disabled by default. For details of commands used to configure the local RADIUS server, see Chapter 73, Local RADIUS Server Commands.

Enable the Local RADIUS Server

The Local RADIUS Server is disabled by default. Enter the following commands to enable the Local RADIUS Server:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# server enable
```

This will automatically initialize the internal Certificate Authority (CA) in the switch. It will also automatically create a server certificate and enrol the certificate with the Local CA by implicitly executing the following commands:

```
awplus(config)# crypto pki trustpoint local
awplus(config)# crypto pki enroll local
```

The crypto pki trustpoint local command declares the Local CA as the CA from which to obtain Certificates. The Local CA has be defined first so Certificates can be obtained from it. The crypto pki enroll local command obtains the system certificate from the Local CA.

The switch is automatically added to the list of authenticators that may send authentication requests to the Local RADIUS Server by implicitly executing the following commands:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# nas 127.0.0.1 key awplus-local-radius-
server
```

Note

The key awplus-local-radius-server is a pre-defined component that can be used for internal exchanges between the switch's RADIUS client and its RADIUS server.

Add the Local RADIUS Server as a RADIUS Server

Although the switch is automatically defined as a NAS (Network Access Server) for the Local RADIUS Server, you must manually add the Local RADIUS Server to the server list defined for the Local RADIUS Client.

Use the following commands to add the Local RADIUS Server as a RADIUS Server. The Local RADIUS Client can then send authentication requests to its Local RADIUS Server:

```
awplus# configure terminal
awplus(config)# radius-server host 127.0.0.1 key awplus-local-
radius-server
```

Add authenticators to the list of authenticators

Authenticators can send authentication requests to the Local RADIUS Server.

Use the following commands to add other authenticators to the list of authenticators.

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# nas <nas-ip-address> key <nas-keystring>
```

Configure the Local RADIUS Server User Database

Add users to the RADIUS user list without assigning VLANs

For entries that will be used to authenticate dot1x supplicants, but not assign them to a VLAN, the following commands will add users to the RADIUS user list:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# user <radius-user-name> password <user-password>
```

Add users to the RADIUS user list and assign VLANs

Add users to the RADIUS user list, and define a VLAN ID that will be assigned to them.

To add entries to be used to authenticate dot1x supplicants, and assign them to a VLAN, follow the two steps shown below:

Step 1: Create groups associated with the VIDs that will be allocated

Enter the following commands to create groups with the VIDs that will be allocated to them:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# group VLAN10Users
awplus(config-radsrv)# vlan 10
awplus(config-radsrv)# group VLAN11Users
awplus(config-radsrv)# vlan 11
```

Step 2: Add the users after creating groups

Add the users and refer to the relevant group in the command that creates the user as below:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# user VCSPCVLAN10 password VCSPCPass
                       group VLAN10Users
awplus(config-radsrv)# user VCSPCVLAN11 password VCSPCPass
                       group VLAN11Users
```

Authenticating login sessions

Authentication can be performed in multiple contexts, such as the authentication of users logging in at a console, as well as tri-authentication of devices connecting to switch ports, see Tri-Authentication Configuration in Chapter 64, Authentication Introduction and Configuration.

RADIUS Authentication with User Privileges

A new security privilege level is available from release 5.4.1. Users with privilege levels 1 to 6 will continue to have access to privilege 1 level commands. Users with privilege 7 to 14 will have access to level 1 commands plus all show commands. Users with privilege level 15 will continue to have access to all commands.

As a result of this new intermediate access level, when a user logs into a management session on a switch running release 5.4.1, and is being authenticated by RADIUS, the RADIUS server needs to be able to indicate to the switch what privilege level to assign to the user's session.

In particular, this means that extra configuration is now required when the RADIUS Server is being set up with users for who will be logging into the switch by console, telnet, or SSH.

The way that the privilege level is associated with a user is, of course, to use the RADIUS attributes. The attributes are configured on RADIUS groups.

Since there are now three security privilege levels there will need to be up to three different groups for login users; each group specifying a different privilege level.

The attributes that need to be configured on the three different RADIUS groups are as follows:

1. For the users with a privilege level of 1-6 use just the RADIUS `attribute Service-Type`, and assign it the value `NAS-Prompt-User`:

```
attribute Service-Type NAS-Prompt-User
```

2. For users with the security privilege of 7-14 use the following 2 RADIUS attributes:

```
attribute Cisco-AVPair shell:priv-lvl=7
attribute Service-Type NAS-Prompt-User
```

3. User with the administrator security privilege use just the RADIUS `attribute Service-Type`, and assign it the value `Administrative-User`:

```
attribute Service-Type Administrative-User
```

Since there is not an explicit RADIUS attribute for the users with the security privilege level 7, we use "`Cisco-AVPair`" to specify this user privilege. But it's very important that we also specify the attribute `Service-Type NAS-Prompt-User` as well, otherwise the following error is generated when a user allocated to this group tries to login into the AlliedWare Plus switch:

```
19:09:14 awplus login[16974]: Invalid user name "tests" in main:698.
Abort.
```

The RADIUS Server attribute `NAS-Prompt-User` is used for non-privileged level users as per the RADIUS RFC. This attribute is used for users with security privilege levels of 1 to 6.

Configuring these RADIUS Server attributes is achieved using Local RADIUS Server commands:

```
                    awplus# configure terminal
             awplus(config)# radius-server local
       awplus(config-radsrv)# group users
awplus(config-radsrv-group)# attribute Service-Type NAS-
                              Prompt_User
```

See the below sample configuration for an AlliedWare Plus switch acting as the RADIUS Server, with the three different security privileges for `admin`, `middle-management`, and `users` groups:

Figure 72-1: Sample RADIUS Server configuration for three different security privileges:

```
crypto pki trustpoint local
!
crypto pki enroll local
radius-server local
 server enable
 nas 10.1.1.1 key test
 nas 127.0.0.1 key awplus-local-radius-server
 group admin
  attribute Service-Type Administrative-User
 group middle-management
  attribute Cisco-AVPair shell:priv-lvl=7
  attribute Service-Type NAS-Prompt-User
 group users
  attribute Service-Type NAS-Prompt-User
 user test encrypted password UukoSyvxY2v9iWXm8e/
JMDJd9iIc3RPyY09lGOb3pA4= group  users
 user tested encrypted password
sEDhM4iJRfJrLhhs+RgjpgkDXtCwuji6AllpApi9EjA= group admin
 user tests encrypted password il9aIh8JLOT6kHDV+Ix7/
8fzyfVpAwRErJg6NPQdJy8= group middle-management
```

Removing users from the RADIUS users list

To remove the user Tom from the user database of the Local RADIUS server, use the commands:

```
                    awplus# configure terminal
             awplus(config)# radius-server local
awplus(config-radsrv)# no user Tom
```

Creating certificates for single users and all users

Create a certificate for a single user

A certificate for user Tom can be created from the local CA by using the commands:

```
awplus# configure terminal
awplus(config)# crypto pki enroll local user Tom
```

Create a certificate for all users

Certificates can be created for all currently defined users by using the commands:

```
awplus# configure terminal
awplus(config)# crypto pki enroll local local-radius-all-users
```

Exporting certificates

User certificates can be exported in PKCS12 format.

To export a certificate for user Tom and upload it to the TFTP server at 192.168.1.1, use the commands:

```
awplus# configure terminal
awplus(config)# crypto pki export local pkcs12 Tom tftp://
192.168.1.1/tomcert.pkcs
```

Defined RADIUS attributes list

This is a full list of valid attributes and pre-defined values that may be used in conjunction with the attribute command on page 73.2, to show or configure defined RADIUS attributes.

Table 72-1 lists all Standard attributes and values, Table 72-2 lists the Vendor-Specific attribute (attribute ID 26) names and values.

More detailed information can be found in the following RFCs, defining the attributes and values for RADIUS server:

- RFC2865: Remote Authentication Dial In User Service (RADIUS)
- RFC2866: RADIUS Accounting
- RFC2867: RADIUS Accounting Modifications for Tunnel Protocol Support
- RFC2868: RADIUS Attributes for Tunnel Protocol Support
- RFC2869: RADIUS Extensions
- RFC3162: RADIUS and IPv6
- RFC3576: Dynamic Authorization Extensions to Remote Authentication Dial In User Service (RADIUS)
- RFC3580: IEEE 802.1X Remote Authentication Dial In User Service (RADIUS) Usage Guidelines
- RFC4072: Diameter Extensible Authentication Protocol (EAP) Application
- RFC4372: Chargeable User Identity
- RFC4603: Additional Values for the NAS-Port-Type Attribute
- RFC4675: RADIUS Attributes for Virtual LAN and Priority Support
- RFC4679: DSL Forum Vendor-Specific RADIUS Attributes
- RFC4818: RADIUS Delegated-IPv6-Prefix Attribute
- RFC4849: RADIUS Filter Rule Attribute
- RFC5176: Dynamic Authorization Extensions to Remote Authentication Dial In User Service (RADIUS)
- RFC5580: Carrying Location Objects in RADIUS and Diameter
- RFC5607: Remote Authentication Dial-In User Service (RADIUS) Authorization for Network Access Server (NAS) Management
- RFC5904: RADIUS Attributes for IEEE 802.16 Privacy Key Management Version 1 (PKMv1) Protocol Support

Table 72-1: Standard RADIUS Attributes

Attribute ID and Name		Value Type/Pre-defined Values
1	User-Name	string
2	User-Password	string
3	CHAP-Password	octets (Hexadecimal string followed by 0x)
4	NAS-IP-Address	ipaddr (IPv4 address)
5	NAS-Port	Integer
6	Service-Type	Integer. Valid values are: ■ Administrative-User (6) ■ Authenticate-Only (8) ■ Authorize-Only (17) ■ Callback-Administrative (11) ■ Callback-Framed-User (4) ■ Callback-Login-User (3) ■ Callback-NAS-Prompt (9) ■ Call-Check (10) ■ Framed-Management (18) ■ Framed-User (2) ■ Login-User (1) ■ NAS-Prompt-User (7) ■ Outbound-User (5)
7	Framed-Protocol	Integer. Valid values are: ■ ARAP (3) ■ Gandalf-SLML (4) ■ PPP (1) ■ SLIP (2) ■ X.75-Synchronous (6) ■ Xylogics-IPX-SLIP (5)
8	Framed-IP-Address	ipaddr (IPv4 address)
9	Framed-IP-Netmask	ipaddr (IPv4 address)
10	Framed-Routing	integer. Valid values are: ■ Broadcast (1) ■ Broadcast-Listen (3) ■ Listen (2) ■ None (0)
11	Filter-Id	string
12	Framed-MTU	Integer
13	Framed-Compression	Integer. Valid values are: ■ IPX-Header-Compression (2) ■ None (0) ■ Stac-LZS (3) ■ Van-Jacobson-TCP-IP (1)
14	Login-IP-Host	IP Address

Table 72-1: Standard RADIUS Attributes(cont.)

Attribute ID and Name		Value Type/Pre-defined Values
15	Login-Service	Integer. Valid values are: ■ LAT (4) ■ PortMaster (3) ■ Rlogin (1) ■ TCP-Clear (2) ■ TCP-Clear-Quiet (8) ■ Telnet (0) ■ X25-PAD (5) ■ X25-T3POS (6)
16	Login-TCP-Port	Integer. Valid values are: ■ Rlogin (513) ■ Rsh (514) ■ Telnet (23)
18	Reply-Message	string
19	Callback-Number	string
20	Callback-Id	string
22	Framed-Route	string
23	Framed-IPX-Network	IP address
24	State	octets (Hexadecimal string followed by 0x)
25	Class	octets (Hexadecimal string followed by 0x)
26	Vendor-Specific	Use the Vendor-specific Attribute Name. For valid values, see "Vendor-Specific RADIUS Attributes" on page 72.17.
27	Session-Timeout	Integer
28	Idle-Timeout	Integer
29	Termination-Action	Integer. Valid values are: ■ Default (0) ■ RADIUS-Request (1)
30	Called-Station-Id	string
31	Calling-Station-Id	string
32	NAS-Identifier	string
33	Proxy-State	octets (Hexadecimal string followed by 0x)
34	Login-LAT-Service	string
35	Login-LAT-Node	string
36	Login-LAT-Group	octets (Hexadecimal string followed by 0x)
37	Framed-AppleTalk-Link	Integer
38	Framed-AppleTalk-Network	Integer

Table 72-1: Standard RADIUS Attributes(cont.)

Attribute ID and Name		Value Type/Pre-defined Values
39	Framed-AppleTalk-Zone	string
40	Acct-Status-Type	Integer. Valid values are: ■ Accounting-Off (8) ■ Accounting-On (7) ■ Alive (3) ■ Failed (15) ■ Interim-Update (3) ■ Start (1) ■ Stop (2) ■ Tunnel-Link-Reject (14) ■ Tunnel-Link-Start (12) ■ Tunnel-Link-Stop (13) ■ Tunnel-Reject (11) ■ Tunnel-Start (9) ■ Tunnel-Stop (10)
41	Acct-Delay-Time	Integer
42	Acct-Input-Octets	Integer
43	Acct-Output-Octets	Integer
44	Acct-Session-Id	string
45	Acct-Authentic	Integer. Valid values are: ■ Diameter (4) ■ Local (2) ■ RADIUS (1) ■ Remote (3)
46	Acct-Session-Time	Integer
47	Acct-Input-Packets	Integer
48	Acct-Output-Packets	Integer

Table 72-1: Standard RADIUS Attributes(cont.)

Attribute ID and Name		Value Type/Pre-defined Values
49	Acct-Terminate-Cause	Integer. Valid values are: ■ Admin-Reboot (7) ■ Admin-Reset (6) ■ Callback (16) ■ Host-Request (18) ■ Idle-Timeout (4) ■ Lost-Carrier (2) ■ Lost-Service (3) ■ NAS-Error (9) ■ NAS-Reboot (11) ■ NAS-Request (10) ■ Port-Disabled (22) ■ Port-Error (8) ■ Port-Preempted (13) ■ Port-Reinit (21) ■ Port-Suspended (14) ■ Port-Unneeded (12) ■ Reauthentication-Failure (20) ■ Service-Unavailable (15) ■ Session-Timeout (5) ■ Supplicant-Restart (19) ■ User-Error (17) ■ User-Request (1)
50	Acct-Multi-Session-Id	string
51	Acct-Link-Count	Integer
52	Acct-Input-Gigawords	Integer
53	Acct-Output-Gigawords	Integer
55	Event-Timestamp	date (Not supported)
56	Egress-VLANID	Integer
57	Ingress-Filters	Integer. Valid values are: ■ Disabled (2) ■ Enabled (1)
58	Egress-VLAN-Name	string
59	User-Priority-Table	octets (Hexadecimal string followed by 0x)
60	CHAP-Challenge	octets (Hexadecimal string followed by 0x)
61	NAS-Port-Type	Integer. Valid values are: ■ ADSL-CAP (12) ■ ADSL-DMT (13) ■ Async (0) ■ Cable (17) ■ Ethernet (15) ■ FDDI (21) ■ G.3-Fax (10) ■ HDLC-Clear-Channel (7)

Table 72-1: Standard RADIUS Attributes(cont.)

Attribute ID and Name		Value Type/Pre-defined Values
61	NAS-Port-Type (cont.)	Integer. Valid values are: ■ IDSL (14) ■ ISDN (2) ■ ISDN-V110 (4) ■ ISDN-V120 (3) ■ PIAFS (6) ■ PPPoA (30) ■ PPPoEoA (31) ■ PPPoEoE (32) ■ PPPoEoQinQ (34) ■ PPPoEoVLAN (33) ■ SDSL (11) ■ Sync (1) ■ Token-Ring (20) ■ Virtual (5) ■ Wireless-802.11 (19) ■ Wireless-Other (18) ■ X.25 (8) ■ X.75 (9) ■ xDSL (16)
62	Port-Limit	Integer
63	Login-LAT-Port	string
64	Tunnel-Type	Integer. Valid values are: ■ AH (6) ■ ATMP (4) ■ DVS (11) ■ ESP (9) ■ GRE (10) ■ IP (7) ■ IP-in-IP (12) ■ L2F (2) ■ L2TP (3) ■ MIN-IP (8) ■ PPTP (1) ■ VLAN (13) ■ VTP (5)

Table 72-1: Standard RADIUS Attributes(cont.)

Attribute ID and Name		Value Type/Pre-defined Values
65	Tunnel-Medium-Type	Integer. Valid values are: ■ Appletalk (12) ■ Banyan-Vines (14) ■ BBN-1822 (5) ■ DecNet-IV (13) ■ E.163 (7) ■ E.164 (8) ■ E.164-NSAP (15) ■ F.69 (9) ■ HDLC (4) ■ IEEE-802 (6) ■ IP (1) ■ IPv4 (1) ■ IPv6 (2) ■ IPX (11) ■ NSAP (3) ■ X.121 (10)
66	Tunnel-Client-Endpoint	string
67	Tunnel-Server-Endpoint	string
68	Acct-Tunnel-Connection	string
69	Tunnel-Password	string
70	ARAP-Password	octets (Hexadecimal string followed by 0x)
71	ARAP-Features	octets (Hexadecimal string followed by 0x)
72	ARAP-Zone-Access	Integer. Valid values are: ■ Default-Zone (1) ■ Zone-Filter-Exclusive (4) ■ Zone-Filter-Inclusive (2)
73	ARAP-Security	Integer
74	ARAP-Security-Data	string
75	Password-Retry	integer
76	Prompt	integer. Valid values are: ■ Echo (1) ■ No-Echo (0)
77	Connect-Info	string
78	Configuration-Token	string
79	EAP-Message	octets (Hexadecimal string followed by 0x)
80	Message-Authenticator	octets (Hexadecimal string followed by 0x)
81	Tunnel-Private-Group-Id	string
82	Tunnel-Assignment-Id	string
83	Tunnel-Preference	Integer

Table 72-1: Standard RADIUS Attributes(cont.)

Attribute ID and Name		Value Type/Pre-defined Values
84	ARAP-Challenge-Response	octets (Hexadecimal string followed by 0x)
85	Acct-Interim-Interval	Integer
86	Acct-Tunnel-Packets-Lost	Integer
87	NAS-Port-Id	string
88	Framed-Pool	string
89	Chargeable-User-Identity	string
90	Tunnel-Client-Auth-Id	string
91	Tunnel-Server-Auth-Id	string
92	NAS-Filter-Rule	string
95	NAS-IPv6-Address	ipv6addr (IPv6 address)
96	Framed-Interface-Id	ifid (Not supported)
97	Framed-IPv6-Prefix	ipv6prefix (Not supported)
98	Login-IPv6-Host	ipv6addr (IPv6 address)
99	Framed-IPv6-Route	string
100	Framed-IPv6-Pool	string
101	Error-Cause	Integer. Valid values are: ■ Administratively-Prohibited (501) ■ Invalid-Attribute-Value (407) ■ Invalid-EAP-Packet (202) ■ Invalid-Request (404) ■ Missing-Attribute (402) ■ Multiple-Session-Selection-Unsupported (508) ■ NAS-Identification-Mismatch (403) ■ Proxy-Processing-Error (505) ■ Proxy-Request-Not-Routable (502) ■ Request-Initiated (507) ■ Residual-Context-Removed (201) ■ Resources-Unavailable (506) ■ Session-Context-Not-Found (503) ■ Session-Context-Not-Removable (504) ■ Unsupported-Attribute (401) ■ Unsupported-Extension (406) ■ Unsupported-Service (405)
102	EAP-Key-Name	string
123	Delegated-IPv6-Prefix	ipv6prefix
126	Operator-Name	string
127	Location-Information	octets (Hexadecimal string followed by 0x)
128	Location-Data	octets (Hexadecimal string followed by 0x)

Table 72-1: Standard RADIUS Attributes(cont.)

Attribute ID and Name		Value Type/Pre-defined Values
129	Basic-Location-Policy-Rules	octets (Hexadecimal string followed by 0x)
130	Extended-Location-Policy-Rules	octets (Hexadecimal string followed by 0x)
131	Location-Capable	Integer. Valid values are: ■ Civix-Location (1) ■ Geo-Location (2) ■ NAS-Location (8) ■ Users-Location (4)
132	Requested-Location-Info	Integer. Valid values are: ■ Civix-Location (1) ■ Future-Requests (16) ■ Geo-Location (2) ■ NAS-Location (8) ■ None (32) ■ Users-Location (4)
133	Framed-Management	Integer. Valid values are: ■ FTP (4) ■ Netconf (3) ■ RCP (7) ■ SCP (8) ■ SFTP (6) ■ SNMP (1) ■ TFTP (5)
134	Management-Transport-Protection	Integer. Valid values are: ■ Integrity-Confidentiality-Protection (3) ■ Integrity-Protection (2) ■ No-Protection (1)
135	Management-Policy-Id	string
136	Management-Privilege-Level	Integer
137	PKM-SS-Cert	octets (Hexadecimal string followed by 0x)
138	PKM-CA-Cert	octets (Hexadecimal string followed by 0x)
139	PKM-Config-Settings	octets (Hexadecimal string followed by 0x)
140	PKM-Cryptosuite-List	octets (Hexadecimal string followed by 0x)
141	PKM-SAID	short
142	PKM-SA-Descriptor	octets (Hexadecimal string followed by 0x)
143	PKM-Auth-Key	octets (Hexadecimal string followed by 0x)

Table 72-2: Vendor-Specific RADIUS Attributes

Vendor-Specific Attribute Name	Value Type/Pre-defined Value
Actual-Data-Rate-Downstream	integer
Actual-Data-Rate-Upstream	integer
Actual-Interleaving-Delay-Downstream	integer
Actual-Interleaving-Delay-Upstream	integer
ADSL-Agent-Circuit-Id	string
ADSL-Agent-Remote-Id	string
Attainable-Data-Rate-Downstream	integer
Attainable-Data-Rate-Upstream	integer
call-id	string
Cisco-Abort-Cause	string
Cisco-Account-Info	string
Cisco-Assign-IP-Pool	integer
Cisco-AVPair	string
Cisco-Call-Filter	integer
Cisco-Call-Type	string
Cisco-Command-Code	string
Cisco-Control-Info	string
Cisco-Data-Filter	integer
Cisco-Data-Rate	integer

Table 72-2: Vendor-Specific RADIUS Attributes (cont.)

Vendor-Specific Attribute Name	Value Type/Pre-defined Value
Cisco-Disconnect-Cause	integer. Valid values are: ■ CLID-Authentication-Failure - 4 ■ Control-C-Detected - 27 ■ EXEC-Program-Destroyed - 28 ■ Exit-Raw-TCP - 24 ■ Exit-Telnet-Session - 22 ■ Failed-PPP-CHAP-Auth - 43 ■ Failed-PPP-LCP-Negotiation - 41 ■ Failed-PPP-PAP-Auth-Fail - 42 ■ Failed-PPP-Remote-Auth - 44 ■ Idle-Timeout - 21 ■ Invalid-Protocol - 120 ■ Lost-Carrier - 1 ■ No-Carrier - 0 ■ No-Detected-Result-Codes - 2 ■ No-Remote-IP-Addr - 23 ■ Password-Fail - 25 ■ PPP-Closed-Event- 46 ■ PPP-Remote-Terminate - 45 ■ Raw-TCP-Disabled - 26 ■ Session-End-Callback - 02 ■ Session-Failed-Security - 01 ■ Session-Timeout - 00 ■ Timeout-PPP-LCP - 40 ■ Unknown - 2 ■ User-Ends-Session - 20
Cisco-Email-Server-Ack-Flag	string
Cisco-Email-Server-Address	string
Cisco-Fax-Account-Id-Origin	string
Cisco-Fax-Auth-Status	string
Cisco-Fax-Connect-Speed	string
Cisco-Fax-Coverpage-Flag	string
Cisco-Fax-Dsn-Address	string
Cisco-Fax-Dsn-Flag	string
Cisco-Fax-Mdn-Address	string
Cisco-Fax-Mdn-Flag	string
Cisco-Fax-Modem-Time	string
Cisco-Fax-Msg-Id	string
Cisco-Fax-Pages	string
Cisco-Fax-Process-Abort-Flag	string
Cisco-Fax-Recipient-Count	string
Cisco-Gateway-Id	string

Table 72-2: Vendor-Specific RADIUS Attributes (cont.)

Vendor-Specific Attribute Name	Value Type/Pre-defined Value
Cisco-Idle-Limit	integer
Cisco-IP-Direct	integer
Cisco-IP-Pool-Definition	string
Cisco-Link-Compression	integer
Cisco-Maximum-Channels	integer
Cisco-Maximum-Time	integer
Cisco-Multilink-ID	integer
Cisco-NAS-Port	string
Cisco-Num-In-Multilink	integer
Cisco-Policy-Down	string
Cisco-Policy-Up	string
Cisco-Port-Used	string
Cisco-PPP-Async-Map	integer
Cisco-PPP-VJ-Slot-Comp	integer
Cisco-Pre-Input-Octets	integer
Cisco-Pre-Input-Packets	integer
Cisco-Pre-Output-Octets	integer
Cisco-Pre-Output-Packets	integer
Cisco-PreSession-Time	integer
Cisco-PW-Lifetime	integer
Cisco-Route-IP	integer
Cisco-Service-Info	string
Cisco-Subscriber-Password	string
Cisco-Target-Util	integer
Cisco-Xmit-Rate	integer
gw-final-xlated-cdn	string
gw-final-xlated-cgn	string
gw-rxd-cdn	string
gw-rxd-cgn	string
h323-billing-model	string
h323-call-origin	string

Table 72-2: Vendor-Specific RADIUS Attributes (cont.)

Vendor-Specific Attribute Name	Value Type/Pre-defined Value
h323-call-type	string
h323-conf-id	string
h323-connect-time	string
h323-credit-amount	string
h323-credit-time	string
h323-currency	string
h323-disconnect-cause	string
h323-disconnect-time	string
h323-gw-id	string
h323-incoming-conf-id	string
h323-preferred-lang	string
h323-prompt-id	string
h323-redirect-ip-address	string
h323-redirect-number	string
h323-remote-address	string
h323-return-code	string
h323-setup-time	string
h323-time-and-day	string
h323-voice-quality	string
incoming-req-uri	string
IWF-Session	octets
Maximum-Data-Rate-Downstream	integer
Maximum-Data-Rate-Upstream	integer
Maximum-Interleaving-Delay-Downstream	integer
Maximum-Interleaving-Delay-Upstream	integer
method	string
Minimum-Data-Rate-Downstream	integer
Minimum-Data-Rate-Downstream-Low-Power	integer
Minimum-Data-Rate-Upstream	integer
Minimum-Data-Rate-Upstream-Low-Power	integer

Table 72-2: Vendor-Specific RADIUS Attributes (cont.)

Vendor-Specific Attribute Name	Value Type/Pre-defined Value
MS-Acct-Auth-Type	integer. Valid values are: ■ CHAP - 2 ■ EAP - 5 ■ MS-CHAP-1 - 3 ■ MS-CHAP-2 - 4 ■ PAP - 1
MS-Acct-EAP-Type	integer. Valid values are: ■ Generic-Token-Card - 6 ■ MD5 - 4 ■ OTP - 5 ■ TLS -13
MS-AFW-Protection-Level	integer. Valid values are: ■ HECP-Response-Sign-And-Encrypt - 2 ■ HECP-Response-Sign-Only - 1
MS-AFW-Zone	integer. Valid values are: ■ MS-AFW-Zone-Boundary-Policy - 1 ■ MS-AFW-Zone-Protected-Policy - 3 ■ MS-AFW-Zone-Unprotected-Policy - 2
MS-ARAP-PW-Change-Reason	integer. Valid values are: ■ Admin-Requires-Password-Change - 3 ■ Expired-Password - 2 ■ Just-Change-Password - 1 ■ Password-Too-Short - 4
MS-BAP-Usage	integer. Valid values are: ■ Allowed - 1 ■ Not-Allowed - 0 ■ Required - 2
MS-CHAP2-CPW	octets
MS-CHAP2-Response	octets
MS-CHAP2-Success	octets
MS-CHAP-Challenge	octets
MS-CHAP-CPW-1	octets
MS-CHAP-CPW-2	octets
MS-CHAP-Domain	string
MS-CHAP-Error	string
MS-CHAP-LM-Enc-PW	octets
MS-CHAP-MPPE-Keys	octets
MS-CHAP-NT-Enc-PW	octets
MS-CHAP-Response	octets

Table 72-2: Vendor-Specific RADIUS Attributes (cont.)

Vendor-Specific Attribute Name	Value Type/Pre-defined Value
MS-Extended-Quarantine-State	integer. Valid values are: ■ Infected - 2 ■ No-Data - 4 ■ Transition - 1 ■ Unknown - 3
MS-Filter	octets
MS-HCAP-Location-Group-Name	string
MS-HCAP-User-Groups	string
MS-HCAP-User-Name	string
MS-Identity-Type	integer. Valid values are: ■ Ignore-User-Lookup-Failure - 2 ■ Machine-Health-Check - 1
MS-IPv4-Remediation-Servers	octets
MS-IPv6-Filter	octets
MS-IPv6-Remediation-Servers	octets
MS-Link-Drop-Time-Limit	integer
MS-Link-Utilization-Threshold	integer
MS-Machine-Name	string
MS-MPPE-Encryption-Policy	octets
MS-MPPE-Encryption-Type	octets
MS-MPPE-Encryption-Types	octets
MS-MPPE-Recv-Key	octets
MS-MPPE-Send-Key	octets
MS-Network-Access-Server-Type	integer. Valid values are: ■ DHCP-Server - 3 ■ HCAP-Server - 6 ■ HRA - 5 ■ Remote-Access-Server - 2 ■ Terminal-Server-Gateway - 1 ■ Unspecified - 0 ■ Wireless-Access-Point - 4
MS-New-ARAP-Password	octets
MS-Old-ARAP-Password	octets
MS-Primary-DNS-Server	ipaddr
MS-Primary-NBNS-Server	ipaddr
MS-Quarantine-Grace-Time	integer

Table 72-2: Vendor-Specific RADIUS Attributes (cont.)

Vendor-Specific Attribute Name	Value Type/Pre-defined Value
MS-Quarantine-IPFilter	octets
MS-Quarantine-Session-Timeout	integer
MS-Quarantine-SOH	octets
MS-Quarantine-State	integer. Valid values are: ■ Full-Access - 0 ■ Probation - 2 ■ Quarantine - 1
MS-Quarantine-User-Class	string
MS-RAS-Client-Name	string
MS-RAS-Client-Version	string
MS-RAS-Correlation	octets
MS-RAS-Vendor	integer
MS-RAS-Version	string
MS-RNAP-Not-Quarantine-Capable	integer. Valid values are: ■ SoH-Not-Sent - 1 ■ SoH-Sent - 0
MS-Secondary-DNS-Server	ipaddr
MS-Secondary-NBNS-Server	ipaddr
MS-Service-Class	string
MS-TSG-Device-Redirection	integer
MS-User-IPv4-Address	ipaddr
MS-User-IPv6-Address	ipv6addr
MS-User-Security-Identity	string
next-hop-dn	string
next-hop-ip	string
outgoing-req-uri	string
prev-hop-ip	string
prev-hop-via	string
release-source	string
remote-media-address	string
session-protocol	string
sip-conf-id	string

Table 72-2: Vendor-Specific RADIUS Attributes (cont.)

Vendor-Specific Attribute Name	Value Type/Pre-defined Value
sip-hdr	string
subscriber	string

Chapter 73: Local RADIUS Server Commands

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Command List

This chapter provides an alphabetical reference for commands used to configure the local RADIUS server on the device. For more information, see Chapter 72, Local RADIUS Server Introduction and Configuration.

attribute

Use this command to define a RADIUS attribute for the local RADIUS server user group.

For a complete list of defined RADIUS attributes and values, see "Defined RADIUS attributes list" on page 72.8.

When used with the help parameter the attribute command displays a list of standard and vendor specific valid RADIUS attributes that are supported by the local RADIUS server.

If an attribute name is specified with the help parameter, then the attribute command displays a list of predefined attribute names. Note that you can only use the defined RADIUS attribute names and not define your own.

When used with the value parameter the attribute command configures RADIUS attributes to the user group. If the specified attribute is already defined then it is replaced with the new value.

Use the no variant of this command to delete an attribute from the local RADIUS server user group.

Syntax

```
attribute [<attribute-name>|<attribute-id>] help
attribute {<attribute-name>|<attribute-id>} <value>
no attribute {<attribute-name>|<attribute-id>}
```

Parameter	Description
<attribute-name>	RADIUS attribute name for standard attributes (see Table 72-1 on page 72.9) or Vendor-Specific attributes (see Table 72-2 on page 72.17).
<attribute-id>	RADIUS attribute numeric identifier for standard attributes (Table 72-1 on page 72.9).
<value>	RADIUS attribute value.
help	Display a list of available attribute types.

Default By default, no attributes are configured.

Mode RADIUS Server Group Configuration

Usage For the Standard attributes, the attribute may be specified using either the attribute name, or its numeric identifier. For example, command:

```
awplus(config-radsrv-group)# attribute acct-terminate-cause
                             help
```

will produce the same results as command:

```
awplus(config-radsrv-group)# attribute 49 help
```

In the same way, where the specific attribute has a pre-defined value, the parameter <*value*> may be substituted with the Value Name or with its numeric value, for example command:

```
awplus(config-radsrv-group)# attribute acct-terminate-cause
                             user-request
```

will produce the same results as command:

```
awplus(config-radsrv-group)# attribute 49 1
```

or command:

```
awplus(config-radsrv-group)# attribute acct-terminate-cause 1
```

Example To check a list of all available defined RADIUS attribute names, use the following commands:

```
                    awplus# configure terminal
                awplus(config)# radius-server local
          awplus(config-radsrv)# group Admin
awplus(config-radsrv-group)# attribute help
```

A list of Vendor-specific Attributes displays after the list of defined Standard Attributes.

To get help for valid RADIUS attribute values for the attribute `Service-Type`, use the following commands:

```
                    awplus# configure terminal
                awplus(config)# radius-server local
          awplus(config-radsrv)# group Admin
awplus(config-radsrv-group)# attribute Service-Type help
```

```
Service-Type : integer (Integer number)
Pre-defined values :
    Administrative-User (6)
    Authenticate-Only (8)
    Authorize-Only (17)
    Callback-Administrative (11)
    Callback-Framed-User (4)
    Callback-Login-User (3)
    Callback-NAS-Prompt (9)
    Call-Check (10)
    Framed-User (2)
    Login-User (1)
    NAS-Prompt-User (7)
    Outbound-User (5)
```

To define the attribute name 'Service-Type' with Administrative User (6) to the RADIUS User Group 'Admin', use the following commands:

```
                    awplus# configure terminal
                awplus(config)# radius-server local
          awplus(config-radsrv)# group Admin
    awplus(config-radsrv-group)# attribute Service-Type 6
```

To delete the attribute 'Service-Type' from the RADIUS User Group 'Admin', use the following commands:

```
                    awplus# configure terminal
                awplus(config)# radius-server local
          awplus(config-radsrv)# group Admin
    awplus(config-radsrv-group)# no attribute Service-Type
```

Related Commands egress-vlan-id
egress-vlan-name

authentication

Use this command to enable the specified authentication methods on the local RADIUS server.

Use the no variant of this command to disable specified authentication methods on the local RADIUS server.

Syntax

```
authentication {mac|eapmd5|eaptls|peap}
no authentication {mac|eapmd5|eaptls|peap}
```

Parameter	Description
mac	Enable MAC authentication method.
eapmd5	Enable EAP-MD5 authentication method.
eaptls	Enable EAP-TLS authentication method.
peap	Enable EAP-PEAP authentication method.

Default All authentication methods are enabled by default.

Mode RADIUS Server Configuration

Example The following commands enable EAP-MD5 authentication methods on the local RADIUS server.

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# authentication eapmd5
```

The following commands disable EAP-MD5 authentication methods on Local RADIUS server.

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# no authentication eapmd5
```

Related Commands

server enable
show radius local-server statistics

clear radius local-server statistics

Use this command to clear the statistics stored on the switch for the local RADIUS server.

Use this command without any parameters to clear all types of local RADIUS server statistics.

Syntax `clear radius local-server statistics [nas|server|user]`

Parameter	Description
`nas`	Clear the NAS (Network Access Server) statistics on the switch. For example, clearing statistics stored for NAS server invalid passwords.
`server`	Clear the Local RADIUS Server statistics on the switch. For example, clearing Local RADIUS Servers statistics for all failed login attempts.
`user`	Clear the Local RADIUS Server user statistics. For example, clearing statistics stored for the number of successful user logins.

Mode Privileged Exec

Usage Refer to the sample output for the show radius local-server statistics for further information about the type of statistics each parameter option for this command clears. Both the nas and server parameters clear unknown username and invalid passwords statistics, while the `user` parameter clears the number of successful and failed logins for each local RADIUS server user.

Example To clear the NAS (Network Access Server) statistics stored on the switch, use the command:.

```
awplus# clear radius local-server statistics nas
```

To clear the local RADIUS server statistics stored on the switch, use the command:.

```
awplus# clear radius local-server statistics server
```

To clear the local RADIUS server user statistics stored on the switch, use the command:.

```
awplus# clear radius local-server statistics user
```

Related Commands show radius local-server statistics

copy fdb-radius-users (to file)

Use this command to create a set of local RADIUS server users from MAC addresses in the local FDB. A local RADIUS server user created using this command can be used for MAC authentication.

Syntax

```
copy fdb-radius-users {local-radius-user-db|flash|nvs|card|debug|
   tftp|scp|<url>} [interface <port>] [vlan <vid>] [group <name>]
   [export-vlan [<group-name>]]
```

Parameter	Description
`local-radius-user-db`	Copy the local RADIUS server users created to the local RADIUS server.
`flash`	Copy the local RADIUS server users created to Flash memory.
`nvs`	Copy the local RADIUS server users created to NVS memory.
`card`	Copy the local RADIUS server users created to SD card.
`debug`	Copy the local RADIUS server users created to debug.
`tftp`	Copy the local RADIUS server users created to the TFTP destination.
`scp`	Copy the local RADIUS server users created to the SCP destination.
`<url>`	Copy the local RADIUS server users created to the specified URL.
`interface <port>`	Copy only MAC addresses learned on a specified switch port. Wildcards may be used when specifying an interface name. For example, when you specify interface port1.* then this command generates RADIUS server users for MAC addresses learned on stack 1.
`vlan <vid>`	Copy only MAC addresses learned on a specified VLAN.
`group <name>`	Assign a RADIUS group name to the local RADIUS server users created.
`export-vlan <group-name>`	Assign a RADIUS group name to the assigned export VLAN.

Mode Privileged Exec

Usage The local RADIUS server users created are written to a specified destination file in local RADIUS user CSV (Comma Separated Values) format. The local RADIUS server users can then be imported to a local RADIUS server using the copy local-radius-user-db (from file) command.

The name and password of the local RADIUS server users created use a MAC address, which can be used for MAC authentication.

This command does not copy a MAC address learned by the CPU or the management port.

This command can filter FDB entries by the interface name and the VLAN ID. When the interface name and the VLAN ID are specified, this command generates local RADIUS server users from only the MAC address learned on the specified interface and on the specified VLAN.

Examples To register the local RADIUS server users from the local FDB directly to the local RADIUS server, use the command:

```
awplus# copy fdb-radius-users local-radius-user-db
```

To register the local RADIUS server users from the interface `port1.0.1` to the local RADIUS server, use the command:

```
awplus# copy fdb-radius-users local-radius-user-db interface
       port1.0.1
```

To copy output generated as local RADIUS server user data from MAC addresses learned on `vlan10` on interface `port1.0.1` to the file `radius-user.csv`, use the command:

```
awplus# copy fdb-radius-users radius-user.csv interface
       port1.0.1 vlan10
```

Related Commands copy local-radius-user-db (to file)
copy local-radius-user-db (from file)

copy local-radius-user-db (from file)

Use this command to copy the Local RADIUS server user data from a file. The file, including the RADIUS user data in the file, must be in the CSV (Comma Separated Values) format.

You can select add or replace as the copy method. The add parameter option copies the contents of specified file to the local RADIUS server user database. If the same user exists then the old user is removed before adding a new user. The replace parameter option deletes all contents of the local RADIUS server user database before copying the contents of specified file.

Syntax

```
copy <source-url> local-radius-user-db [add|replace]
```

Parameter	Description
<source-url>	URL of the source file.
add	Add file contents to local RADIUS server user database.
replace	Replace current local RADIUS server user database with file contents.

Default When no copy method is specified with this command the replace option is applied.

Mode Privileged Exec

Examples To replace the current local RADIUS server user data to the contents of http://datahost/user.csv, use the following command:

```
awplus# copy http://datahost/user.csv local-radius-user-db
```

To add the contents of http://datahost/user.csv to the current local RADIUS server user database, use the following command:

```
awplus# copy http://datahost/user.csv local-radius-user-db add
```

Related commands

copy fdb-radius-users (to file)
copy local-radius-user-db (to file)

copy local-radius-user-db (to file)

Use this command to copy the local RADIUS server user data to a file. The output file produced is CSV (Comma Separated Values) format.

Syntax `copy local-radius-user-db {flash|nvs|card|tftp|scp|<destination-url>}`

Parameter	Description
`flash`	Copy to flash memory.
`nvs`	Copy to NVS memory.
`card`	Copy to SD card.
`tftp`	Copy to TFTP destination.
`scp`	Copy to SCP destination.
`<destination-url>`	URL of the Destination file.

Mode Privileged Exec

Example Copy the current local RADIUS server user data to http://datahost/user.csv.

```
awplus# copy local-radius-user-db http://datahost/user.csv
```

Related Commands copy fdb-radius-users (to file)
copy local-radius-user-db (from file)

crypto pki enroll local

Use this command to obtain a system certificate from the Local CA (Certificate Authority).

Use the no variant of this command to delete system certificates created by a Local CA (Certificate Authority).

Syntax

```
crypto pki enroll local
no crypto pki enroll local
```

Default The system certificate is not available until this command is issued.

Mode Global Configuration

Example The following command obtains the system certificate from the Local CA (Certificate Authority).

```
awplus# configure terminal
awplus(config)# crypto pki enroll local
```

The following command deletes the system certificate created by the Local CA (Certificate Authority).

```
awplus# configure terminal
awplus(config)# no crypto pki enroll local
```

Related Commands

crypto pki trustpoint local
group

crypto pki enroll local local-radius-all-users

Use this command to create certificates for all users registered in the local RADIUS server. These certificates are created by the Local Certificate Authority (CA) on the switch.

Syntax `crypto pki enroll local local-radius-all-users`

Default By default, there are no certificates for users in the local RADIUS server.

Mode Global Configuration

Example The following command obtains the local RADIUS server certificates for the user from the Local CA (Certificate Authority).

```
awplus# configure terminal
awplus(config)# crypto pki enroll local local-radius-all-users
```

Related Commands crypto pki trustpoint local
show crypto pki certificates

crypto pki enroll local user

Use this command to obtain a local user certificate from the Local CA (Certificate Authority).

Use the no variant of this command to delete user certificates created by the Local CA (Certificate Authority).

Syntax

```
crypto pki enroll local user <user-name>
no crypto pki enroll local user <user-name>
```

Parameter	Description
<user-name>	User name.

Default By default, there is no user certificate.

Mode Global Configuration

Example The following command obtains Tom's certificate from the Local CA (Certificate Authority).

```
awplus# configure terminal
awplus(config)# crypto pki enroll local user Tom
```

The following command deletes Tom's certificates created by the Local CA (Certificate Authority):

```
awplus# configure terminal
awplus(config)# no crypto pki enroll local user Tom
```

Related Commands

crypto pki trustpoint local
show crypto pki certificates

crypto pki export local pem

Use this command to export the certificate associated with the Local CA to a PEM format file.

Syntax `crypto pki export local pem url <url>`

Parameter	Description
<url>	URL string.

Mode Global Configuration

Example The following command exports the Local CA certificate to a PEM format file.

```
awplus# configure terminal
awplus(config)# crypto pki export local pem url tftp://
192.168.1.1/cacert.pem
```

Related Commands crypto pki enroll local

crypto pki export local pkcs12

Use this command to export a specified certificate to a PKCS12 format file.

This command cannot be used for exporting certificates for the local system.

Syntax `crypto pki export local pkcs12 <user-name> <destination-url>`

Parameter	Description
<user-name>	User name.
<destination-url>	Destination URL string.

Mode Global Configuration

Example The following commands exports a certificate for a user named client to a PKCS12 format file.

```
awplus# configure terminal
awplus(config)# crypto pki export local pkcs12 client tftp://
192.168.1.1/cacert.pem
```

To export Tom's certificate to PKSC12 format file, use the commands:

```
awplus# configure terminal
awplus(config)# crypto pki export local pksc12 Tom tftp://
192.168.1.1/tom.pfx
```

Related Commands crypto pki enroll local

crypto pki trustpoint local

Use this command to declare the Local CA (Certificate Authority) as the trustpoint that the system uses. The ca-trustpoint configuration mode is available after this command is issued.

Use the no variant of this command to delete all information and certificates associated with Local CA as the trustpoint.

Syntax

```
crypto pki trustpoint local
no crypto pki trustpoint local
```

Default Local CA is not a trustpoint.

Mode Global Configuration

Examples Use the following commands to declare the Local CA as the trustpoint.

```
awplus# configure terminal
awplus(config)# crypto pki trustpoint local
```

Use the following commands to delete all information and certificates associated with the Local CA.

```
awplus# configure terminal
awplus(config)# no crypto pki trustpoint local
```

To create a client certificate for all users registered to the local RADIUS server, use the following commands:

```
awplus(config)# crypto pki trustpoint local
awplus(ca-trust-point)# exit
awplus(config)# crypto pki enroll local alternative
```

Related Commands

crypto pki enroll local
show crypto pki trustpoints

debug crypto

Use this command to enable Public Key Infrastructure (PKI) debugging. When PKI debugging is enabled, the PKI module starts generating diagnostic messages to the system log.

Use the no variant of this command to disable Public Key Infrastructure (PKI) debugging. When PKI debugging is disabled, the PKI module stops generating diagnostic messages to the system log.

Syntax

```
debug crypto pki
no debug crypto pki
```

Default PKI debugging is disabled by default

Mode Privileged Exec

Example To enable the PKI debugging facility, use the command:

```
awplus# debug crypto pki
```

To disable the PKI debugging facility, use the command:

```
awplus# no debug crypto pki
```

domain-style

Use this command to enable a specified domain style on the local RADIUS server. The local RADIUS server decodes the domain portion of a username login string when this command is enabled.

Use the no variant of this command to disable the specified domain style on the local RADIUS server.

Syntax `domain-style {suffix-atsign|ntdomain}`

Parameter	Description
`suffix-atsign`	Enable at sign "@" delimited suffix style, i.e. "user@domain".
`ntdomain`	Enable NT domain style, i.e. "domain\user".

Default This feature is disabled by default.

Mode RADIUS Server

Usage When both domain styles are enabled, the first domain style configured has the highest priority. A username login string is matched against the first domain style enabled. Then, if the username login string is not decoded, it is matched against the second domain style enabled.

Example To enable NT domain style on the local RADIUS server, use the commands:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# domain-style ntdomain
```

To disable NT domain style on the local RADIUS server, use the commands:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# no domain-style ntdomain
```

Related Commands server enable

egress-vlan-id

Use this command to configure the standard RADIUS attribute 'Egress-VLANID (56)' for the local RADIUS Server user group.

Use the no variant of this command to remove the Egress-VLANID attribute from the local RADIUS server user group.

Syntax

```
egress-vlan-id <vid> [tagged|untagged]
no egress-vlan-id
```

Parameter	Description
<vid>	The VLAN identifier to be used for the Egress VLANID attribute, in the range 1 to 4094.
`tagged`	Set frames on the VLAN as tagged. This sets the tag indication field to indicate that all frames on this VLAN are tagged.
`untagged`	Set all frames on the VLAN as untagged. This sets the tag indication field to indicate that all frames on this VLAN are untagged.

Default By default, no Egress-VLANID attributes are configured.

Mode RADIUS Server Group Configuration

Usage When a Voice VLAN is configured for dynamic VLAN allocation (switchport voice vlan command on page 17.28), the RADIUS server must be configured to send the VLAN information when an IP phone is successfully authenticated. Use either the egress-vlan-id command or the egress-vlan-name command on page 73.20, and specify the tagged parameter.

Examples To set the 'Egress-VLANID' attribute for the NormalUsers local RADIUS server user group to VLAN identifier 200, with tagged frames, use the commands:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# group NormalUsers
awplus(config-radsrv-group)# egress-vlan-id 200 tagged
```

To remove the 'Egress-VLANID' attribute for the NormalUsers local RADIUS server user group, use the commands:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# group NormalUsers
awplus(config-radsrv-group)# no egress-vlan-id
```

Related Commands
attribute
egress-vlan-name
switchport voice vlan

egress-vlan-name

Use this command to configure the standard RADIUS attribute 'Egress-VLAN-Name (58)' for the local RADIUS server user group.

Use the no variant of this command to remove the Egress-VLAN-Name attribute from the local RADIUS server user group.

Syntax

```
egress-vlan-name <vlan-name> [tagged|untagged]
no egress-vlan-name
```

Parameter	Description
<*vlan-name*>	The VLAN name to be configured as the Egress-VLAN-Name attribute.
`tagged`	Set frames on the VLAN as tagged. This sets the tag indication field to indicate that all frames on this VLAN are tagged.
`untagged`	Set all frames on the VLAN as untagged. This sets the tag indication field to indicate that all frames on this VLAN are untagged.

Default By default, no Egress-VLAN-Name attributes are configured.

Mode RADIUS Server Group Configuration

Usage When a Voice VLAN is configured for dynamic VLAN allocation (switchport voice vlan command on page 17.28), the RADIUS server must be configured to send the VLAN information when an IP phone is successfully authenticated. Use either the egress-vlan-id command on page 73.19 or the egress-vlan-name command, and specify the tagged parameter.

Examples To configure the 'Egress-VLAN-Name' attribute for the RADIUS server user group NormalUsers with the VLAN name 'vlan2' and all frames on this VLAN tagged, use the commands:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# group NormalUsers
awplus(config-radsrv-group)# egress-vlan-name vlan2 tagged
```

To delete the 'Egress-VLAN-Name' attribute for the NormalUsers group, use the commands:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# group NormalUsers
awplus(config-radsrv-group)# no egress-vlan-name
```

Related Commands
attribute
egress-vlan-id
switchport voice vlan

group

Use this command to create a local RADIUS server user group, and enter local RADIUS Server User Group Configuration mode.

Use the no variant of this command to delete the local RADIUS server user group.

Syntax

```
group <user-group-name>
no group <user-group-name>
```

Parameter	Description
<user-group-name>	User group name string.

Mode RADIUS Server

Example The following command creates the user group NormalUsers.

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# group NormalUsers
```

The following command deletes user group NormalUsers.

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# no group NormalUsers
```

Related Commands

user (RADIUS server)
show radius local-server user
vlan (RADIUS server)

nas

This command adds a client device (the Network Access Server or the NAS) to the list of devices that are able to send authentication requests to the local RADIUS server. The NAS is identified by its IP address and a shared secret (also referred to as a shared key) must be defined that the NAS will use to establish its identity.

Use the no variant of this command to remove a NAS client from the list of devices that are allowed to send authentication requests to the local RADIUS server.

Syntax

```
nas <ip-address> key <nas-keystring>
no nas <ip-address>
```

Parameter	Description
<ip-address>	RADIUS NAS IP address.
<nas-keystring>	NAS shared keystring.

Mode RADIUS server

Example The following commands add the NAS with an IP address of `192.168.1.2` to the list of clients that may send authentication requests to the local RADIUS server. Note the shared key that this NAS will use to establish its identify is `NAS_PASSWORD`.

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# nas 192.168.1.2 key NAS_PASSWORD
```

The following commands remove the NAS with an IP address of `192.168.1.2` from the list of clients that are allowed to send authentication requests to the local RADIUS server:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# no nas 192.168.1.2
```

Related Commands show radius local-server nas

radius-server local

Use this command to navigate to the Local RADIUS server configuration mode `(config-radsrv)` from the Global Configuration mode `(config)`.

Syntax `radius-server local`

Mode Global Configuration

Example Local RADIUS Server commands are available from `config-radsrv` configuration mode. To change mode from User Exec mode to the Local RADIUS Server mode (config-radsrv), use the commands:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)#
```

Output

```
awplus(config)#radius-server local
Creating Local CA repository.....OK
Enrolling Local System to local trustpoint..OK
awplus(config-radsrv)#
```

Related Commands
server enable
show radius local-server group
show radius local-server nas
show radius local-server statistics
show radius local-server user

server auth-port

Use this command to change the UDP port number for local RADIUS server authentication.

Use the no variant of this command to reset the RADIUS server authentication port back to the default.

Syntax

```
server auth-port <1-65535>
no server auth-port
```

Parameter	Description
<1-65535>	UDP port number.

Default The default local RADIUS server UDP authentication port number is 1812.

Mode RADIUS Server

Example The following commands set the RADIUS server authentication port to 10000.

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# server port 10000
```

The following commands reset the RADIUS server authentication port back to the default UDP port of 1812.

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# no server port
```

Related Commands

server enable
show radius local-server statistics

server enable

This command enables the local RADIUS server. The local RADIUS server feature is started immediately when this command is issued.

The no variant of this command disables local RADIUS server. When this command is issued, the local RADIUS server stops operating.

Syntax

```
server enable
no server enable
```

Default The local RADIUS server is disabled by default and must be enabled for use with this command.

Mode RADIUS Server

Examples To enable the local RADIUS server, use the following commands:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# server enable
```

To disable the local RADIUS server, use the command:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# no server enable
```

Related Commands

server auth-port
show radius local-server statistics

show crypto pki certificates

Use this command to display certificate information for Local CA and Local System certificates.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show crypto pki certificates [local-ca|local]`

Parameter	Description
`local-ca`	Local CA certificate.
`local`	Local system certificate.

Mode User Exec and Privileged Exec

Example The following command displays Local CA (Certificate Authority) certificate information.

```
awplus# show crypto pki certificates local-ca
```

The following command displays Local System certificate information.

```
awplus# show crypto pki certificates local
```

The following command displays information for all Local CA and Local System certificates.

```
awplus# show crypto pki certificates
```

Output

Figure 73-1: Example output from the **show crypto pki certificates** command showing Local System and Local CA certificates

```
awplus#show crypto pki certificates
Certificate: Local System
    Data:
        Version: 3 (0x2)
        Serial Number: 4 (0x4)
        Signature Algorithm: sha1WithRSAEncryption
        Issuer: O=Allied-Telesis, CN=AlliedwarePlusCA
        Validity
            Not Before: Oct  8 07:50:55 2009 GMT
            Not After : Oct  6 07:50:55 2019 GMT
        Subject: O=Allied-Telesis, CN=Tom
Certificate: Local CA
    Data:
        Version: 3 (0x2)
        Serial Number: 0 (0x0)
        Signature Algorithm: sha1WithRSAEncryption
        Issuer: O=Allied-Telesis, CN=AlliedwarePlusCA
        Validity
            Not Before: Oct  8 07:55:55 2009 GMT
            Not After : Oct  6 07:55:55 2019 GMT
        Subject: O=Allied-Telesis, CN=Tom
```

Table 73-1: Parameters in the output of the **show crypto pki certificates** command

Parameter	Description
`Certificate`	Certificate name
`Version`	Protocol version
`Serial Number`	Serial number of the certificate
`Signature Algorithm`	Algorithm used for the certificate signature
`Issuer`	Subject of issuer creating the certificate
`Validity`	Validity period
`Subject`	Subject of the certificate

Related Commands crypto pki enroll local

show crypto pki certificates local-radius-all-users

Use this command to display certificate information for local RADIUS server users.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show crypto pki certificates local-radius-all-users`

Mode User Exec and Privileged Exec

Example The following command displays information of all local RADIUS server user certificates.

```
awplus# show crypto pki certificates local-radius-all-users
```

Output

Figure 73-2: Example output from the **show crypto pki certificates local-radius-all-users** command

```
awplus#show crypto pki certificates local-radius-all-users
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number: 2 (0x2)
        Signature Algorithm: sha1WithRSAEncryption
        Issuer: O=Allied-Telesis, CN=AlliedwarePlusCA
        Validity
            Not Before: Oct  8 07:50:55 2009 GMT
            Not After : Oct  6 07:50:55 2019 GMT
        Subject: O=Allied-Telesis, CN=Tom
```

Table 73-2: Parameters in the output of the **show crypto pki certificates local-radius-all-users** command

Parameter	Description
`Certificate`	Certificate name
`Version`	Protocol version
`Serial Number`	Serial number of the certificate
`Signature Algorithm`	Algorithm used for the certificate signature
`Issuer`	Subject of issuer creating the certificate
`Validity`	Validity period
`Subject`	Subject of the certificate

Related Commands crypto pki enroll local local-radius-all-users

show crypto pki certificates user

Use this command to display certificate information for a specified local RADIUS server user.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show crypto pki certificates user [<user-name>]
```

Parameter	Description
<user-name>	User name.

Mode

User Exec and Privileged Exec

Example

The following command displays Tom's certificate information.

```
awplus# show crypto pki certificates user Tom
```

Output

Figure 73-3: Example output from the **show crypto pki certificates user** command to show certificate information for user Tom

```
awplus#show crypto pki certificates user Tom
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number: 2 (0x2)
        Signature Algorithm: sha1WithRSAEncryption
        Issuer: O=Allied-Telesis, CN=AlliedwarePlusCA
        Validity
            Not Before: Oct  8 07:50:55 2009 GMT
            Not After : Oct  6 07:50:55 2019 GMT
        Subject: O=Allied-Telesis, CN=Tom
```

Table 73-3: Parameters in the output of the **show crypto pki certificates user** command

Parameter	Description
`Certificate`	Certificate name
`Version`	Protocol version
`Serial Number`	Serial number of the certificate
`Signature Algorithm`	Algorithm used for the certificate signature
`Issuer`	Subject of issuer creating the certificate
`Validity`	Validity period
`Subject`	Subject of the certificate

Related Commands

crypto pki enroll local user

show crypto pki trustpoints

Use this command to display trustpoint information.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show crypto pki trustpoints
```

Mode

User Exec and Privileged Exec

Example

The following command displays trustpoint information.

```
awplus# show crypto pki trustpoint
```

Output

Figure 73-4: Example output from the **show crypto pki trustpoints** command

```
Trustpoint local:
Subject Name:
CN = AlliedwarePlusCA
o = Allied-Telesis
Serial Number:0C
```

Table 73-4: Parameters in the output of the **show crypto pki trustpoints** command

Parameter	Description
`Subject Name`	CA certificate subject.
`Serial Number`	Current serial number of CA.

Related Commands

crypto pki enroll local

show radius local-server group

Use this command to display information about the local RADIUS server user group.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show radius local-server group [<user-group-name>]
```

Parameter	Description
<user-group-name>	User group name string.

Mode User Exec and Privileged Exec

Example The following command displays Local RADIUS server user group information.

```
awplus# show radius local-server group
```

Output

Figure 73-5: Example output from the **show radius local-server group** command

```
Group-Name          Vlan
-------------------------------------------------------------
NetworkOperators    ManagementNet
NormalUsers         CommonNet
```

Table 73-5: Parameters in the output of the **show radius local-server group** command

Parameter	Description
Group-Name	Group name.
Vlan	VLAN name assigned to the group.

Related Commands group

show radius local-server nas

Use this command to display information about NAS (Network Access Servers) registered to the local RADIUS server.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show radius local-server nas [<ip-address>]`

Parameter	Description
`<ip-address>`	Specify NAS IP address for show output.

Mode User Exec and Privileged Exec

Example The following command displays NAS information.

```
awplus# show radius local-server nas
```

Output

Figure 73-6: Example output from the **show radius local-server nas** command

```
NAS-Address     Shared-Key
-----------------------------------------------------------
127.0.0.1       awplus-local-radius-server
```

Table 73-6: Parameters in the output of the **show radius local-server nas** command

Parameter	Description
`NAS-Address`	IP address of NAS.
`Shared-Key`	Shared key used for RADIUS connection.

Related Commands nas

show radius local-server statistics

Use this command to display statistics about the local RADIUS server.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show radius local-server statistics
```

Mode

User Exec and Privileged Exec

Usage

Both unknown usernames and invalid passwords will display as failed logins in the show output.

Example

The following command displays Local RADIUS server statistics.

```
awplus# show radius local-server statistics
```

Output

Figure 73-7: Example output from the **show radius local-server statistics** command

```
Server status  : Run (administrative status is enable)
Enabled methods: MAC EAP-MD5 EAP-TLS EAP-PEAP

Successes               :1  Unknown NAS               :0
Failed Logins           :0  Invalid packet from NAS   :0
Internal Error          :0  Unknown Error             :0

NAS : 127.0.0.1
Successes               :0  Shared key mismatch       :0
Failed Logins           :0  Unknown RADIUS message    :0
Unknown EAP message     :0  Unknown EAP auth type     :0
Corrupted packet        :0

NAS : 192.168.1.61
Successes               :0  Shared key mismatch       :0
Failed Logins           :0  Unknown RADIUS message    :0
Unknown EAP message     :0  Unknown EAP auth type     :0
Corrupted packet        :0

NAS : 192.168.1.63
Successes               :1  Shared key mismatch       :0
Failed Logins           :0  Unknown RADIUS message    :0
Unknown EAP message     :0  Unknown EAP auth type     :0
Corrupted packet        :0

NAS : 192.168.1.65
Successes               :0  Shared key mismatch       :0
Failed Logins           :0  Unknown RADIUS message    :0
Unknown EAP message     :0  Unknown EAP auth type     :0
Corrupted packet        :0

Username          Successes  Failures
a                 1          0
admin             0          0
```

Related Commands

clear radius local-server statistics
radius-server local
server enable
server auth-port

show radius local-server user

Use this command to display information about the local RADIUS server user.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show radius local-server user [<user-name>]
show radius local-server user <user-name> format csv
```

Parameter	Description
`<user-name>`	RADIUS user name. If no user name is specified, information for all users is displayed.
`format`	File format.
`csv`	Comma separated value format.

Mode User Exec and Privileged Exec

Usage You can send output from any show command, including the CSV format output from this command, to a file. See "Controlling "show" Command Output" on page 1.41.

Example The following command displays Local RADIUS server user information for user Tom.

```
awplus# show radius local-server user Tom
```

Figure 73-8: Example output from the show radius local-server user command

```
User-Name   Password   Group          Vlan
-----------------------------------------------------------------
Tom         abcd       NetworkOperators ManagementNet
```

The following command displays all Local RADIUS server information for all users.

```
awplus# show radius local-server user
```

The following command displays Local RADIUS server user information for TOM in CSV format.

```
awplus# show radius local-server user Tom format csv
```

Figure 73-9: Example output from the show radius local-server user csv command

```
true,"NetworkOperators","Tom",
"abcd",0,2099/01/
01,1,"","","ManagementNet",false,3600,false,0,"",false,"
```

Table 73-7: Parameters in the output from the **show radius local-server user** command

Parameter	Description
`User-Name`	User name.
`Password`	User password.
`Group`	Group name assigned to the user.
`Vlan`	VLAN name assigned to the user.

Related Commands

group
user (RADIUS server)

user (RADIUS server)

Use this command to register a user to the local RADIUS server.

Use the no variant of this command to delete a user from the local RADIUS server.

Syntax

```
user <radius-user-name> [encrypted] password <user-password>
    [group <user-group>]

no user <radius-user-name>
```

Parameter	Description
<radius-user-name>	RADIUS user name. This can also be a MAC address in the IEEE standard format of HH-HH-HH-HH-HH-HH if you are configuring MAC authentication to use local RADIUS server.
encrypted	Specifies that the password is being entered in its encrypted form, so that it is not further encrypted. When creating a new user, enter the password in plaintext, and do not use the encrypted parameter. Use the encrypted parameter only when referring to a user that has previously been created. For instance, when adding an existing user from another RADIUS server, use the encrypted parameter, and enter the encrypted version of the password that appears in the output of show commands for the user.
<user-password>	User password. This can also be a MAC address in the IEEE standard format of HH-HH-HH-HH-HH-HH if you are configuring MAC authentication to use local RADIUS server.
group	Specify the group for the user.
<user-group>	User group name.

Mode RADIUS Server

Usage RADIUS user names cannot contain question mark (?), space ( ), or quote (“ “) characters. RADIUS user names containing the below characters cannot use certificate authentication:

```
/ \ ' $ & ( ) * ; < > ` |
```

Certificates cannot be created and exported for RADIUS user names that contain the above characters. We advise you to avoid using these characters in RADIUS user names if you need to use certificate authentication, because you will not be able to create and export certificates.

You also can use the IEEE standard format hexadecimal notation (HH-HH-HH-HH-HH-HH) to specify a supplicant MAC address to configure the user name and user password parameters to use local RADIUS server for MAC Authentication. See the Sample MAC Authentication Configuration in Chapter 66, AAA Introduction and Configuration. See also the command user 00-db-59-ab-70-37 password 00-db-59-ab-70-37 as shown in the command examples.

Examples The following commands add user `Tom` to the local RADIUS server and sets his password to `QwerSD`.

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# user Tom password QwerSD
```

The following commands add user `Tom` to the local RADIUS server user group NormalUsers and sets his password `QwerSD`.

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# user Tom password QwerSD group
NormalUsers
```

The following commands remove user Tom from the local RADIUS server:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# no user Tom
```

The following commands add the supplicant MAC address 00-d0-59-ab-70-37 to the local RADIUS server:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# user 00-db-59-ab-70-37 password 00-db-
59-ab-70-37
```

The following commands remove the supplicant MAC address 00-d0-59-ab-70-37 from the local RADIUS server:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# no user 00-db-59-ab-70-37
```

Related Commands group
show radius local-server user

vlan (RADIUS server)

Use this command to set the VLAN ID or name for the local RADIUS server user group. The VLAN information is used for authentication with the dynamic VLAN feature.

Use the no variant of this command to clear the VLAN ID or VLAN name for the local RADIUS server user group.

Syntax

```
vlan {<vid>|<vlan-name>}
no vlan
```

Parameter	Description
<vid>	VLAN ID.
<vlan-name>	VLAN name.

Default VLAN information is not set by default.

Mode RADIUS Server Group

Example The following commands set VLAN ID 200 to the group named NormalUsers:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# group NormalUsers
awplus(config-radsrv-group)# vlan 200
```

The following commands remove VLAN ID 200 from the group named NormalUsers:

```
awplus# configure terminal
awplus(config)# radius-server local
awplus(config-radsrv)# group NormalUsers
awplus(config-radsrv-group)# no vlan
```

Related Commands

group
show radius local-server user

Chapter 74: Secure Shell (SSH) Introduction

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Introduction

This chapter describes how the Secure Shell protocol is implemented in the AlliedWare Plus™ Operating System. It covers:

- Support for Secure Shell.
- Configuring your device as a Secure Shell server and client.
- Using Secure Shell to manage your device.

The AlliedWare Plus™ OS supports SSH version 2 and SSH version 1.5, making it backwards compatible with SSH version 1.

Secure management is important in modern networks, as the ability to easily and effectively manage switches and routers, and the requirement for security, are two almost universal requirements. Protocols such as Telnet and rlogin allow you to manage devices remotely, but can have serious security problems, such as relying on reusable plaintext passwords that are vulnerable to wiretapping or password guessing. The Secure Shell (SSH) protocol is superior to these protocols by providing encrypted and strongly authenticated remote login sessions.

SSH provides sessions between a host running a SSH server and a machine with a SSH client. The AlliedWare Plus™ OS includes both a SSH server and a SSH client to enable you to securely—with the benefit of cryptographic authentication and encryption—manage your devices over an insecure network:

- SSH replaces Telnet for remote terminal sessions; SSH is strongly authenticated and encrypted.
- Remote command execution allows you to send commands to a device securely and conveniently, without requiring a terminal session on the device.
- SSH allows you to connect to another host from your switch or router.

The AlliedWare Plus™ OS supports Secure Copy (SCP) and SSH File Transfer Protocol (SFTP). Both these protocols allow you to securely copy files between your device and remote machines. SFTP provides additional features from SCP, such as allowing you to manipulate the remote files, and halt or resume file transfers without closing the session.

Secure Shell on the AlliedWare Plus OS

The AlliedWare Plus™ OS implementation of SSH is compatible with the following RFCs and Internet Drafts:

- The Secure Shell (SSH) Protocol Architecture (RFC 4251)
- The Secure Shell (SSH) Authentication Protocol (RFC 4252)
- The Secure Shell (SSH) Transport Layer Protocol (RFC 4253)
- The Secure Shell (SSH) Connection Protocol (RFC 4254)
- The SSH (Secure Shell) Remote Login Protocol (draft-ylonen-ssh-protocol-00.txt)
- SSH File Transfer Protocol (draft-ietf-secsh-filexfer-13.txt)

Secure Shell supports the following features for both SSH version 2 and SSH version 1.5:

- Inbound SSH connections (server mode) and outbound SSH connections (client mode).
- File loading to and from remote machines using Secure Copy, using either the SSH client or SSH server mode.
- RSA public keys with lengths of 768–32768 bits, and DSA keys with lengths of 1024 bits. Keys are stored in a format compatible with other SSH implementations, and mechanisms are provided to copy keys to and from your device.
- Secure encryption, such as Triple DES and Blowfish.
- Remote non-interactive shell that allows arbitrary commands to be sent securely to your device, possibly automatically.
- Compression of Secure Shell traffic.
- Tunnelling of TCP/IP traffic.

Secure Shell supports the following features for SSH version 2 only:

- File loading from remote machines using SSH File Transfer Protocol (SFTP).
- A login banner on the SSH server, that displays when SSHv2 clients connect to the server.

Configuring the SSH Server

This section provides instructions on:

- Creating a Host Key
- Enabling the Server
- Modifying the Server
- Validating the Server Configuration
- Adding SSH Users
- Authenticating SSH Users
- Adding a Login Banner
- Monitoring the Server and Managing Sessions
- Debugging the Server

Creating a Host Key

The SSH server uses either an RSA or DSA host key to authenticate itself with SSH clients. This key must be configured before the SSH server can operate. If no host key exists, you cannot start the SSH server.

Once created, the host key is stored securely on the device. To generate a host key for the SSH server, use the command:

```
awplus(config)# crypto key generate hostkey {dsa|rsa|rsa1}
                [<768-32768>]
```

This command has two parameters for creating RSA keys. The rsa parameter creates a host key for SSH version 2 sessions only. To create a host key for SSH version 1 sessions, use the rsa1 parameter.

To destroy a host key, use the command:

```
awplus(config)# crypto key destroy hostkey {dsa|rsa|rsa1}
```

To display a host key stored on your device, use the command:

```
awplus(config)# show crypto key hostkey [dsa|rsa|rsa1]
```

Enabling the Server

You must enable the SSH server before connections from SSH, SCP, and SFTP clients are accepted. When the SSH server is disabled it rejects connections from SSH clients. The SSH server is disabled by default on your device.

To enable the SSH server, use the command:

```
awplus(config)# service ssh [ip|ipv6]
```

To disable the SSH server, use the command:

```
awplus(config)# no service ssh [ip|ipv6]
```

When enabled, the SSH server allows SCP and SFTP sessions by default. To disable these services, use the commands:

```
awplus(config)# no ssh server scp

awplus(config)# no ssh server sftp
```

This allows you to reject SCP or SFTP file transfer requests, while still allowing Secure Shell connections. To re-enable SCP and SFTP services, use the command:

```
awplus(config)# ssh server scp

awplus(config)# ssh server sftp
```

Modifying the Server

To modify the SSH version that the server supports, or the TCP port that the server listens to for incoming sessions, use the command:

```
awplus(config)# ssh server {[v1v2|v2only]|<1-65535>}
```

The server listens on port 22 for incoming sessions, and supports both SSH version 2 and SSH version 1, by default.

To modify session and login timeouts on the SSH server, and the number of unauthenticated connections the server allows, use the command:

```
awplus(config)# ssh server {[session-timeout <0-3600>]
               [login-timeout <1-600>]
               [max-startups <1-128>]}
```

The SSH server waits 60 seconds for a client to authenticate itself, by default. You can alter this waiting time by using the login-timeout parameter. If the client is still not authenticated after the set timeout, then the SSH server disconnects the session.

The SSH server only allows only 10 unauthenticated SSH sessions at any point in time, by default. You can modify the number of unauthenticated sessions it allows, by using the max-startups parameter.

Once a client has authenticated, the SSH session does not time out, by default. Use the session-timeout parameter to set a maximum time period the server waits before deciding that a session is inactive and terminating it

For example, to set the session timeout to 600 seconds, the login timeout to 30 seconds, and the maximum number of concurrent unauthenticated sessions to 5, use the command:

```
awplus(config)# ssh server session-timeout 600 login-timeout
               30 max-startups 5
```

To remove the configured session timeout, login timeout, or maximum startups, use the command:

```
awplus(config)# no ssh server session-timeout login-timeout
               max-startups
```

Validating the Server Configuration

To validate the SSH server configuration, use the command:

```
awplus(config)# show running-config ssh
```

Adding SSH Users

The SSH server requires you to register SSH users. Users that are not registered cannot access the SSH server. Ensure first that you have defined the user in the Authorized User Database of your device. To add a new user, use the command:

```
awplus(config)# username USERNAME (privilege 1-15) password
                PASSWORD
```

To register a user with the SSH server, use the command:

```
awplus(config)# ssh server allow-users <username-pattern>
                [<hostname-pattern>]
```

Registered entries can contain just the username, or the username with some host details, such as an IP address range. Additionally you can specify a range of users or hostname details by using an asterisk to match any string of characters. For example, to allow any user from the IP range 192.168.1.1 to 192.168.1.255, use the command:

```
awplus(config)# ssh server allow-users * 192.168.1.*
```

To display the list of allowed users, use the command:

```
awplus# show ssh server allow-users
```

To delete an entry from the list of allowed users, use the command:

```
awplus(config)# no ssh server allow-users <username-pattern>
                [<hostname-pattern>]
```

The SSH server also contains a list of denied users. The server checks all incoming sessions against this list and denies any matching session, regardless of whether the session matches an entry in the allowed users list. To add an entry to the list of denied users, use the command:

```
awplus(config)# ssh server deny-users <username-pattern>
                [<hostname-pattern>]
```

This allows you to deny specific users from a range of allowed users. For example, to deny a user with the IP address 192.168.1.12, use the command:

```
awplus(config)# ssh server deny-users * 192.168.1.12
```

To display the database of denied users, use the command:

```
awplus# show ssh server deny-users
```

To delete a client from the database of denied users, use the command:

```
awplus(config)# no ssh server deny-users <username-pattern>
                [<hostname-pattern>]
```

Authenticating SSH Users

SSH users can use either their password or public key authentication to authenticate themselves with the SSH server. To use public key authentication, copy the user's public key file from their client device to the SSH server. To associate the key with a user, use the command:

```
awplus(config)# crypto key pubkey-chain userkey <username>
                [<filename>]
```

For example, to associate the file key.pub with the user "langley", use the command:

```
awplus(config)# crypto key pubkey-chain userkey langley
                key.pub
```

To add a key as text into the terminal for user "geoff", first enter the command:

```
awplus(config)# crypto key pubkey-chain userkey geoff
```

then paste or type the key in as text.

You can add multiple keys for the same user. To display the list of public keys associated with a user, use the command:

```
awplus(config)# show crypto key pubkey-chain userkey
                <username> [<1-65535>]
```

The <1-65535> parameter allows you to display an individual key.

To delete a key associated with a user from your device, use the command:

```
awplus(config)# no crypto key pubkey-chain userkey
                <username> <1-65535>
```

Adding a Login Banner

You can add a login banner to the SSH server for sessions with SSH version 2 clients. The server displays the banner to clients before the login prompt. To set the login banner's message, use the command:

```
awplus(config)# banner login
```

then enter your message and use Ctrl+D to finish.

To view the configured login banner, use the command:

```
awplus# show banner login
```

To remove the configured message for the login banner, use the command:

```
awplus(config)# no banner login
```

Monitoring the Server and Managing Sessions

To display the current status of the SSH server, use the command:

```
awplus# show ssh server
```

To display the current status of SSH sessions on your device, use the command:

```
awplus# show ssh
```

Note that this displays both SSH server and SSH client sessions that your Allied Telesis device is running. Use this command to view the unique identification number assigned to each incoming or outgoing SSH session. You need the ID number when terminating a specific session from your device.

To terminate a session, or all sessions, use the command:

```
awplus# clear ssh {<1-65535>|all}
```

Debugging the Server

Information which may be useful for troubleshooting the SSH server is available using the SSH debugging function. You can enable server debugging while the SSH server is functioning. Use the command:

```
awplus# debug ssh server [brief|full]
```

To disable SSH server debugging, use the command:

```
awplus# no debug ssh server
```

Configuring the SSH Client

This section provides instructions on:

- Modifying the Client
- Adding SSH Servers
- Authenticating with a Server
- Connecting to a Server and Running Commands
- Copying files to and from the Server
- Debugging the Client

Modifying the Client

You can configure a selection of variables when using the SSH client. Note that the following configuration commands apply only to client sessions initiated after the command. The configured settings are not saved; after you have logged out from the SSH client, the client returns to using the default settings. Use the command:

```
awplus(config)# ssh client {port <1-65535>|version {1|2}|
                session-timeout <0-3600>|connect-timeout
                <1-600>}
```

The SSH client uses TCP port 22, by default. You can change the TCP port for the remote SSH server by using the port parameter.

The client supports both SSH version 1 and version 2 sessions, by default. To change the SSH client to only use a specific SSH version for sessions, for example SSH version 1, use the version parameter.

The client terminates sessions that are not established after 30 seconds, by default. You can change this time period by using the session-timeout parameter.

Once the client has authenticated with a server, the client does not time out the SSH session, by default. Use the session-timeout parameter to set a maximum time period the client waits before deciding that a session is inactive and terminating the session.

To modify the SSH client so that it uses port 2000 for sessions, and supports only SSH version 1 connections, use the command:

```
awplus(config# ssh client port 2000 version 1
```

To modify the SSH client so that unestablished sessions time out after 60 seconds, and inactive sessions time out after 100 seconds, use the command:

```
awplus(config)# ssh client session-timeout 100 connect-timeout
                100
```

To remove the configured port, SSH version, session timeout, and connection timeout settings, use the command:

```
awplus(config)# no ssh client port version session-timeout
                connect-timeout
```

Adding SSH Servers

SSH servers identify themselves using a host key (see "Creating a Host Key" on page 74.4). Before the SSH client establishes a session with a SSH server, it confirms that the host key sent by the server matches its database entry for the server. If the database does not contains a host key for the server, then the SSH client requires you to confirm that the host key sent from the server is correct.

To add an SSH server to the client's database, use the command:

```
awplus# crypto key pubkey-chain knownhosts [vrf
<vrf-name>] [ip|ipv6] <hostname> [rsa|dsa|rsa1]
```

To display the SSH servers in the client's database, use the command:

```
awplus# show crypto key pubkey-chain knownhosts [vrf
<vrf-name>|global] [<1-65535>]
```

To remove an entry in the database, use the command:

```
awplus# no crypto key pubkey-chain knownhosts [vrf
<vrf-name>] <1-65535>
```

Authenticating with a Server

You can authenticate your session with a server by either using a password, or using RSA or DSA public key authentication. To use public key authentication, you must generate a pair of keys, one private and one public, and copy the public key onto the SSH server.

To generate an RSA or DSA set of private and public keys for an SSH user, use the command:

```
awplus(config)# crypto key generate userkey <username> {dsa|
rsa|rsa1} [<768-32768>]
```

You can generate one key of each encryption type per user on your client. When authenticating with an SSH server that supports SSH version 1 only, you must use a key generated by the rsa1 parameter.

To copy the public key onto the SSH server, you must display the key onscreen. To display the public key associated with a user, use the command:

```
awplus# show crypto key userkey <username> [dsa|rsa|
rsa1]
```

To display the public keys set for other users, you must specify their username. Only users with the highest privilege setting can use this command to view the keys of other users.

To delete a public and private pair of keys associated with a user, use the command:

```
awplus(config)# crypto key destroy userkey <username> {dsa|rsa|
rsa1}
```

Connecting to a Server and Running Commands

To connect to a remote SSH server and execute a command, use the command:

```
awplus# ssh [vrf <vrf-name>] [ip|ipv6][{[user
        <username>]|[port <1-65535>]|[version {1|2}]}]
        <hostname> [<line>]
```

By default, the SSH client attempts to use SSH version 2 with the SSH server. If this fails, the client uses SSH version 1.

For example, to connect to the SSH server at 192.168.1.2 as user “john”, and execute the command “show sys”, use the command:

```
awplus# ssh user john 192.168.1.2 “show sys”
```

Copying files to and from the Server

You can use either the SCP or SFTP client to transfer files from a remote SSH server. Use the command:

```
awplus# copy <source-url> <destination-url>
```

For example, to use SFTP to load a file from the SSH server 192.168.1.2, onto the flash memory of your device, use the command:

```
awplus# copy sftp://192.168.1.2/key.pub flash
```

To upload files to the SSH server, you must use SCP. For example, to upload the file bobskey.pub as the user “bob”, use the command:

```
awplus# copy flash:/bobskey.pub scp://bob@192.168.1.2
```

For more information see Chapter 6, Creating and Managing Files.

Debugging the Client

Information which may be useful for troubleshooting the SSH client is available using the SSH debugging function. You can enable client debugging while the SSH client is functioning. Use the command:

```
awplus# debug ssh client [brief|full]
```

To disable SSH client debugging, use the command:

```
awplus# no debug ssh client
```

Chapter 75: Secure Shell (SSH) Configuration

SSH Server Configuration Example.....75.2

SSH Server Configuration Example

This chapter provides a Secure Shell server configuration example. For more information about the SSH server, see Chapter 74, Secure Shell (SSH) Introduction. For detailed information about the commands used to configure the SSH server, see Chapter 76, Secure Shell (SSH) Commands.

The following example configures a SSH server where:

- the SSH server uses RSA encryption
- the SSH server is compatible with both SSH version 1 and version 2 clients
- three SSH users are configured: Manager, John and Asuka. “Manager” can connect from only a defined range of hosts, while “john” and “asuka” can SSH from all hosts
- the SSH users use RSA private and public key authentication

This example shows how to create RSA encryption keys, configure the Secure Shell server, and register users to make Secure Shell connections to your device.

Step 1: Login as a highest Privileged User.

To create the keys and add users, you must login as a privileged user.

Step 2: Create encryption keys.

Two RSA private keys are required before enabling the Secure Shell server for each type of SSH version. Use the commands:

```
awplus# configure terminal
awplus(config)# crypto key generate hostkey rsa
awplus(config)# crypto key generate hostkey rsa1
awplus(config)# exit
```

To verify the key creation, use the command:

```
awplus# show crypto key hostkey
```

Step 3: Enable the Secure Shell server.

Enable Secure Shell on the device using the commands:

```
awplus# configure terminal
awplus(config)# service ssh
```

Modify the SSH server settings as desired. For example, to set the login-timeout to 60, and the session-timeout to 3600, use the commands:

```
awplus(config)# ssh server session-timeout 3600 login-timeout 60
```

To verify the server configuration, use the command:

```
awplus# show ssh
```

Step 4: Create SSH users.

In order to connect and execute commands, you must register users in the SSH user database, and in the User Authentication Database of the device.

To create the users `john` and `asuka` in the User Authentication Database, use the commands:

```
awplus# configure terminal
awplus(config)# username john privilege 15 password secret
awplus(config)# username asuka privilege 15 password
                very-secret
```

To register `john` and `asuka` as SSH clients, use the commands:

```
awplus(config)# ssh server allow-users john
awplus(config)# ssh server allow-users asuka
```

To register “manager” as an SSH client so that can only connect from the IP address 192.168.1.1, use the command:

```
awplus(config)# ssh server allow-users manager 192.168.1.1
```

Step 5: Set up Authentication.

SSH users cannot connect unless the server can authenticate them. There are two ways to authenticate an SSH session: password authentication, and RSA or DSA private/public key authentication. When using password authentication, the user must supply their User Authentication Database password.

To use private/public key authentication, copy the public keys for each user onto the device. To copy the files onto flash from the key directory of an attached TFTP server, use the command:

```
awplus# copy tftp://key/john.pub flash:/john.pub
awplus# copy tftp://key/asuka.pub flash:/asuka.pub
```

To associate the key file with each user, use the command:

```
awplus# configure terminal
awplus(config)# cryto key pubkey-chain userkey john john.pub
awplus(config)# cryto key pubkey-chain userkey asuka asuka.pub
awplus(config)# cryto key pubkey-chain userkey manager
                manager.pub
```

Chapter 76: Secure Shell (SSH) Commands

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Introduction

This chapter provides an alphabetical reference for commands used to configure Secure Shell (SSH). For more information, see Chapter 74, Secure Shell (SSH) Introduction, and Chapter 75, Secure Shell (SSH) Configuration.

Command List

banner login (SSH)

This command configures a login banner on the SSH server. This displays a message on the remote terminal of the SSH client before the login prompt. SSH client version 1 does not support this banner.

To add a banner, first enter the command banner login, and hit [Enter]. Write your message. You can use any character and spaces. Use Ctrl+D at the end of your message to save the text and re-enter the normal command line mode.

The banner message is preserved if the device restarts.

The no variant of this command deletes the login banner from the device.

Syntax

```
banner login
no banner login
```

Default No banner is defined by default.

Mode Global Configuration

Examples To set a login banner message, use the commands:

```
awplus# configure terminal
awplus(config)# banner login

Type CNTL/D to finish.
... banner message comes here ...
^D
awplus(config)#
```

and enter the message. Use Ctrl+D to finish.

To remove the login banner message, use the commands:

```
awplus# configure terminal
awplus(config)# no banner login
```

Related Commands show banner login

clear ssh

This command deletes Secure Shell sessions currently active on the device. This includes both incoming and outgoing sessions. The deleted sessions are closed. You can only delete an SSH session if you are a system manager or the user who initiated the session. If all is specified then all active SSH sessions are deleted.

Syntax `clear ssh {<1-65535>|all}`

Parameters	Description
`<1-65535>`	Specify a session ID in the range 1 to 65535 to delete a specific session.
`all`	Delete all SSH sessions.

Mode Privileged Exec

Examples To stop the current SSH session 123, use the command:

```
awplus# clear ssh 123
```

To stop all SSH sessions active on the device, use the command:

```
awplus# clear ssh all
```

Related Commands service ssh
ssh

crypto key destroy hostkey

This command deletes the existing public and private keys of the SSH server. Note that for an SSH server to operate it needs at least one set of hostkeys configured before an SSH server is started.

Syntax `crypto key destroy hostkey {dsa|rsa|rsa1}`

Parameters	Description
`dsa`	Deletes the existing DSA public and private keys.
`rsa`	Deletes the existing RSA public and private keys configured for SSH version 2 connections.
`rsa1`	Deletes the existing RSA public and private keys configured for SSH version 1 connections.

Mode Global Configuration

Example To destroy the RSA host key used for SSH version 2 connections, use the commands:

```
awplus# configure terminal
awplus(config)# crypto key destroy hostkey rsa
```

Related Commands crypto key generate hostkey
service ssh

crypto key destroy userkey

This command destroys the existing public and private keys of an SSH user configured on the device.

Syntax `crypto key destroy userkey <username> {dsa|rsa|rsa1}`

Parameters	Description
`<username>`	Name of the user whose userkey you are destroying. The username must begin with a letter. Valid characters are all numbers, letters, and the underscore, hyphen and full stop symbols.
`dsa`	Deletes the existing DSA userkey.
`rsa`	Deletes the existing RSA userkey configured for SSH version 2 connections.
`rsa1`	Deletes the existing RSA userkey for SSH version 1 connections.

Mode Global Configuration

Example To destroy the RSA user key for the SSH user `remoteuser`, use the commands:

```
awplus# configure terminal
awplus(config)# crypto key destroy userkey remoteuser rsa
```

Related Commands
crypto key generate hostkey
show ssh
show crypto key hostkey

crypto key generate hostkey

This command generates public and private keys for the SSH server using either an RSA or DSA cryptography algorithm. You must define a host key before enabling the SSH server. Start SSH server using the service ssh command. If a host key exists with the same cryptography algorithm, this command replaces the old host key with the new key.

This command is not saved in the device configuration. However, the device saves the keys generated by this command in the non-volatile memory.

Syntax

```
crypto key generate hostkey {dsa|rsa|rsa1} [<768-32768>]
```

Parameters	Description
`dsa`	Creates a DSA hostkey. Both SSH version 1 and 2 connections can use the DSA hostkey.
`rsa`	Creates an RSA hostkey for SSH version 2 connections.
`rsa1`	Creates an RSA hostkey for SSH version 1 connections.
<768-32768>	The length in bits of the generated key. The default is 1024 bits.

Default 1024 bits is the default key length. The DSA algorithm supports 1024 bits.

Mode Global Configuration

Examples To generate an RSA host key for SSH version 2 connections that is 2048 bits in length, use the commands:

```
awplus# configure terminal
awplus(config)# crypto key generate hostkey rsa 2048
```

To generate a DSA host key, use the commands:

```
awplus# configure terminal
awplus(config)# crypto key generate dsa
```

Related Commands

crypto key destroy hostkey
service ssh
show crypto key hostkey

crypto key generate userkey

This command generates public and private keys for an SSH user using either an RSA or DSA cryptography algorithm. To use public key authentication, copy the public key of the user onto the remote SSH server.

This command is not saved in the device configuration. However, the device saves the keys generated by this command in the non-volatile memory.

Syntax `crypto key generate userkey <username> {dsa|rsa|rsa1} [<768-32768>]`

Parameters	Description
`<username>`	Name of the user that the user key is generated for. The username must begin with a letter. Valid characters are all numbers, letters, and the underscore, hyphen and full stop symbols.
`dsa`	Creates a DSA userkey. Both SSH version 1 and 2 connections can use a key created with this command.
`rsa`	Creates an RSA userkey for SSH version 2 connections.
`rsa1`	Creates an RSA userkey for SSH version 1 connections.
`<768-32768>`	The length in bits of the generated key. The DSA algorithm supports only 1024 bits. Default: 1024.

Mode Global Configuration

Examples To generate a 2048-bits RSA user key for SSH version 2 connections for the user `bob`, use the commands:

```
awplus# configure terminal
awplus(config)# crypto key generate userkey bob rsa 2048
```

To generate a DSA user key for the user `lapo`, use the commands:

```
awplus# configure terminal
awplus(config)# crypto key generate userkey lapo dsa
```

Related Commands crypto key destroy userkey
show crypto key userkey

crypto key pubkey-chain knownhosts

This command adds a public key of the specified SSH server to the known host database on your switch. The SSH client on your switch uses this public key to verify the remote SSH server.

The key is retrieved from the server. Before adding a key to this database, check that the key sent to you is correct.

If the server's key changes, or if your SSH client does not have the public key of the remote SSH server, then your SSH client will inform you that the public key of the server is unknown or altered.

The no variant of this command deletes the public key of the specified SSH server from the known host database on your device.

Syntax

```
crypto key pubkey-chain knownhosts [vrf <vrf-name>] [ip|ipv6]
   <hostname> [rsa|dsa|rsa1]

no crypto key pubkey-chain knownhosts [vrf <vrf-name>] <1-65535>
```

Parameter	Description
`vrf`	Apply this command to the specified VRF instance.
<vrf-name>	The VRF instance name
`ip`	Keyword used prior to specifying an IPv4 address
`ipv6`	Keyword used prior to specifying an IPv6 address
<hostname>	IPv4/IPv6 address or hostname of a remote server in the format `a.b.c.d` for an IPv4 address, or in the format `x:x::x:x` for an IPv6 address
`rsa`	Specify the RSA public key of the server to be added to the known host database.
`dsa`	Specify the DSA public key of the server to be added to the known host database.
`rsa1`	Specify the SSHv1 public key of the server to be added to the know host database.
<1-65535>	Specify a key identifier when removing a key using the no parameter.

Default If no cryptography algorithm is specified, then rsa is used as the default cryptography algorithm.

Mode Privilege Exec

Usage This command adds a public key of the specified SSH server to the known host database on the switch. The key is retrieved from the server. The remote SSH server is verified by using this public key. The user is requested to check the key is correct before adding it to the database.

If the remote server's host key is changed, or if the device does not have the public key of the remote server, then SSH clients will inform the user that the public key of the server is altered or unknown.

Examples

To add the RSA host key of the remote SSH host IPv4 address `192.0.2.11` to the known host database, use the command:

```
awplus# crypto key pubkey-chain knownhosts 192.0.2.11
```

To delete the second entry in the known host database, use the command:

```
awplus# no crypto key pubkey-chain knownhosts 2
```

To add the RSA host key of the remote SSH host IPv4 address `192.0.2.11` in VRF `red` to the known host database, use the command:

```
awplus# crypto key pubkey-chain knownhosts vrf red 192.0.2.11
```

To delete the second entry in the known host database in VRF `red`, use the command:

```
awplus# no crypto key pubkey-chain knownhosts vrf red 2
```

Validation Commands

show crypto key pubkey-chain knownhosts

crypto key pubkey-chain userkey

This command adds a public key for an SSH user on the SSH server. This allows the SSH server to support public key authentication for the SSH user. When configured, the SSH user can access the SSH server without providing a password from the remote host.

The no variant of this command removes a public key for the specified SSH user that has been added to the public key chain. When a SSH user's public key is removed, the SSH user can no longer login using public key authentication.

Syntax

```
crypto key pubkey-chain userkey <username> [<filename>]
no crypto key pubkey-chain userkey <username> <1-65535>
```

Parameters	Description
<username>	Name of the user that the SSH server associates the key with. The username must begin with a letter. Valid characters are all numbers, letters, and the underscore, hyphen and full stop symbols. Default: no default
<filename>	Filename of a key saved in flash. Valid characters are any printable character. You can add a key as a hexadecimal string directly into the terminal if you do not specify a filename.
<1-65535>	The key ID number of the user's key. Specify the key ID to delete a key.

Mode Global Configuration

Usage You should import the public key file from the client node. The device can read the data from a file on the flash or user terminal.

Or you can add a key as text into the terminal. To add a key as text into the terminal, first enter the command crypto key pubkey-chain userkey <*username*>, and hit [Enter]. Enter the key as text. Note that the key you enter as text must be a valid SSH RSA key, not random ASCII text. Use [Ctrl]+D after entering it to save the text and re-enter the normal command line mode.

Note you can generate a valid SSH RSA key on the switch first using the crypto key generate host rsa command. View the SSH RSA key generated on the switch using the show crypto hostkey rsa command. Copy and paste the displayed SSH RSA key after entering the crypto key pubkey-chain userkey <*username*> command. Use [Ctrl]+D after entering it to save it.

Examples To generate a valid SSH RSA key on the switch and add the key, use the following commands:

```
awplus# configure terminal

awplus(config)# crypto key generate host rsa

awplus(config)# exit

awplus# show crypto key hostkey rsa

AAAAB3NzaC1yc2EAAAABIwAAAIEAr1s7SokW5aW2fcOw1TStpb9J
20bWluhnUC768EoWhyPW6FZ2t5360O5M29EpKBmGqlkQaz5V0mU9
IQe66+5YyD4UxOKSDtTI+7jtjDcoGWHb2u4sFwRpXwJZcgYrXW16
+6NvNbk+h+c/pqGDijj4SvfZZfeITzvvyZW4/I4pbN8=


awplus# configure terminal

awplus(config)# crypto key pubkey-chain userkey joe
Type CNTL/D to finish:

AAAAB3NzaC1yc2EAAAABIwAAAIEAr1s7SokW5aW2fcOw1TStpb9J
20bWluhnUC768EoWhyPW6FZ2t5360O5M29EpKBmGqlkQaz5V0mU9
IQe66+5YyD4UxOKSDtTI+7jtjDcoGWHb2u4sFwRpXwJZcgYrXW16
+6NvNbk+h+c/pqGDijj4SvfZZfeITzvvyZW4/I4pbN8=

control-D

awplus(config)#
```

To add a public key for the user `graydon` from the file `key.pub`, use the commands:

```
awplus# configure terminal

awplus(config)# crypto key pubkey-chain userkey graydon key.pub
```

To add a public key for the user `tamara` from the terminal, use the commands:

```
awplus# configure terminal

awplus(config)# crypto key pubkey-chain userkey tamara
```

and enter the key. Use Ctrl+D to finish.

To remove the first key entry from the public key chain of the user `john`, use the commands:

```
awplus# configure terminal

awplus(config)# no crypto key pubkey-chain userkey john 1
```

Related Commands show crypto key pubkey-chain userkey

debug ssh client

This command enables the SSH client debugging facility. When enabled, any SSH, SCP and SFTP client sessions send diagnostic messages to the login terminal.

The no variant of this command disables the SSH client debugging facility. This stops the SSH client from generating diagnostic debugging message.

Syntax

```
debug ssh client [brief|full]
no debug ssh client
```

Parameter	Description
`brief`	Enables brief debug mode.
`full`	Enables full debug mode.

Default SSH client debugging is disabled by default.

Mode Privileged Exec and Global Configuration

Examples To start SSH client debugging, use the command:

```
awplus# debug ssh client
```

To start SSH client debugging with extended output, use the command:

```
awplus# debug ssh client full
```

To disable SSH client debugging, use the command:

```
awplus# no debug ssh client
```

Related Commands

debug ssh server
show ssh client
undebug ssh client

debug ssh server

This command enables the SSH server debugging facility. When enabled, the SSH server sends diagnostic messages to the system log. To display the debugging messages on the terminal, use the terminal monitor command.

The no variant of this command disables the SSH server debugging facility. This stops the SSH server from generating diagnostic debugging messages.

Syntax

```
debug ssh server [brief|full]
no debug ssh server
```

Parameter	Description
`brief`	Enables brief debug mode.
`full`	Enables full debug mode.

Default SSH server debugging is disabled by default.

Mode Privileged Exec and Global Configuration

Examples To start SSH server debugging, use the command:

```
awplus# debug ssh server
```

To start SSH server debugging with extended output, use the command:

```
awplus# debug ssh server full
```

To disable SSH server debugging, use the command:

```
awplus# no debug ssh server
```

Related Commands

debug ssh client
show ssh server
undebug ssh server

service ssh

This command enables the Secure Shell server on the device. Once enabled, connections coming from SSH clients are accepted.

SSH server needs a host key before it starts. If an SSHv2 host key does not exist, then this command fails. If SSHv1 is enabled but a host key for SSHv1 does not exist, then SSH service is unavailable for version 1.

The no variant of this command disables the Secure Shell server. When the Secure Shell server is disabled, connections from SSH, SCP, and SFTP clients are not accepted. This command does not affect existing SSH sessions. To terminate existing sessions, use the clear ssh command.

Syntax

```
service ssh [ip|ipv6]
no service ssh [ip|ipv6]
```

Default The Secure Shell server is disabled by default. Both IPv4 and IPv6 Secure Shell server are enabled when you issue service ssh without specifying the optional ip or ipv6 parameters.

Mode Global Configuration

Examples To enable both the IPv4 and the IPv6 Secure Shell server, use the commands:

```
awplus# configure terminal
awplus(config)# service ssh
```

To enable the IPv4 Secure Shell server only, use the commands:

```
awplus# configure terminal
awplus(config)# service ssh ip
```

To enable the IPv6 Secure Shell server only, use the commands:

```
awplus# configure terminal
awplus(config)# service ssh ipv6
```

To disable both the IPv4 and the IPv6 Secure Shell server, use the commands:

```
awplus# configure terminal
awplus(config)# no service ssh
```

To disable the IPv4 Secure Shell server only, use the commands:

```
awplus# configure terminal
awplus(config)# no service ssh ip
```

To disable the IPv6 Secure Shell server only, use the commands:

```
awplus# configure terminal
awplus(config)# no service ssh ipv6
```

Related Commands

crypto key generate hostkey
show running-config ssh
show ssh server
ssh server allow-users
ssh server deny-users

show banner login

This command displays the banner message configured on the device. The banner message is displayed to the remote user before user authentication starts.

Syntax

```
show banner login
```

Mode

User Exec, Privileged Exec, Global Configuration, Interface Configuration, Line Configuration

Example

To display the current login banner message, use the command:

```
awplus# show banner login
```

Related Commands

banner login (SSH)

show crypto key hostkey

This command displays the SSH host keys generated by RSA and DSA algorithm.

A host key pair (public and private keys) is needed to enable SSH server. The private key remains on the device secretly. The public key is copied to SSH clients to identify the server

Syntax `show crypto key hostkey [dsa|rsa|rsa1]`

Parameter	Description
`dsa`	Displays the DSA algorithm public key.
`rsa`	Displays the RSA algorithm public key for SSH version 2 connections.
`rsa1`	Displays the RSA algorithm public key for SSH version 1 connections.

Mode User Exec, Privileged Exec and Global Configuration

Output Figure 76-1: Example output from the **show crypto key hostkey** command

```
Type Bits   Fingerprint
-------------------------------------------------------------
rsa  2058   4e:7d:1d:00:75:79:c5:cb:c8:58:2e:f9:29:9c:1f:48
dsa  1024   fa:72:3d:78:35:14:cb:9a:1d:ca:1c:83:2c:7d:08:43
rsa1 1024   e2:1c:c8:8b:d8:6e:19:c8:f4:ec:00:a2:71:4e:85:8b
```

Table 76-1: Parameters in output of the **show crypto key hostkey** command

Parameter	Description
`Type`	Algorithm used to generate the key.
`Bits`	Length in bits of the key.
`Fingerprint`	Checksum value for the public key.

Examples To show the public keys generated on the device for SSH server, use the command:

```
awplus# show crypto key hostkey
```

To display the RSA public key of the SSH server, use the command:

```
awplus# show crypto key hostkey rsa
```

Related Commands crypto key destroy hostkey
crypto key generate hostkey

show crypto key pubkey-chain knownhosts

This command displays the list of public keys maintained in the known host database on the device.

Syntax

```
show crypto key pubkey-chain knownhosts [vrf <vrf-name>|global]
    [<1-65535>]
```

Parameter	Description
`global`	When VRF-Lite is configured, apply the command to the global routing and forwarding table.
`vrf`	Apply the command to the specified VRF instance.
<vrf-name>	The name of the VRF instance.
<1-65535>	Key identifier for a specific key. Displays the public key of the entry if specified.

Default Display all keys.

Mode User Exec, Privileged Exec and Global Configuration

Usage When VRF-Lite is configured:

- If vrf is specified, this command displays the known host database from the specified VRF instance.
- If global is specified, this command displays the known host database from the global routing environment.
- If neither vrf nor global is specified, this command displays the known host database from the global routing environment and each configured VRF.

For more information about VRF see, Chapter 45, VRF-Lite Introduction and Configuration and Chapter 46, VRF-Lite Commands.

Output Figure 76-2: Example output from the **show crypto key public-chain knownhosts** command

```
No     Hostname         Type Fingerprint
-------------------------------------------------------------------
1      172.16.23.1      rsa  c8:33:b1:fe:6f:d3:8c:81:4e:f7:2a:aa:a5:be:df:18
2      172.16.23.10     rsa  c4:79:86:65:ee:a0:1d:a5:6a:e8:fd:1d:d3:4e:37:bd
3      5ffe:1053:ac21:ff00:0101:bcdf:ffff:0001
                        rsa1 af:4e:b4:a2:26:24:6d:65:20:32:d9:6f:32:06:ba:57
```

Table 76-2: Parameters in the output of the **show crypto key public-chain knownhosts** command

Parameter	Description
`No`	Number ID of the key.
`Hostname`	Host name of the known SSH server.
`Type`	The algorithm used to generate the key.
`Fingerprint`	Checksum value for the public key.

Examples To display public keys of known SSH servers, use the command:

```
awplus# show crypto key pubkey-chain knownhosts
```

To display the key data of the first entry in the known host data, use the command:

```
awplus# show crypto key pubkey-chain knownhosts 1
```

Related Commands crypto key pubkey-chain knownhosts

show crypto key pubkey-chain userkey

This command displays the public keys registered with the SSH server for SSH users. These keys allow remote users to access the device using public key authentication. By using public key authentication, users can access the SSH server without providing password.

Syntax `show crypto key pubkey-chain userkey <username> [<1-65535>]`

Parameter	Description
<username>	User name of the remote SSH user whose keys you wish to display. The username must begin with a letter. Valid characters are all numbers, letters, and the underscore, hyphen and full stop symbols.
<1-65535>	Key identifier for a specific key.

Default Display all keys.

Mode User Exec, Privileged Exec and Global Configuration

Output Figure 76-3: Example output from the **show crypto key public-chain userkey** command

```
No Type Bits Fingerprint
-------------------------------------------------------------
1  dsa  1024 2b:cc:df:a8:f8:2e:8f:a4:a5:4f:32:ea:67:29:78:fd
2  rsa  2048 6a:ba:22:84:c1:26:42:57:2c:d7:85:c8:06:32:49:0e
```

Table 76-3: Parameters in the output of the **show crypto key userkey** command

Parameter	Description
`No`	Number ID of the key.
`Type`	The algorithm used to generate the key.
`Bits`	Length in bits of the key.
`Fingerprint`	Checksum value for the key.

To display the public keys for the user `manager` that are registered with the SSH server, use the command:

```
awplus# show crypto key pubkey-chain userkey manager
```

Related Commands crypto key pubkey-chain userkey

show crypto key userkey

This command displays the public keys created on this device for the specified SSH user.

Syntax `show crypto key userkey <username> [dsa|rsa|rsa1]`

Parameter	Description
`<username>`	User name of the local SSH user whose keys you wish to display. The username must begin with a letter. Valid characters are all numbers, letters, and the underscore, hyphen and full stop symbols.
`dsa`	Displays the DSA public key.
`rsa`	Displays the RSA public key used for SSH version 2 connections.
`rsa1`	Displays the RSA key used for SSH version 1 connections.

Mode User Exec, Privileged Exec and Global Configuration

Output Figure 76-4: Example output from the **show crypto key userkey** command

```
Type Bits   Fingerprint
-------------------------------------------------------------
rsa  2048   e8:d6:1b:c0:f4:b6:e6:7d:02:2e:a9:d4:a1:ca:3b:11
rsa1 1024   12:25:60:95:64:08:8e:a1:8c:3c:45:1b:44:b9:33:9b
```

Table 76-4: Parameters in the output of the **show crypto key userkey** command

Parameter	Description
`Type`	The algorithm used to generate the key.
`Bits`	Length in bits of the key.
`Fingerprint`	Checksum value for the key.

Examples To show the public key generated for the user, use the command:

```
awplus# show crypto key userkey manager
```

To store the RSA public key generated for the user manager to the file "user.pub", use the command:

```
awplus# show crypto key userkey manager rsa > manager-rsa.pub
```

Related Commands crypto key generate userkey

show running-config ssh

This command displays the current running configuration of Secure Shell (SSH).

Syntax `show running-config ssh`

Mode Privileged Exec and Global Configuration

Output Figure 76-5: Example output from the **show running-config ssh** command

```
!
ssh server session-timeout 600
ssh server login-timeout 30
ssh server allow-users manager 192.168.1.*
ssh server allow-users john
ssh server deny-user john*.a-company.com
ssh server
```

Table 76-5: Parameters in the output of the **show running-config ssh** command

Parameter	Description
`ssh server`	SSH server is enabled.
`ssh server v2`	SSH server is enabled and only support SSHv2.
`ssh server <port>`	SSH server is enabled and listening on the specified TCP port.
`no ssh server scp`	SCP service is disabled.
`no ssh server sftp`	SFTP service is disabled.
`ssh server session-timeout`	Configure the server session timeout.
`ssh server login-timeout`	Configure the server login timeout.
`ssh server max-startups`	Configure the maximum number of concurrent sessions waiting authentication.
`no ssh server authentication password`	Password authentication is disabled.
`no ssh server authentication publickey`	Public key authentication is disabled.
`ssh server allow-users`	Add the user (and hostname) to the allow list.
`ssh server deny-users`	Add the user (and hostname) to the deny list.

Example To display the current configuration of SSH, use the command:

```
awplus# show running-config ssh
```

Related Commands service ssh
show ssh server

show ssh

This command displays the active SSH sessions on the device, both incoming and outgoing.

Syntax `show ssh`

Mode User Exec, Privileged Exec and Global Configuration

Output Figure 76-6: Example output from the **show ssh** command

```
Secure Shell Sessions:
ID  Type Mode   Peer Host    Username   State       Filename
---------------------------------------------------------------
414 ssh  server 172.16.23.1  root       open
456 ssh  client 172.16.23.10 manager    user-auth
459 scp  client 172.16.23.12 root       download    550dev_.awd
463 ssh  client 5ffe:33fe:5632:ffbb:bc35:ddee:0101:ac51
                             manager    user-auth
```

Table 76-6: Parameters in the output of the **show ssh** command

Parameter	Description	
ID	Unique identifier for each SSH session.	
Type	Session type; either SSH, SCP, or SFTP.	
Mode	Whether the device is acting as an SSH client (client) or SSH server (server) for the specified session.	
Peer Host	The hostname or IP address of the remote server or client.	
Username	Login user name of the server.	
State	The current state of the SSH session. One of:	
	connecting	The device is looking for a remote server.
	connected	The device is connected to the remote server.
	accepted	The device has accepted a new session.
	host-auth	host-to-host authentication is in progress.
	user-auth	User authentication is in progress.
	authenticated	User authentication is complete.
	open	The session is in progress.
	download	The user is downloading a file from the device.
	upload	The user is uploading a file from the device.
	closing	The user is terminating the session.
	closed	The session is closed.
Filename	Local filename of the file that the user is downloading or uploading.	

Example To display the current SSH sessions on the device, use the command:

```
awplus# show ssh
```

Related Commands clear ssh

show ssh client

This command displays the current configuration of the Secure Shell client.

Syntax `show ssh client`

Mode User Exec, Privileged Exec and Global Configuration

Output Figure 76-7: Example output from the **show ssh client** command

```
Secure Shell Client Configuration
-----------------------------------------------------------------
Port                                : 22
Version                             : 2,1
Connect Timeout                     : 30 seconds
Session Timeout                     : 0 (off)
Debug                               : NONE
```

Table 76-7: Parameters in the output of the **show ssh client** command

Parameter	Description
`Port`	SSH server TCP port where the SSH client connects to. The default is port 22.
`Version`	SSH server version; either "1", "2" or "2,1".
`Connect Timeout`	Time in seconds that the SSH client waits for an SSH session to establish. If the value is 0, the connection is terminated when it reaches the TCP timeout.
`Debug`	Whether debugging is active on the client.

Example To display the current configuration for SSH clients on the login shell, use the command:

```
awplus# show ssh client
```

Related Commands show ssh server

show ssh server

This command displays the current configuration of the Secure Shell server.

Note that changes to the SSH configuration affects only new SSH sessions coming from remote hosts, and does not affect existing sessions.

Syntax `show ssh server`

Mode User Exec, Privileged Exec and Global Configuration

Output Figure 76-8: Example output from the **show ssh server** command

```
Secure Shell Server Configuration
-----------------------------------------------------------------
SSH Server                          : Enabled
Port                                : 22
Version                             : 2
Services                            : scp, sftp
User Authentication                 : publickey, password
Idle Timeout                        : 60 seconds
Maximum Startups                    : 10
Debug                               : NONE
```

Table 76-8: Parameters in the output of the **show ssh server** command

Parameter	Description
`SSH Server`	Whether the Secure Shell server is enabled or disabled.
`Port`	TCP port where the Secure Shell server listens for connections. The default is port 22.
`Version`	SSH server version; either "1", "2" or "2,1".
`Services`	List of the available Secure Shell service; one or more of SHELL, SCP or SFTP.
`Authentication`	List of available authentication methods.
`Login Timeout`	Time (in seconds) that the SSH server will wait the SSH session to establish. If the value is 0, the client login will be terminated when TCP timeout reaches.
`Idle Timeout`	Time (in seconds) that the SSH server will wait to receive data from the SSH client. The server disconnects if this timer limit is reached. If set at 0, the idle timer remains off.
`Maximum Startups`	The maximum number of concurrent connections that are waiting authentication. The default is 10.
`Debug`	Whether debugging is active on the server.

Example To display the current configuration of the Secure Shell server, use the command:

```
awplus# show ssh server
```

Related Commands show ssh
show ssh client

show ssh server allow-users

This command displays the user entries in the allow list of the SSH server.

Syntax `show ssh server allow-users`

Mode User Exec, Privileged Exec and Global Configuration

Output Figure 76-9: Example output from the **show ssh server allow-users** command

```
Username          Remote Hostname (pattern)
----------------- --------------------------------
awplus            192.168.*
john
manager           *.alliedtelesis.com
```

Table 76-9: Parameters in the output of the **show ssh server allow-users** command

Parameter	Description
`Username`	User name that is allowed to access the SSH server.
`Remote Hostname (pattern)`	IP address or hostname pattern of the remote client. The user is allowed requests from a host that matches this pattern. If no hostname is specified, the user is allowed from all hosts.

Example To display the user entries in the allow list of the SSH server, use the command:

```
awplus# show ssh server allow-users
```

Related Commands ssh server allow-users
ssh server deny-users

show ssh server deny-users

This command displays the user entries in the deny list of the SSH server. The user in the deny list is rejected to access the SSH server. If a user is not included in the access list of the SSH server, the user is also rejected.

Syntax `show ssh server deny-users`

Mode User Exec, Privileged Exec and Global Configuration

Output Figure 76-10: Example output from the **show ssh server deny-user** command

```
Username          Remote Hostname (pattern)
----------------- --------------------------------
john              *.b-company.com
manager           192.168.2.*
```

Table 76-10: Parameters in the output of the **show ssh server deny-user** command

Parameter	Description
`Username`	The user that this rule applies to.
`Remote Hostname (pattern)`	IP address or hostname pattern of the remote client. The user is denied requests from a host that matches this pattern. If no hostname is specified, the user is denied from all hosts.

Example To display the user entries in the deny list of the SSH server, use the command:

```
awplus# show ssh server deny-users
```

Related Commands ssh server allow-users
ssh server deny-users

ssh

This command initiates a Secure Shell connection to a remote SSH server.

If the server requests a password for the user login, the user needs to type in the correct password on "Password:" prompt.

SSH client identifies the remote SSH server by it's public key registered on the client device. If the server identification is changed, server verification fails. If the public key of the server has been changed, it is required that the public key of the server should be explicitly added to the known host database.

Note Note that any hostname specified with ssh cannot begin with a hyphen (-) character.

Syntax

```
ssh [vrf <vrf-name>] [ip|ipv6][{[user <username>]|[port <1-65535>]|
   [version {1|2]}}] <hostname> [<line>]
```

Parameter	Description	
`vrf`	Apply the command to the specified VRF instance.	
<vrf-name>	The name of the VRF instance.	
`ip`	Specify IPv4 SSH.	
`ipv6`	Specify IPv6 SSH.	
`user`	Login user. If user is specified, the username is used for login to the remote SSH server when user authentication is required. Otherwise the current user name is used.	
	<username>	User name to login on the remote server.
`port`	SSH server port. If port is specified, the SSH client connects to the remote SSH server with the specified TCP port. Other- wise, the client port configured by "ssh client" command or the default TCP port (22) is used.	
	<1-65535>	TCP port.
`version`	SSH client version. If version is specified, the SSH client supports only the specified SSH version. By default, SSH client uses SSHv2 first. If the server does not support SSHv2, it will try SSHv1. The default version can be configured by "ssh client" command.	
	`1`	Use SSH version 1.
	`2`	Use SSH version 2.

Parameter(cont.)	Description(cont.)	
<hostname>	IPv4/IPv6 address or hostname of a remote server in the format `a.b.c.d` for an IPv4 address, or in the format `x:x::x:x` for an IPv6 address corresponding to the ip or ipv6 optional keywords used. Note that any hostname specified with ssh cannot begin with a hyphen (-) character.	
	<line>	Command to execute on the remote server. If a command is specified, the command is executed on the remote SSH server and the session is disconnected when the remote command finishes.

Mode User Exec and Privileged Exec

Examples To login to the remote SSH server at 192.0.2.5, use the command:

```
awplus# ssh ip 192.0.2.5
```

To login to the remote SSH server at 192.0.2.5 as user manager, use the command:

```
awplus# ssh ip user manager 192.0.2.5
```

To login to the remote SSH server at 192.0.2.5 that is listening TCP port 2000, use the command:

```
awplus# ssh port 2000 192.0.2.5
```

To login to the remote SSH server with example_host using IPv6 session, use the command:

```
awplus# ssh ipv6 example_host
```

To run the cmd command on the remote SSH server at 192.0.2.5, use the command:

```
awplus# ssh ip 192.0.2.5 cmd
```

To login to the remote SSH server at 192.168.1.1 on VRF `red`, use the command:

```
awplus# ssh vrf red 192.168.1.1
```

Related Commands
crypto key generate userkey
crypto key pubkey-chain knownhosts
debug ssh client
ssh client

ssh client

This command modifies the default configuration parameters of the Secure Shell (SSH) client. The configuration is used for any SSH client on the device to connect to remote SSH servers. Any parameters specified on SSH client explicitly override the default configuration parameters.

The change affects the current user shell only. When the user exits the login session, the configuration does not persist. This command does not affect existing SSH sessions.

The no variant of this command resets configuration parameters of the Secure Shell (SSH) client changed by the ssh client command, and restores the defaults.

This command does not affect the existing SSH sessions.

Syntax

```
ssh client {port <1-65535>|version {1|2}|session-timeout <0-3600>|
   connect-timeout <1-600>}

no ssh client {port|version|session-timeout|connect-timeout}
```

Parameter	Description
`port`	The default TCP port of the remote SSH server. If an SSH client specifies an explicit port of the server, it overrides the default TCP port. Default: 22
	<1-65535> TCP port number.
`version`	The SSH version used by the client for SSH sessions. The SSH client supports both version 2 and version 1 Default: version 2 Note: SSH version 2 is the default SSH version. SSH client supports SSH version 1 if SSH version 2 is not configured using a ssh version command.
	`1` SSH clients on the device supports SSH version 1 only.
	`2` SSH clients on the device supports SSH version 2 only
`session-timeout`	The global session timeout for SSH sessions. If the session timer lapses since the last time an SSH client received data from the remote server, the session is terminated. If the value is 0, then the client does not terminate the session. Instead, the connection is terminated when it reaches the TCP timeout. Default: 0 (session timer remains off)
	<0-3600> Timeout in seconds.
`connect-timeout`	The maximum time period that an SSH session can take to become established. The SSH client terminates the SSH session if this timeout expires and the session is still not established. Default: 30
	<1-600> Timeout in seconds.

Mode Privileged Exec

Examples

To configure the default TCP port for SSH clients to 2200, and the session timer to 10 minutes, use the command:

```
awplus# ssh client port 2200 session-timeout 600
```

To configure the connect timeout of SSH client to 10 seconds, use the command:

```
awplus# ssh client connect-timeout 10
```

To restore the connect timeout to its default, use the command:

```
awplus# no ssh client connect-timeout
```

Related Commands

show ssh client
ssh

ssh server

This command modifies the configuration of the SSH server. Changing these parameters affects new SSH sessions connecting to the device.

The no variant of this command restores the configuration of a specified parameter to its default. The change affects the SSH server immediately if the server is running. Otherwise, the configuration is used when the server starts.

To enable the SSH server, use the service ssh command.

Syntax

```
ssh server {[v1v2|v2only]|<1-65535>}
ssh server {[session-timeout <0-3600>] [login-timeout <1-600>]
    [max-startups <1-128>]}
no ssh server {[session-timeout] [login-timeout] [max-startups]}
```

Parameter	Description
v1v2	Supports both SSHv2 and SSHv1client connections. Default: v1v2
v2only	Supports SSHv2 client connections only.
<1-65535>	The TCP port number that the server listens to for incoming SSH sessions. Default: 22
session-timeout	There is a maximum time period that the server waits before deciding that a session is inactive and should be terminated. The server considers the session inactive when it has not received any data from the client, and when the client does not respond to keep alive messages. Default: 0 (session timer remains off).
	<0-3600> Timeout in seconds.
login-timeout	The maximum time period the server waits before disconnecting an unauthenticated client. Default: 60
	<1-600> Timeout in seconds.
max-startups	The maximum number of concurrent unauthenticated connections the server accepts. When the number of SSH connections awaiting authentication reaches the limit, the server drops any additional connections until authentication succeeds or the login timer expires for a connection. Default: 10
	<1-128> Number of sessions.

Mode Global Configuration

Examples To configure the session timer of SSH server to 10 minutes (600 seconds), use the commands:

```
awplus# configure terminal
awplus(config)# ssh server login-timeout 600
```

To configure the login timeout of SSH server to 30 seconds, use the commands:

```
awplus# configure terminal
awplus(config)# ssh server login-timeout 30
```

To limit the number of SSH client connections waiting authentication from SSH server to 3, use the commands:

```
awplus# configure terminal
awplus(config)# ssh server max-startups
```

To set max-startups parameters of SSH server to the default configuration, use the commands:

```
awplus# configure terminal
awplus(config)# no ssh server max-startups
```

To support the Secure Shell server with TCP port 2200, use the commands:

```
awplus# configure terminal
awplus(config)# ssh server 2200
```

To force the Secure Shell server to support SSHv2 only, use the commands:

```
awplus# configure terminal
awplus(config)# ssh server v2only
```

To support both SSHv2 and SSHv1, use the commands:

```
awplus# configure terminal
awplus(config)# ssh server v1v2
```

Related Commands show ssh server
ssh client

ssh server allow-users

This command adds a username pattern to the allow list of the SSH server. If the user of an incoming SSH session matches the pattern, the session is accepted.

When there are no registered users in the server's database of allowed users, the SSH server does not accept SSH sessions even when enabled.

SSH server also maintains the deny list. The server checks the user in the deny list first. If a user is listed in the deny list, then the user access is denied even if the user is listed in the allow list.

The no variant of this command deletes a username pattern from the allow list of the SSH server. To delete an entry from the allow list, the username and hostname pattern should match exactly with the existing entry.

Syntax

```
ssh server allow-users <username-pattern> [<hostname-pattern>]
no ssh server allow-users <username-pattern> [<hostname-pattern>]
```

Parameter	Description
`<username-pattern>`	The username pattern that users can match to. An asterisk acts as a wildcard character that matches any string of characters.
`<hostname-pattern>`	The host name pattern that hosts can match to. If specified, the server allows the user to connect only from hosts matching the pattern. An asterisk acts as a wildcard character that matches any string of characters.

Mode Global Configuration

Example To allow the user `john` to create an SSH session from any host, use the commands:

```
awplus# configure terminal
awplus(config)# ssh server allow-users john
```

To allow the user `john` to create an SSH session from a range of IP address (from 192.168.1.1 to 192.168.1.255), use the commands:

```
awplus# configure terminal
awplus(config)# ssh server allow-users john 192.168.1.*
```

To allow the user `john` to create a SSH session from `a-company.com` domain, use the commands:

```
awplus# configure terminal
awplus(config)# ssh server allow-users john *.a-company.com
```

To delete the existing user entry `john 192.168.1.*` in the allow list, use the commands:

```
awplus# configure terminal
awplus(config)# no ssh server allow-users john 192.168.1.*
```

Related Commands

show running-config ssh
show ssh server allow-users
ssh server deny-users

ssh server authentication

This command enables RSA public-key or password user authentication for SSH Server. Apply the password keyword with the ssh server authentication command to enable password authentication for users. Apply the publickey keyword with the ssh server authentication command to enable RSA public-key authentication for users.

Use the no variant of this command to disable RSA public-key or password user authentication for SSH Server. Apply the password keyword with the no ssh authentication command to disable password authentication for users. Apply the required publickey keyword with the no ssh authentication command to disable RSA public-key authentication for users.

Syntax

```
ssh server authentication {password|publickey}
no ssh server authentication {password|publickey}
```

Parameter	Description
`password`	Specifies user password authentication for SSH server.
`publickey`	Specifies user publickey authentication for SSH server.

Default Both RSA public-key authentication and password authentication are enabled by default.

Mode Global Configuration

Usage For password authentication to authenticate a user, password authentication for a user must be registered in the local user database or on an external RADIUS server, before using the ssh server authentication password command.

For RSA public-key authentication to authenticate a user, a public key must be added for the user, before using the ssh server authentication publickey command.

Example To enable `password` authentication for users connecting through SSH, use the commands:

```
awplus# configure terminal
awplus(config)# ssh server authentication password
```

To enable `publickey` authentication for users connecting through SSH, use the commands:

```
awplus# configure terminal
awplus(config)# ssh server authentication publickey
```

To disable `password` authentication for users connecting through SSH, use the commands:

```
awplus# configure terminal
awplus(config)# no ssh server authentication password
```

To disable `publickey` authentication for users connecting through SSH, use the commands:

```
awplus# configure terminal
awplus(config)# no ssh server authentication publickey
```

Related Commands crypto key pubkey-chain userkey
service ssh
show ssh server

ssh server deny-users

This command adds a username pattern to the deny list of the SSH server. If the user of an incoming SSH session matches the pattern, the session is rejected.

SSH server also maintains the allow list. The server checks the user in the deny list first. If a user is listed in the deny list, then the user access is denied even if the user is listed in the allow list.

If a hostname pattern is specified, the user is denied from the hosts matching the pattern.

The no variant of this command deletes a username pattern from the deny list of the SSH server. To delete an entry from the deny list, the username and hostname pattern should match exactly with the existing entry.

Syntax

```
ssh server deny-users <username-pattern> [<hostname-pattern>]
no ssh server deny-users <username-pattern> [<hostname-pattern>]
```

Parameter	Description
<username-pattern>	The username pattern that users can match to. The username must begin with a letter. Valid characters are all numbers, letters, and the underscore, hyphen, full stop and asterisk symbols. An asterisk acts as a wildcard character that matches any string of characters.
<hostname-pattern>	The host name pattern that hosts can match to. If specified, the server denies the user only when they connect from hosts matching the pattern. An asterisk acts as a wildcard character that matches any string of characters.

Mode Global Configuration

Example To deny the user `john` to access SSH login from any host, use the commands:

```
awplus# configure terminal
awplus(config)# ssh server deny-users john
```

To deny the user john to access SSH login from a range of IP address (from 192.168.2.1 to 192.168.2.255), use the commands:

```
awplus# configure terminal
awplus(config)# ssh server deny-users john 192.168.2.*
```

To deny the user `john` to access SSH login from `b-company.com` domain, use the commands:

```
awplus# configure terminal
awplus(config)# ssh server deny-users john*.b-company.com
```

To delete the existing user entry `john 192.168.2.*` in the deny list, use the commands:

```
awplus# configure terminal
awplus(config)# no ssh server deny-users john 192.168.2.*
```

Related Commands
show running-config ssh
show ssh server deny-users
ssh server allow-users

ssh server resolve-host

This command enables resolving an IP address from a host name using a DNS server for client host authentication.

The no variant of this command disables this feature.

Syntax
```
ssh server resolve-hosts
no ssh server resolve-hosts
```

Default This feature is disabled by default.

Mode Global Configuration

Usage Your device has a DNS Client that is enabled automatically when you add a DNS server to your device. To add a DNS server to the list of servers that the device sends DNS queries to use the ip name-server command on page 25.42.

For information about configuring DNS see "Domain Name System (DNS)" on page 24.8.

Example To resolve a host name using a DNS server, use the commands:

```
awplus# configure terminal
awplus(config)# ssh server resolve-hosts
```

Related Commands
ip name-server
show ssh server
ssh server allow-users
ssh server deny-users

ssh server scp

This command enables the Secure Copy (SCP) service on the SSH server. Once enabled, the server accepts SCP requests from remote clients.

You must enable the SSH server as well as this service before the device accepts SCP connections. The SCP service is enabled by default as soon as the SSH server is enabled.

The no variant of this command disables the SCP service on the SSH server. Once disabled, SCP requests from remote clients are rejected.

Syntax

```
ssh server scp
no ssh server scp
```

Mode Global Configuration

Examples To enable the SCP service, use the commands:

```
awplus# configure terminal
awplus(config)# ssh server scp
```

To disable the SCP service, use the commands:

```
awplus# configure terminal
awplus(config)# no ssh server scp
```

Related Commands show running-config ssh
show ssh server

ssh server sftp

This command enables the Secure FTP (SFTP) service on the SSH server. Once enabled, the server accepts SFTP requests from remote clients.

You must enable the SSH server as well as this service before the device accepts SFTP connections. The SFTP service is enabled by default as soon as the SSH server is enabled. If the SSH server is disabled, SFTP service is unavailable.

The no variant of this command disables SFTP service on the SSH server. Once disabled, SFTP requests from remote clients are rejected.

Syntax

```
ssh server sftp
no ssh server sftp
```

Mode Global Configuration

Examples To enable the SFTP service, use the commands:

```
awplus# configure terminal
awplus(config)# ssh server sftp
```

To disable the SFTP service, use the commands:

```
awplus# configure terminal
awplus(config)# no ssh server sftp
```

Related Commands

show running-config ssh
show ssh server

undebug ssh client

This command applies the functionality of the no debug ssh client command.

undebug ssh server

This command applies the functionality of the no debug ssh server command.

Chapter 77: DHCP Snooping Introduction and Configuration

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Introduction

This chapter provides information about DHCP snooping, support for it on this switch, and how to configure it.

For detailed descriptions of the commands used to configure DHCP snooping, see Chapter 78, DHCP Snooping Commands; for related ACL commands, see Chapter 56, IPv4 Hardware Access Control List (ACL) Commands. For information about Dynamic Host Configuration protocol and how to configure it, see Chapter 85, Dynamic Host Configuration Protocol (DHCP) Introduction and Chapter 86, Dynamic Host Configuration Protocol (DHCP) Commands.

DHCP Snooping

DHCP snooping provides an extra layer of security on the switch via dynamic IP source filtering. DHCP snooping filters out traffic received from unknown, or 'untrusted' ports, and builds and maintains a DHCP snooping database.

Dynamic Host Configuration Protocol (DHCP) dynamically assigns IP addresses to client devices. The use of dynamically assigned addresses requires traceability, so that a service provider can determine which clients own a particular IP address at a certain time.

With DHCP snooping, IP sources are dynamically verified, and filtered accordingly. IP packets that are not sourced from recognized IP addresses can be filtered out. This ensures the required traceability.

With DHCP snooping, an administrator can control port-to-IP connectivity by:

- permitting port access to specified IP addresses only
- permitting port access to DHCP issued IP addresses only
- dictating the number of IP clients on any given port
- passing location information about an IP client to the DHCP server
- permitting only known IP clients to ARP

Ports on the switch are classified as either trusted or untrusted:

- Trusted ports receive only messages from within your network.
- Untrusted ports receive messages from outside your network.

DHCP snooping blocks unauthorized IP traffic from untrusted ports, and prevents it from entering the trusted network. It validates DHCP client packets from untrusted ports and forwards them to trusted ports in the VLAN.

On this switch, DHCP snooping is disabled by default, and can be enabled on per-VLAN basis to operate over switch ports and over static and dynamic (LACP) link aggregators (channel groups).

DHCP Snooping Database

When you enable DHCP snooping, the switch intercepts all DHCP packets it receives, and sends them to the Central Processing Unit (CPU), where they are verified. The DHCP snooping database stores and maintains this information. The database contains entries for:

- current IP address leases dynamically allocated by a DHCP server
- static or dynamic entries added from the command line—typically used to add a DHCP snooping entry for a client that has a preconfigured IP address on an untrusted port

Database backup

The switch periodically saves the dynamic entries in the DHCP snooping database to a hidden file (.dhcp.dsn.gz) in Non-Volatile Storage (NVS), or can be configured to save it to Flash memory or to an SD card. If such a database file exists, it is loaded when the switch starts up with DHCP snooping enabled, or when DHCP snooping is subsequently enabled.

Lease entries

Each entry in the database corresponds to a DHCP IP address lease.

For dynamic entries added automatically by DHCP snooping, each entry contains the following information:

- the IP address that was allocated to that client
- the MAC address of the client device
- the time until expiry
- the VLAN to which the client is attached
- the port to which the client is attached
- the IP address of the DHCP server

For static entries added from the command line, each entry contains the following subset of information:

- the IP address allocated to the client
- the MAC address of the client device (optional)
- the VLAN to which the client is attached
- the port to which the client is attached

Each entry also shows its source: Dynamic or Static.

On this switch, the maximum number of lease entries that can be stored in the DHCP snooping database for each port can be configured—the default is 1.

Expired entries

For dynamic entries, the switch receives expiry information with the client lease information in DHCP packets. Entries expire when the time left to expiry is 0 seconds. Expired entries are automatically deleted from the database. Static entries have no expiry information, and are not checked. All dynamic entries in the database are written to the backup file. Whenever DHCP snooping is enabled, the DHCP snooping database is repopulated from the backup file and any static entries in the start-up configuration file. Any entries present in the backup file that have expired are ignored.

DHCP Option 82

If the switch is at the edge of the network, it can be configured to insert DHCP Option 82 information into client-originated BOOTP/DHCP packets that it is forwarding to a DHCP server. The switch also removes Option 82 information from BOOTP reply packets destined for an untrusted port if the DHCP client hardware is directly attached to a port on the switch.

DHCP servers that are configured to recognize Option 82 may use the information to implement IP address or other parameter assignment policies, based on the network location of the client device.

When Option 82 information for DHCP snooping is enabled, the switch inserts Option 82 information into BOOTP request packets received from an untrusted port. The switch inserts the following Option 82 information:

- Remote ID: this identifies the host. By default, this is the MAC address of the switch (sub-option1).
- Circuit ID: this specifies the switch port and VLAN ID that the client-originated DHCP packet was received on (sub-option2). By default, this is the VLAN ID and the Ifindex (interface number).
- Subscriber ID (optional): this is a string of up to 50 characters that differentiates or groups client ports on the switch (sub-option 6).

Support on this switch

This switch inserts Option 82 (agent option) information into DHCP packets received through untrusted ports, and removes it from DHCP packets transmitted through untrusted ports. This is enabled by default, and can be disabled if required.

You can specify values for the Remote ID and Circuit ID sub-options of the Option 82 field. The Remote ID can be specified as an alphanumeric (ASCII) string, 1 to 63 characters in length. The Circuit ID can be specified as the VLAN ID and port number.

Subscriber IDs can be configured for ports, and if they have been configured, they are inserted in DHCP packets as part of the Option 82 information.

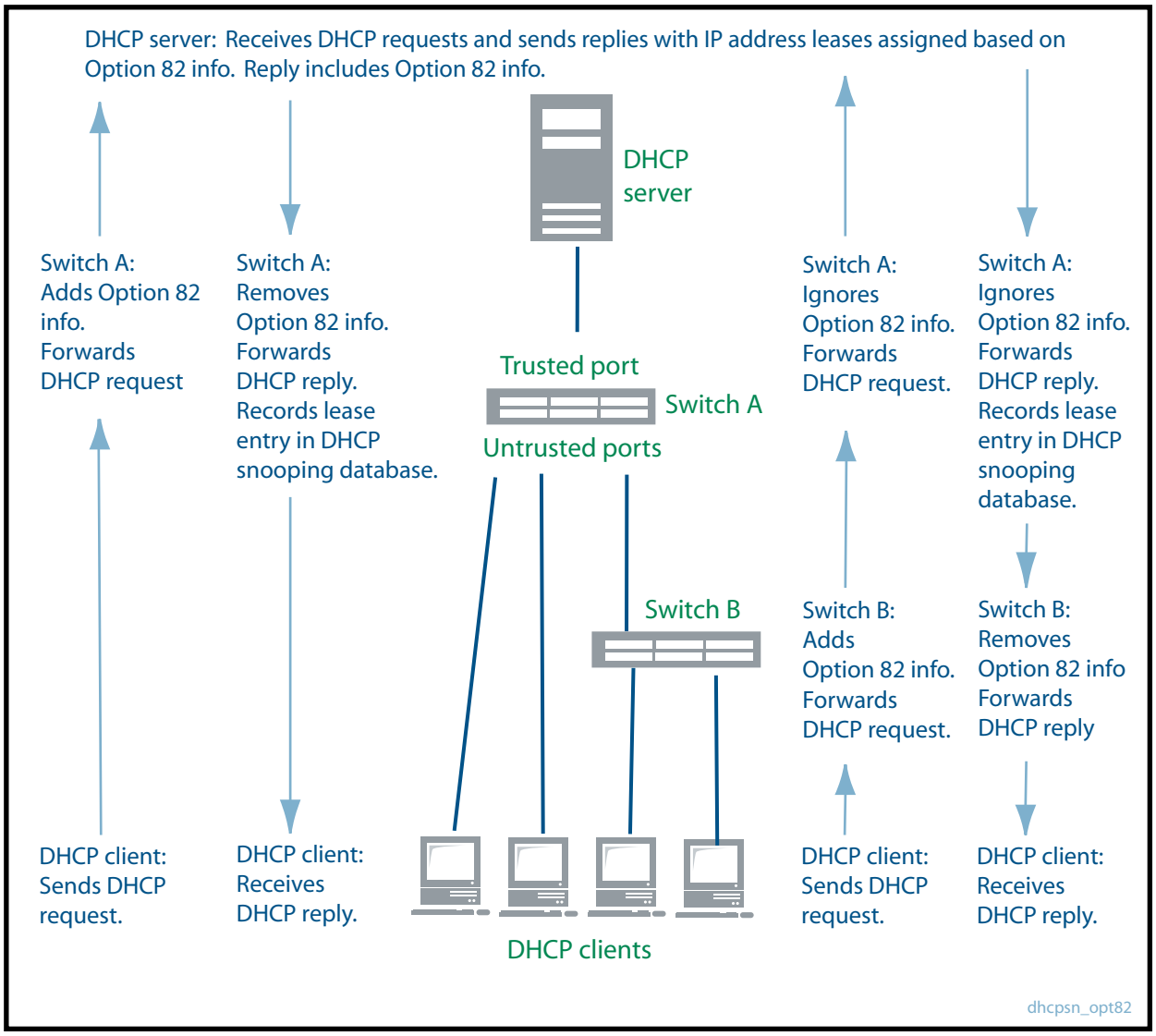
Regardless of whether Option 82 is enabled for DHCP snooping, if the switch receives a BOOTP/DHCP request packet on a trusted port, and the packet contains Option 82 information, it does not update the Option 82 information for the receiver port. By default, if it receives a DHCP request packet containing Option 82 information on an untrusted port, it drops the packet. However, if the switch is connected via untrusted ports to edge switches that insert DHCP Option 82 information into DHCP packets, you may need to allow these DHCP packets through the untrusted ports—the switch can be configured to forward these packets.

Note that the Option 82 agent information inserted by the DHCP snooping differs from the information added by DHCP Relay (see "DHCP Relay Agent Introduction" on page 85.8). The switch cannot be configured to use both the DHCP relay agent option and DHCP snooping.

Operation Figure 77-1 shows DHCP packet flow between DHCP clients and server, where:

- Switch A has DHCP snooping enabled. The DHCP server is connected to a trusted port on Switch A; DHCP clients and Switch B are connected to untrusted ports.
- Switch A is configured to add and remove DHCP Option 82 information (ip dhcp snooping agent-option command on page 78.10).
- Switch A is configured to forward DHCP packets that already contain Option 82 information without changing it (ip dhcp snooping agent-option allow-untrusted command on page 78.11).
- Switch B is Layer 2 switching traffic from downstream DHCP clients, and adds and removes DHCP Option 82 information.

Figure 77-1: DHCP packet flow with DHCP snooping and Option 82 (agent option)



For more information about Option 82, see RFC 3046, DHCP Relay Agent Information Option.

Traffic Filtering with DHCP Snooping

DHCP filtering prevents IP addresses from being falsified or 'spoofed'. This guarantees that customers cannot avoid detection by spoofing IP addresses that are not actually allocated to them. With DHCP filtering, the switch permits packets to enter over a specific port if their source IP address is currently allocated to a client connected to that port.

Support on this switch

On this switch, Access Control Lists (ACLs) based on DHCP snooping can be used with access groups to filter IP packets. For instance, IP traffic on untrusted ports can be limited to packets matching valid DHCP lease information stored in the DHCP snooping database. Quality of Service (QoS) configuration can also be applied to these ACLs.

The DHCP snooping feature is enabled or disabled per VLAN, and several of the related configuration settings are applied per port. If there are multiple VLANs on a port, all the VLANs will be subject to the same per-port settings.

Operation

Table 77-1 on page 77.7 shows the filtering that is applied by DHCP snooping on a switch with the following DHCP filtering configuration for untrusted ports:

- DHCP snooping is enabled on all VLANs (service dhcp-snooping command on page 78.24, ip dhcp snooping command on page 78.9)
- ARP security (arp security command on page 78.2) is enabled on all VLANs
- MAC address verification is enabled on the switch (ip dhcp snooping verify mac-address command on page 78.21; enabled by default), and all DHCP clients are directly connected to the switch.
- Access Control Lists allow IP packets that match the source IP address and MAC address of a valid lease entry in the DHCP snooping database, and deny other IP packets (access-list commands in Chapter 56, IPv4 Hardware Access Control List (ACL) Commands).
- DHCP requests containing Option 82 info are not allowed (ip dhcp snooping agent-option allow-untrusted command on page 78.11 this is disabled by default).
- Log messages and SNMP notifications are enabled for DHCP snooping and ARP security violations (ip dhcp snooping violation command on page 78.22, arp security violation command on page 78.3, snmp-server enable trap command on page 88.17).

Table 77-1: DHCP filtering on the switch

When the switch ...	And ...	Then the switch ...
DHCP packets		
Receives a DHCP BOOTP packet on a trusted port		Forwards the DHCP packet.
	The packet contains a valid IP address lease for a client, and the maximum number of leases for the client port has not been reached.	Adds or updates a lease entry in the DHCP snooping database.
	The maximum number of leases for the client port has been reached.	Drops the DHCP packet, generates a log message for the violation, generates an SNMP notification (trap), and does not add a lease entry to the database.
A lease entry in the DHCP snooping database expires		Removes the expired entry from the database.
Receives a DHCP BOOTP request packet on an untrusted port	The source MAC address and client hardware address match.	
Receives a DHCP BOOTP request packet on an untrusted port	The source MAC address and client hardware address do not match.	Drops the packet, generates a log message for the violation, and sends an SNMP notification (trap).
Receives a DHCP BOOTP request packet on an untrusted port	The packet contains Option 82 info.	Drops the DHCP packet, generates a log message for the violation, and sends an SNMP notification (trap).
Receives a DHCP BOOTP reply packet on an untrusted port		Drops the DHCP packet, generates a log message for the violation, and sends an SNMP notification (trap).
IP packets		
Receives an IP packet on a trusted port		Forwards the IP packet.
Receives an IP packet on an untrusted port	Its source MAC address, IP address, and receiving port match a valid lease entry in the DHCP snooping database.	Forwards the IP packet.
Receives an IP packet on an untrusted port	Its source MAC address, IP address, and receiving port do not match a valid lease entry in the DHCP snooping database.	Drops the packet. Does not generate a log message or an SNMP notification.
ARP packets		
Receives an ARP request on a trusted port		Forwards the ARP packet.
Receives an ARP request on an untrusted port	Its source MAC address, IP address, and receiving port match a valid entry in the DHCP snooping database	Forwards the ARP packet.
Receives an ARP request on an untrusted port	Its source MAC address, IP address, and receiving port do not match an entry in the DHCP snooping database	Drops the packet, generates a log message for the violation, and sends an SNMP notification (trap).

ARP Security

ARP security prevents ARP spoofing. ARP spoofing occurs when devices send fake, or 'spoofed', ARP messages to an Ethernet LAN. This makes it possible for an unauthorized host to claim to be an authorized host. The unauthorized host can then intercept traffic intended for the authorized host, and can access the wider network.

Spoofed ARP messages contain the IP address of an authorized host, with a MAC address which does not match the real MAC address of the host. When ARP security is enabled for DHCP snooping, the switch checks ARP packets sourced from untrusted ports against the entries in the DHCP snooping binding database. If it finds a matching entry, it forwards the ARP packet as normal. If it does not find a matching entry, it drops the ARP packet. This ensures that only trusted clients (with a recognized IP address and MAC address) can generate ARP packets into the network. ARP security is not applied to packets received on trusted ports.

ARP security is disabled by default, and can be enabled on VLANs to ensure that on untrusted ports, only trusted clients (with a recognized IP address and MAC address) can generate ARP packets into the network. ARP security is applied to both dynamic and static DHCP snooping entries. For static DHCP entries without a MAC address defined, ARP security compares only the IP address details.

MAC Address Verification

When MAC address verification is enabled, the switch forwards DHCP packets received on untrusted ports only if the source MAC address and client hardware address match. MAC address verification is enabled by default.

DHCP Snooping Violations

Packets violating DHCP snooping or ARP security checks (if these are enabled) are automatically dropped. The switch can also be configured to send SNMP notifications (atDhcpsnTrap and atArpsecTrap), to generate log messages, or to shut down the link on which the packet was received.

If the switch is configured to send notifications for DHCP snooping or ARP security violations, the rate is limited to one notification per second. If there are any further violations within a second, no notifications are sent for them. After one second, the switch only sends further notifications if the source MAC address and/or the violation reason are different from previous notifications. (If log messages are also generated for ARP security and DHCP snooping violations, you can see a record of all violations in the log, even if notifications were not sent for all of them.)

Interactions with Other Features

DHCP snooping interacts with other switch features as follows:

- Ports in trunk mode

  The DHCP snooping feature is enabled or disabled per VLAN, and several of the related configuration settings are applied to ports. If there are multiple VLANs on a port, all the VLANs will be subject to the same per-port settings.

- DHCP relay

  The switch cannot use DHCP snooping to filter IP traffic from a DHCP relay device.

  DHCP snooping (service dhcp-snooping command on page 78.24) and the DHCP relay agent option (ip dhcp-relay agent-option command on page 86.14) cannot both be enabled on the switch at the same time.

- DHCP snooping can be configured with port provisioning.

- Authentication

  DHCP snooping cannot be enabled on a switch that is configured for web authentication (auth-web enable command on page 65.28), roaming authentication (auth roaming enable command on page 65.17, auth roaming disconnected command on page 65.15), or guest VLAN authentication (auth guest-vlan command on page 65.9), or vice versa.

- Stacking

  If DHCP snooping is enabled in a stack, the DHCP snooping database and its backup file are automatically synchronized across all stack members, so that a new stack master can reinstate this database.

- Link aggregators

  DHCP snooping can operate over switch ports, and over static and dynamic (LACP) link aggregators (channel groups). If a switch port is added to an aggregator, DHCP snooping configuration is applied to the aggregator; configuration of the original switch port is not preserved. If the switch port is then removed from the aggregator, it returns to default DHCP snooping settings.

- Private VLANs

  Private VLANs are not supported for DHCP snooping.

Configuration

This section provides a general configuration procedure for DHCP snooping.

Configure DHCP Snooping

Note that if a port in trunk mode has multiple VLANs attached, then the DHCP snooping configuration settings for the port apply to all the VLANs.

Table 77-2: General configuration procedure for DHCP snooping

Enable DHCP snooping		
1.	`awplus#` `configure terminal`	Enter Global Configuration mode.
2.	`awplus(config)#` `service dhcp-snooping`	Enable DHCP snooping on the switch. Default: disabled
3.	`awplus(config)#` `interface <vid-list>`	Enter Interface Configuration mode for the VLANs to enable DHCP snooping on.
4.	`awplus(config-if)#` `ip dhcp snooping`	Enable DHCP snooping on these VLANs. Default: disabled
5.	`awplus(config-if)#` `exit`	Return to Global Configuration mode.
6.	`awplus(config-if)#` `interface <port-list>`	Enter Interface Configuration mode for ports connected to the trusted network. The port(s) connected to the DHCP server(s) must be configured as trusted ports.
7.	`awplus(config-if)#` `ip dhcp snooping trust`	Set these ports to be trusted ports. Default: untrusted
8.	`awplus(config-if)#` `exit`	Return to Global Configuration mode.
9.	`awplus(config)#` `interface <port-list>`	If you want to allow more than one DHCP lease for any ports, enter Interface Configuration mode for the required ports. The default is likely to be suitable for edge ports; on an aggregation switch, you may need to increase the maximum number of leases for ports connected to other switches and/or for multiple VLANs. Note that you cannot change this setting once DHCP snooping ACLs are attached to these interfaces.

Table 77-2: General configuration procedure for DHCP snooping(cont.)

10.	`awplus(config-if)#` `ip dhcp snooping max-bindings <0-520>`	Change the maximum number of leases for these ports. Default: 1
11.	`awplus(config-if)#` `exit`	Return to Global Configuration mode.
Configure DHCP filtering		
12.	`awplus(config)#` `access-list hardware <name>`	Create a hardware access list, and enter Hardware Access List Configuration mode to configure it. See the access-list hardware (named) command on page 56.19.

13.	`awplus(config-ip-hw-acl)#`
	`[<seqnum>] permit ip dhcpsnooping any`
	`[<seqnum>] deny ip any any`
		Configure the hardware access list to permit traffic with *source IP address* matching valid entries in the DHCP snooping database, and to deny other traffic. (The last filter applied to the ports by any access list must be the filter that denies all other traffic.)
		OR

	`awplus(config-ip-hw-acl)#`
	`[<seqnum>] permit ip dhcpsnooping any mac dhcpsnooping any`
	`[<seqnum>] deny ip any any mac any any`
		Configure the hardware access list to permit traffic with *source IP address and source MAC address* matching valid entries in the DHCP snooping database, and to deny other traffic. (The last filter applied to the ports by any access list must be the filter that denies all other traffic.)
		See the (access-list hardware IP protocol filter) command on page 56.24.

14.	`awplus(config-ip-hw-acl)#` `exit`	Return to Global Configuration mode.
15.	`awplus(config)#` `interface <port-list>`	Enter Interface Configuration mode for the ports to add the DHCP snooping access list to. Typically this would be all untrusted ports.
16.	`awplus(config-if)#` `access-group <name>`	Add the hardware-based access list(s) to these ports. The *name* in this command is the name of the access list specified in Step 12.
17.	`awplus(config-if)#` `exit`	Return to Global Configuration mode.

Table 77-2: General configuration procedure for DHCP snooping(cont.)

Configure ARP security		
18.	`awplus(config)#` `interface <vid-list>`	Enter Interface Configuration mode for the VLANs to enable ARP security on. Default: disabled
19.	`awplus(config-if)#` `arp security`	Enable ARP security on particular VLANs if required. On untrusted ports, ARP security forwards ARP packets that have a source IP address and MAC address matching a dynamic entry in the DHCP snooping database, or an IP address matching a static entry. It drops other ARP packets, and treats them as ARP security violations. Default: disabled
20.	`awplus(config-if)#` `exit`	Return to Global Configuration mode.
Configure DHCP Option 82		
21.	`awplus(config)#` `no ip dhcp snooping agent-option`	If you do not want the switch to insert DHCP Option 82 information into DHCP packets received on untrusted ports, or to remove this information from DHCP packets transmitted on untrusted ports, disable the DHCP Option 82 agent option. Default: enabled if DHCP snooping is enabled.
22.	`awplus(config)#` `ip dhcp snooping agent-option allow-untrusted`	If there are edge switches that add the Option 82 information to DHCP packets, and that are connected to untrusted ports on this switch, you may wish to enable this switch to forward these packets, and the associated DHCP reply packets, without changing the Option 82 information in them. Default: disabled.
23.	`awplus(config)#` `interface <port-list>`	Enter Interface Configuration mode for one or more ports to add a Subscriber ID for.
24.	`awplus(config-if)#` `ip dhcp snooping subscriber-id [<sub-id>]`	Add the Subscriber ID for these ports. The Subscriber ID is included in Option 82 information. Default: no Subscriber ID.
25.	`awplus(config)#` `interface <interface-list>`	Enter Interface Configuration mode for one or more VLANs to add a Circuit ID for.

Table 77-2: General configuration procedure for DHCP snooping(cont.)

26.	`awplus(config-if)#`	
	`ip dhcp snooping agent-option circuit-id vlantriplet`	Specify the Circuit ID for the VLAN or group of VLANs as the VLAN ID and port number. Default: VLAN ID and Ifindex number.
27.	`awplus(config)#`	
	`interface <interface-list>`	Enter Interface Configuration mode for one or more VLANs to add a Remote ID for.
28.	`awplus(config-if)#`	
	`ip dhcp snooping agent-option remote-id <remote-id>`	Specify the Remote ID for the VLAN or group of VLANs as an alphanumeric (ASCII) string, 1 to 63 characters in length. Default: the switch's MAC address.
29.	`awplus(config-if)#`	
	`exit`	Return to Global Configuration mode.
Configure MAC address verification		
30.	`awplus(config)#`	
	`no ip dhcp snooping verify mac-address`	If not required, disable MAC address verification. Default: enabled
Configure the DHCP snooping database		
31.	`awplus(config)#`	
	`ip dhcp snooping database {nvs|flash|card}`	If required, change the location of the file to which the switch writes the dynamic entries from the DHCP snooping database. Default: nvs (non-volatile storage)
32.	`awplus(config)#`	
	`no ip dhcp snooping delete-by-client`	By default, the switch deletes DHCP lease entries from the DHCP snooping database when it receives matching DHCP release messages. Disable these deletions if required, so that lease entries remain in the database until they expire. Default: enabled—entries are deleted when leases are released.
33.	`awplus(config)#`	
	`ip dhcp snooping delete-by-linkdown`	If required, set the switch to delete dynamic entries from the DHCP snooping database when their ports go down. Default: disabled—entries remain if links go down.
34.	`awplus(config)#`	
	`ip source binding <ipaddr> [<macaddr>] vlan <vid> interface <port>`	You can actively add, modify, or remove static entries from the DHCP snooping database.
35.	`awplus#`	
	`ip dhcp snooping binding <ipaddr> [<macaddr>] vlan <vid> interface <port> expiry <expiry-time>`	You can actively add or remove dynamic entries from the DHCP snooping database. These changes affect the current database and backup file, but are not stored in the running configuration.

Table 77-2: General configuration procedure for DHCP snooping(cont.)

Configure violation actions		
36.	`awplus(config)#`	
	`interface <port-list>`	Enter Interface Configuration mode for the ports for which you want to configure actions in response to DHCP snooping or ARP security violations.
37.	`awplus(config-if)#`	
	`ip dhcp snooping violation {log|trap|link-down} ...`	If required, set the switch to generate an SNMP notification (trap), to generate a log message, and/or to block traffic on the port on which a DHCP snooping and/or ARP security violation is detected.
	`arp security violation {log|trap|link-down} ...`	Default: By default, if a packet does not match the DHCP snooping and ARP security restrictions, the packet is dropped, but no other action is taken.
38.	`awplus(config-if)#`	
	`exit`	Return to Global Configuration mode.
39.	`awplus(config)#`	
	`snmp-server enable trap dhcpsnooping`	In order to send SNMP notifications: ■ set the action for violations to trap (Step 37) ■ configure SNMP—see Chapter 88, SNMP Commands ■ set the SNMP server to enable DHCP snooping notifications (by default notifications are disabled on the SNMP server). The port connecting the switch to the SNMP manager should be set as a trusted port (Step 7 on page 77.10).
40.	`awplus(config)#`	
	`exit`	Return to Privileged Exec mode.
Check the configuration		
41.	`awplus#`	
	`show ip dhcp snooping`	Check the DHCP snooping configuration.
	`show ip dhcp snooping interface [<port-list>]`	
	`show ip dhcp snooping acl`	
	`show arp security`	
	`show arp security interface [<port-list>]`	
	`show running-config dhcp`	
Troubleshooting DHCP snooping		
42.	`awplus#`	
	`show ip dhcp snooping binding`	Check all entries in the DHCP snooping database.
43.	`awplus#`	
	`show ip source binding`	Check the static entries in the DHCP snooping database.

Table 77-2: General configuration procedure for DHCP snooping(cont.)

44.	`awplus#`
	`show ip dhcp snooping statistics [detail] [interface <interface-list>]`
	`clear ip dhcp snooping statistics [interface <port-list>]`
		Check DHCP snooping statistics.

45.	`awplus#`
	`show arp security statistics [detail] [interface <port-list>]`
	`clear arp security statistics [interface <port-list>]`
		Check ARP security statistics.

46.	`awplus#`
	`debug ip dhcp snooping {all|acl|db|packet [detail]}`
	`show debugging ip dhcp snooping`
	`debug arp security`
	`show debugging arp security`
		Enable debug output for DHCP snooping and/or ARP security.

47.		If you have not already set the switch to log DHCP snooping and ARP security violations, you can do this for troubleshooting purposes. See Step 37 on page 77.14.
48.	`awplus#` `show log`	Display the contents of the buffered log, including any DHCP snooping log and debug messages. (See also Chapter 10, Logging Commands.)

Disabling DHCP Snooping

If you disable DHCP snooping on the whole switch (no service dhcp-snooping command on page 78.24), all the DHCP snooping configuration is removed, except for the Access Control Lists (ACL). Any ACLs on a port that permit traffic matching DHCP snooping entries and block other traffic, will block all traffic if DHCP snooping is disabled on the port. If you disable DHCP snooping either on the whole switch or on particular VLANs (no ip dhcp snooping command on page 78.9), you must also remove any DHCP snooping ACLs from the ports to maintain connectivity (no access-group command on page 56.4).

Related Features

In addition to configuring DHCP snooping as described in Table 77-2, consider whether you also need to configure the following:

- VLANs—see Chapter 16, VLAN Introduction and Chapter 17, VLAN Commands
- Additional ACL filters—see Chapter 55, Access Control Lists Introduction and Chapter 57, IPv4 Software Access Control List (ACL) Commands
- QoS—see Chapter 60, Quality of Service (QoS) Introduction and Chapter 61, QoS Commands
- SNMP—Chapter 87, SNMP Introduction and Chapter 88, SNMP Commands

Chapter 78: DHCP Snooping Commands

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Command List

This chapter gives detailed information about the commands used to configure DHCP snooping. For detailed descriptions of related ACL commands, see Chapter 56, IPv4 Hardware Access Control List (ACL) Commands. For more information about DHCP snooping, see Chapter 77, DHCP Snooping Introduction and Configuration.

DHCP snooping can operate on static link aggregators (e.g., sa2) and dynamic link aggregators (e.g. po3) link aggregators, as well as switch ports (e.g., port1.0.2).

arp security

Use this command to enable ARP security on untrusted ports in the VLANs, so that the switch only responds to/forwards ARP packets if they have recognized IP and MAC source addresses.

Use the no variant of this command to disable ARP security on the VLANs.

Syntax

```
arp security
no arp security
```

Default Disabled

Mode Interface Configuration (VLANs)

Usage Enable ARP security to provide protection against ARP spoofing. DHCP snooping must also be enabled on the switch (service dhcp-snooping command on page 78.24), and on the VLANs (ip dhcp snooping command on page 78.9).

Example To enable ARP security on VLANs 2 to 4, use the commands:

```
awplus# configure terminal
awplus(config)# interface vlan2-vlan4
awplus(config-if)# arp security
```

Related Commands

arp security violation
show arp security
show arp security interface
show arp security statistics

arp security violation

Use this command to specify an additional action to perform if an ARP security violation is detected on the ports. ARP security must also be enabled (arp security command on page 78.2).

Use the no variant of this command to remove the specified action, or all actions. Traffic violating ARP security will be dropped, but no other action will be taken.

Syntax

```
arp security violation {log|trap|link-down} ...
no arp security violation [log|trap|link-down] ...
```

Parameter	Description
`log`	Generate a log message. To display these messages, use the show log command on page 10.40.
`trap`	Generate an SNMP notification (trap). To send SNMP notifications, SNMP must also be configured, and DHCP snooping notifications must be enabled using the snmp-server enable trap command on page 88.17. Notifications are limited to one per second and to one per source MAC and violation reason. Additional violations within a second of a notification being sent will not result in further notifications. Default: disabled.
`link-down`	Shut down the port that received the packet. Default: disabled.

Default When the switch detects an ARP security violation, it drops the packet. By default, it does not perform any other violation actions.

Mode Interface Configuration (switch ports, static or dynamic aggregated links)

Usage When the switch detects an ARP security violation on an untrusted port in a VLAN that has ARP security enabled, it drops the packet. This command sets the switch to perform additional actions in response to ARP violations.

If a port has been shut down in response to a violation, to bring it back up again after any issues have been resolved, use the no shutdown command on page 11.13.

Example To send SNMP notifications for ARP security violations on ports 1.0.1 to 1.0.8, use the commands:

```
awplus# configure terminal
awplus(config)# snmp-server enable trap dhcpsnooping
awplus(config)# interface port1.0.1-port1.0.8
awplus(config-if)# arp security violation trap
```

Related Commands

arp security
show arp security interface
show arp security statistics
show log
snmp-server enable trap

clear arp security statistics

Use this command to clear ARP security statistics for the specified ports, or for all ports.

Syntax

```
clear arp security statistics [interface <port-list>]
```

Parameter	Description
<port-list>	The ports to clear statistics for. If no ports are specified, statistics are cleared for all ports. The ports may be switch ports, or static or dynamic link aggregators.

Mode

Privileged Exec

Example

To clear statistics for ARP security on interface port1.0.1, use the command:

```
awplus# clear arp security statistics interface port1.0.1
```

Related Commands

arp security violation
show arp security
show arp security statistics

clear ip dhcp snooping binding

Use this command to remove one or more DHCP Snooping dynamic entries from the DHCP Snooping binding database. If no options are specified, all entries are removed from the database.

Caution If you remove entries from the database for current clients, they will lose IP connectivity until they request and receive a new DHCP lease. If you clear all entries, all clients connected to untrusted ports will lose connectivity.

Syntax

```
clear ip dhcp snooping binding [<ipaddr>] [interface <port-list>]
   [vlan <vid-list>]
```

Parameter	Description
<ipaddr>	Remove the entry for this client IP address.
<port-list>	Remove all entries for these ports. The port list may contain switch ports, and static or dynamic link aggregators (channel groups).
<vid-list>	Remove all entries associated with these VLANs.

Mode Privileged Exec

Usage This command removes dynamic entries from the database. Note that dynamic entries can also be deleted by using the no variant of the ip dhcp snooping binding command on page 78.14.

Dynamic entries can individually restored by using the ip dhcp snooping binding command.

To remove static entries, use the no variant of the ip source binding command on page 78.23.

Example To remove a dynamic lease entry from the DHCP snooping database for a client with the IP address 192.168.1.2, use the command:

```
awplus# clear ip dhcp snooping binding 192.168.1.2
```

Related Commands
ip dhcp snooping binding
ip source binding
show ip dhcp snooping binding

clear ip dhcp snooping statistics

Use this command to clear DHCP snooping statistics for the specified ports, or for all ports.

Syntax `clear ip dhcp snooping statistics [interface <port-list>]`

Parameter	Description
<port-list>	The ports to clear statistics for. If no ports are specified, statistics are cleared for all ports. The port list can contain switch ports, or static or dynamic link aggregators.

Mode Privileged Exec

Example To clear statistics for the DHCP snooping on interface port1.0.1, use the command:

```
awplus# clear ip dhcp snooping statistics interface port1.0.1
```

Related Commands
clear arp security statistics
show ip dhcp snooping
show ip dhcp snooping statistics

debug arp security

Use this command to enable ARP security debugging.

Use the no variant of this command to disable debugging for ARP security.

Syntax

```
debug arp security
no debug arp security
```

Default Disabled

Mode Privileged Exec

Example To enable ARP security debugging, use the commands:

```
awplus# debug arp security
```

Related Commands

show debugging arp security
show log
terminal monitor

debug ip dhcp snooping

Use this command to enable the specified types of debugging for DHCP snooping.

Use the no variant of this command to disable the specified types of debugging.

Syntax

```
debug ip dhcp snooping {all|acl|db|packet [detail]}
no debug ip dhcp snooping {all|acl|db|packet [detail]}
```

Parameter	Description
`all`	All DHCP snooping debug.
`acl`	DHCP snooping access list debug.
`db`	DHCP snooping binding database debug.
`packet`	DHCP snooping packet debug. For the no variant of this command, this option also disables detailed packet debug, if it was enabled.
`detail`	Detailed packet debug.

Default Disabled

Mode Privileged Exec

Example To enable access list debugging for DHCP snooping, use the commands:

```
awplus# debug ip dhcp snooping acl
```

Related Commands

debug arp security
show debugging ip dhcp snooping
show log
terminal monitor

ip dhcp snooping

Use this command to enable DHCP snooping on one or more VLANs.

Use the no variant of this command to disable DHCP snooping on the VLANs.

Syntax

```
ip dhcp snooping
no ip dhcp snooping
```

Default DHCP snooping is disabled on VLANs by default.

Mode Interface Configuration (VLANs)

Usage For DHCP snooping to operate on a VLAN, it must:

- be enabled on the particular VLAN by using this command
- be enabled globally on the switch by using the service dhcp-snooping command on page 78.24
- have at least one port connected to a DHCP server configured as a trusted port by using the ip dhcp snooping trust command on page 78.20

Any ACLs on a port that permit traffic matching DHCP snooping entries and block other traffic, will block all traffic if DHCP snooping is disabled on the port. If you disable DHCP snooping on particular VLANs using this command, you must also remove any DHCP snooping ACLs from the ports to maintain connectivity (no access-group command on page 56.4).

Example To enable DHCP snooping on VLANs 2 to 4, use the commands:

```
awplus# configure terminal
awplus(config)# interface vlan2-vlan4
awplus(config-if)# ip dhcp snooping
```

To disable DHCP snooping on the switch, use the command:

```
awplus# configure terminal
awplus(config)# interface vlan2-vlan4
awplus(config-if)# no ip dhcp snooping
```

Related Commands

ip dhcp snooping trust
service dhcp-snooping
show ip dhcp snooping

ip dhcp snooping agent-option

Use this command to enable DHCP Option 82 data insertion on the switch. When this is enabled, the switch:

- inserts DHCP Option 82 into DHCP packets that it receives on untrusted ports
- removes DHCP Option 82 from DHCP packets that it sends to untrusted ports.

Use the no variant of this command to disable DHCP Option 82.

Syntax

```
ip dhcp snooping agent-option
no ip dhcp snooping agent-option
```

Default DHCP Option 82 is enabled by default when DHCP snooping is enabled.

Mode Global Configuration

Usage DHCP snooping must also be enabled on the switch (service dhcp-snooping command on page 78.24), and on the VLANs (ip dhcp snooping command on page 78.9).

If a subscriber ID is configured for the port (ip dhcp snooping subscriber-id command on page 78.19), the switch includes this in the DHCP Option 82 information it inserts into DHCP packets received on the port.

Example To disable DHCP Option 82 on the switch, use the commands:

```
awplus# configure terminal
awplus(config)# no ip dhcp snooping agent-option
```

Related Commands

ip dhcp snooping
ip dhcp snooping agent-option allow-untrusted
ip dhcp snooping subscriber-id
service dhcp-snooping
show ip dhcp snooping

ip dhcp snooping agent-option allow-untrusted

Use this command to enable DHCP Option 82 reception on untrusted ports. When this is enabled, the switch accepts incoming DHCP packets that contain DHCP option 82 data on untrusted ports.

Use the no variant of this command to disable DHCP Option 82 reception on untrusted ports.

Syntax

```
ip dhcp snooping agent-option allow-untrusted
no ip dhcp snooping agent-option allow-untrusted
```

Default Disabled

Mode Global Configuration

Usage If the switch is connected via untrusted ports to edge switches that insert DHCP Option 82 data into DHCP packets, you may need to allow these DHCP packets through the untrusted ports, by using this command.

When this is disabled (default), the switch treats incoming DHCP packets on untrusted ports that contain DHCP option 82 data as DHCP snooping violations: it drops them and applies any violation action specified by the ip dhcp snooping violation command on page 78.22. The switch stores statistics for packets dropped; to display these statistics, use the show ip dhcp snooping statistics command on page 78.40.

Example To enable DHCP snooping Option 82 data reception on untrusted ports, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp snooping agent-option allow-untrusted
```

Related Commands

ip dhcp snooping agent-option
ip dhcp snooping violation
show ip dhcp snooping
show ip dhcp snooping statistics

ip dhcp snooping agent-option circuit-id vlantriplet

Use this command to specify the Circuit ID sub-option of the Option 82 field as the VLAN ID and port number. The Circuit ID specifies the switch port and VLAN ID that the client-originated DHCP packet was received on.

Use the no variant of this command to set the Circuit ID to the default, the VLAN ID and Ifindex (interface number).

Syntax

```
ip dhcp snooping agent-option circuit-id vlantriplet
no ip dhcp snooping agent-option circuit-id
```

Default By default, the Circuit ID is the VLAN ID and Ifindex (interface number).

Mode Interface Configuration for a VLAN interface.

Usage The Circuit ID sub-option is included in the DHCP Option 82 field of forwarded client DHCP packets:

- DHCP snooping Option 82 is enabled (ip dhcp snooping agent-option command on page 78.10; enabled by default), and
- DHCP snooping is enabled on the switch (service dhcp-snooping) and on the VLAN to which the port belongs (ip dhcp snooping)

Examples To set the Circuit ID to `vlantriplet` for client DHCP packets received on `vlan1`, use the commands:

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip dhcp snooping agent-option circuit-id
vlantriplet
```

To return the Circuit ID format to the default for `vlan1`, use the commands:

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# no ip dhcp snooping agent-option circuit-id
```

Related Commands

ip dhcp snooping agent-option
ip dhcp snooping agent-option remote-id
show ip dhcp snooping
show ip dhcp snooping agent-option

ip dhcp snooping agent-option remote-id

Use this command to specify the Remote ID sub-option of the Option 82 field. The Remote ID identifies the device that inserted the Option 82 information. If a Remote ID is not specified, the Remote ID sub-option is set to the switch's MAC address.

Use the no variant of this command to set the Remote ID to the default, the switch's MAC address.

Syntax

```
ip dhcp snooping agent-option remote-id <remote-id>
no ip dhcp snooping agent-option remote-id
```

Parameter	Description
<remote-id>	An alphanumeric (ASCII) string, 1 to 63 characters in length. If the Remote ID contains spaces, it must be enclosed in double quotes. Wildcards are not allowed.

Default The Remote ID is set to the switch's MAC address by default.

Mode Interface Configuration for a VLAN interface.

Usage The Remote ID sub-option is included in the DHCP Option 82 field of forwarded client DHCP packets:

- DHCP snooping Option 82 is enabled (ip dhcp snooping agent-option command on page 78.10; enabled by default), and
- DHCP snooping is enabled on the switch (service dhcp-snooping) and on the VLAN to which the port belongs (ip dhcp snooping)

Examples To set the Remote ID to `myid` for client DHCP packets received on `vlan1`, use the commands:

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip dhcp snooping agent-option remote-id
myid
```

To return the Remote ID format to the default for `vlan1`, use the commands:

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# no ip dhcp snooping agent-option remote-id
```

Related Commands

ip dhcp snooping agent-option
ip dhcp snooping agent-option circuit-id vlantriplet
show ip dhcp snooping
show ip dhcp snooping agent-option

ip dhcp snooping binding

Use this command to manually add a dynamic-like entry (with an expiry time) to the DHCP snooping database. Once added to the database, this entry is treated as a dynamic entry, and is stored in the DHCP snooping database backup file. This command is not stored in the switch's running configuration.

Use the no variant of this command to delete a dynamic entry for an IP address from the DHCP snooping database, or to delete all dynamic entries from the database.

Caution If you remove entries from the database for current clients, they will lose IP connectivity until they request and receive a new DHCP lease. If you clear all entries, all clients connected to untrusted ports will lose connectivity.

Syntax

```
ip dhcp snooping binding <ipaddr> [<macaddr>] vlan <vid> interface
   <port> expiry <expiry-time>

no ip dhcp snooping binding [<ipaddr>]
```

Parameter	Description
<ipaddr>	Client's IP address.
<macaddr>	Client's MAC address in HHHH.HHHH.HHHH format.
<vid>	The VLAN ID for the entry, in the range 1 to 4094.
<port>	The port the client is connected to. The port can be a switch port, or a static or dynamic link aggregation (channel group).
<expiry-time>	The expiry time for the entry, in the range 5 to 2147483647 seconds.

Mode Privileged Exec

Usage Note that dynamic entries can also be deleted from the DHCP snooping database by using the clear ip dhcp snooping binding command on page 78.5.

To add or remove static entries from the database, use the ip source binding command on page 78.23.

Example To restore an entry in the DHCP snooping database for a DHCP client with the IP address 192.168.1.2, MAC address 0001.0002.0003, on port1.0.6 of vlan6, and with an expiry time of 1 hour, use the commands:

```
awplus# ip dhcp snooping binding 192.168.1.2 0001.0002.0003
        vlan 6 interface port1.0.6 expiry 3600
```

Related Commands

clear ip dhcp snooping binding
ip source binding
show ip dhcp snooping binding

ip dhcp snooping database

Use this command to set the location of the file to which the dynamic entries in the DHCP snooping database are written. This file provides a backup for the DHCP snooping database.

Use the no variant of this command to set the database location back to the default, nvs.

Syntax

```
ip dhcp snooping database {nvs|flash|card}
no ip dhcp snooping database
```

Parameter	Description
nvs	The switch checks the database and writes the file to non-volatile storage (NVS) on the switch at 2 second intervals if it has changed.
flash	The switch checks the database and writes the file to Flash memory on the switch at 60 second intervals if it has changed.
card	The switch checks the database and writes the file to an SD card installed in the switch at 2 second intervals if it has changed. Note that a current DHCP snooping backup database file is essential to maintain connectivity for DHCP clients after a switch reboot. If you configure the switch to save this file to an SD card, we recommend that you ensure the card is always present.

Default NVS

Mode Global Configuration

Usage In a stack, the backup file is automatically synchronized across all stack members to the location configured. If the backup file is stored on an SD card on the stack master, it is only synchronized across stack members that also have an SD card installed.

If the location of the backup file is changed by using this command, a new file is created in the new location, and the old version of the file remains in the old location. This can be removed if necessary (hidden file: .dhcp.dsn.gz).

Example To set the location of the DHCP snooping database to non-volatile storage on the switch, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp snooping database nvs
```

Related Commands show ip dhcp snooping

ip dhcp snooping delete-by-client

Use this command to set the switch to remove a dynamic entry from the DHCP snooping database when it receives a valid DHCP release message with matching IP address, VLAN ID, and client hardware address on an untrusted port, and to discard release messages that do not match an entry in the database.

Use the no variant of this command to set the switch to forward DHCP release messages received on untrusted ports without removing any entries from the database.

Syntax

```
ip dhcp snooping delete-by-client
no ip dhcp snooping delete-by-client
```

Default Enabled: by default, DHCP lease entries are deleted from the DHCP snooping database when matching DHCP release messages are received.

Mode Global Configuration

Usage DHCP clients send a release message when they no longer wish to use the IP address they have been allocated by a DHCP server. Use this command to enable DHCP snooping to use the information in these messages to remove entries from its database immediately. Use the no variant of this command to ignore these release messages. Lease entries corresponding to ignored DHCP release messages eventually time out when the lease expires.

Example To set the switch to delete DHCP snooping lease entries from the DHCP snooping database when a matching release message is received, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp snooping delete-by-client
```

To set the switch to forward and ignore the content of any DHCP release messages it receives, use the commands:

```
awplus# configure terminal
awplus(config)# no ip dhcp snooping delete-by-client
```

Related Commands show ip dhcp snooping

ip dhcp snooping delete-by-linkdown

Use this command to set the switch to remove a dynamic entry from the DHCP snooping database when its port goes down. If the port is part of an aggregated link, the entries in the database are only deleted if all the ports in the aggregated link are down.

Use the no variant of this command to set the switch not to delete entries when ports go down.

Syntax

```
ip dhcp snooping delete-by-linkdown
no ip dhcp snooping delete-by-linkdown
```

Default Disabled: by default DHCP Snooping bindings are not deleted when an interface goes down.

Mode Global Configuration

Usage If this command is enabled in a stack, and the master goes down and is replaced by a new master, entries in the DHCP snooping database for ports on the master are removed, unless they are part of link aggregators that are still up.

Examples To set the switch to delete DHCP snooping lease entries from the DHCP snooping database when links go down, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp snooping delete-by-linkdown
```

To set the switch *not* to delete DHCP snooping lease entries from the DHCP snooping database when links go down, use the commands:

```
awplus# configure terminal
awplus(config)# no ip dhcp snooping delete-by-linkdown
```

Related Commands show ip dhcp snooping

ip dhcp snooping max-bindings

Use this command to set the maximum number of DHCP lease entries that can be stored in the DHCP snooping database for each of the ports. Once this limit has been reached, no further DHCP lease allocations made to devices on the port are stored in the database.

Use the no variant of this command to reset the maximum to the default, 1.

Syntax

```
ip dhcp snooping max-bindings <0-520>
no ip dhcp snooping max-bindings
```

Parameter	Description
<0-520>	The maximum number of bindings that will be stored for the port in the DHCP snooping binding database. If 0 is specified, no entries will be stored in the database for the port.

Default The default for maximum bindings is 1.

Mode Interface Configuration (port)

Usage The maximum number of leases cannot be changed for a port while there are DHCP snooping Access Control Lists (ACL) associated with the port. Before using this command, remove any DHCP snooping ACLs associated with the ports. To display ACLs used for DHCP snooping, use the show ip dhcp snooping acl command on page 78.33.

In general, the default (1) will work well on an edge port with a single directly connected DHCP client. If the port is on an aggregation switch that is connected to an edge switch with multiple DHCP clients connected through it, then use this command to increase the number of lease entries for the port.

If there are multiple VLANs configured on the port, the limit is shared between all the VLANs on this port. For example, the default only allows one lease to be stored for one VLAN. To allow connectivity for the other VLANs, use this command to increase the number of lease entries for the port.

Example To set the maximum number of bindings to be stored in the DHCP snooping database to 10 per port for ports 1.0.1 to 1.0.8, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1-port1.0.8
awplus(config-if)# ip dhcp snooping max-bindings 10
```

Related Commands

access-group
show ip dhcp snooping acl
show ip dhcp snooping interface

ip dhcp snooping subscriber-id

Use this command to set a Subscriber ID for the ports.

Use the no variant of this command to remove Subscriber IDs from the ports.

Syntax

```
ip dhcp snooping subscriber-id [<sub-id>]
no ip dhcp snooping subscriber-id
```

Parameter	Description
<sub-id>	The Subscriber ID; an alphanumeric (ASCII) string 1 to 50 characters in length. If the Subscriber ID contains spaces, it must be enclosed in double quotes. Wildcards are not allowed.

Default No Subscriber ID.

Mode Interface Configuration (port)

Usage The Subscriber ID sub-option is included in the DHCP Option 82 field of client DHCP packets forwarded from a port if:

- a Subscriber ID is specified for the port using this command, and
- DHCP snooping Option 82 is enabled (ip dhcp snooping agent-option command on page 78.10; enabled by default), and
- DHCP snooping is enabled on the switch (service dhcp-snooping) and on the VLAN to which the port belongs (ip dhcp snooping)

Example To set the Subscriber ID for port 1.0.3 to room_534, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# ip dhcp snooping subscriber-id room_534
```

To remove the Subscriber ID from port 1.0.3, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# no ip dhcp snooping subscriber-id
```

Related Commands
ip dhcp snooping agent-option
show ip dhcp snooping interface

ip dhcp snooping trust

Use this command to set the ports to be DHCP snooping trusted ports.

Use the no variant of this command to return the ports to their default as untrusted ports.

Syntax

```
ip dhcp snooping trust
no ip dhcp snooping trust
```

Default All ports are untrusted by default.

Mode Interface Configuration (port)

Usage Typically, ports connecting the switch to trusted elements in the network (towards the core) are set as trusted ports, while ports connecting untrusted network elements are set as untrusted. Configure ports connected to DHCP servers as trusted ports.

Example To set switch ports 1.0.1 and 1.0.2 to be trusted ports, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1-port1.0.2
awplus(config-if)# ip dhcp snooping trust
```

Related Commands show ip dhcp snooping interface

ip dhcp snooping verify mac-address

Use this command to verify that the source MAC address and client hardware address match in DHCP packets received on untrusted ports.

Use the no variant of this command to disable MAC address verification.

Syntax

```
ip dhcp snooping verify mac-address
no ip dhcp snooping verify mac-address
```

Default Enabled—source MAC addresses are verified by default.

Mode Global Configuration

Usage When MAC address verification is enabled, the switch treats DHCP packets with source MAC address and client hardware address that do not match as DHCP snooping violations: it drops them and applies any other violation action specified by the ip dhcp snooping violation command on page 78.22. To bring the port back up again after any issues have been resolved, use the no shutdown command on page 11.13.

Example To disable MAC address verification on the switch, use the commands:

```
awplus# configure terminal
awplus(config)# no ip dhcp snooping verify mac-address
```

Related Commands

ip dhcp snooping violation
show ip dhcp snooping
show ip dhcp snooping statistics

ip dhcp snooping violation

Use this command to specify the action the switch will take when it detects a DHCP snooping violation by a DHCP packet on the ports.

Use the no variant of this command to disable the specified violation actions, or all violation actions.

Syntax

```
ip dhcp snooping violation {log|trap|link-down} ...
no ip dhcp snooping violation [{log|trap|link-down} ...]
```

Parameter	Description
`log`	Generate a log message. To display these messages, use the show log command on page 10.40. Default: disabled.
`trap`	Generate an SNMP notification (trap). To send SNMP notifications, SNMP must also be configured, and DHCP snooping notifications must be enabled using the snmp-server enable trap command on page 88.17. Notifications are limited to one per second and to one per source MAC and violation reason. Default: disabled.
`link-down`	Set the port status to link-down. Default: disabled.

Default By default, DHCP packets that violate DHCP snooping are dropped, but no other violation action is taken.

Mode Interface Configuration (port)

Usage If a port has been shut down in response to a violation, to bring it back up again after any issues have been resolved, use the no shutdown command on page 11.13.

IP packets dropped by DHCP snooping filters do not result in other DHCP snooping violation actions.

Example To set the switch to send an SNMP notification and set the link status to link-down if it detects a DHCP snooping violation on switch ports 1.0.1 to 1.0.4, use the commands:

```
awplus# configure terminal
awplus(config)# snmp-server enable trap dhcpsnooping
awplus(config)# interface port1.0.1-port1.0.4
awplus(config-if)# ip dhcp snooping violation trap link-down
```

Related Commands

show ip dhcp snooping interface
show log
snmp-server enable trap

ip source binding

Use this command to add or replace a static entry in the DHCP snooping database.

Use the no variant of this command to delete the specified static entry or all static entries from the database.

Syntax

```
ip source binding <ipaddr> [<macaddr>] vlan <vid> interface <port>
no ip source binding [<ipaddr>]
```

Parameter	Description
<ipaddr>	Client's IP address. If there is already an entry in the DHCP snooping database for this IP address, then this command replaces it with the new entry.
<macaddr>	Client's MAC address in HHHH.HHHH.HHHH format.
<vid>	The VLAN ID associated with the entry.
<port>	The port the client is connected to.

Mode Global Configuration

Usage This command removes static entries from the database.

To remove dynamic entries, use the clear ip dhcp snooping binding command on page 78.5 or the no variant of the ip dhcp snooping binding command on page 78.14.

Example To add a static entry to the DHCP snooping database for a client with the IP address 192.168.1.2, MAC address 0001.0002.0003, on port1.0.6 of vlan6, use the command:

```
awplus# configure terminal
awplus(config)# ip source binding 192.168.1.2 0001.0002.0003
vlan 6 interface port1.0.6
```

To remove the static entry for IP address 192.168.1.2 from the database, use the commands:

```
awplus# configure terminal
awplus(config)# no ip source binding 192.168.1.2
```

To remove all static entries from the database, use the commands:

```
awplus# configure terminal
awplus(config)# no ip source binding
```

Related Commands

clear ip dhcp snooping binding
ip dhcp snooping binding
show ip dhcp snooping binding
show ip source binding

service dhcp-snooping

Use this command to enable the DHCP snooping service globally on the switch. This must be enabled before other DHCP snooping configuration commands can be entered.

Use the no variant of this command to disable the DHCP snooping service on the switch. This removes all DHCP snooping configuration from the running configuration, except for any DHCP snooping maximum bindings settings (ip dhcp snooping max-bindings command on page 78.18), and any DHCP snooping-based Access Control Lists (ACLs), which are retained when the service is disabled.

Syntax

```
service dhcp-snooping

no service dhcp-snooping
```

Default DHCP snooping is disabled on the switch by default.

Mode Global Configuration

Usage For DHCP snooping to operate on a VLAN, it must be enabled on the switch by using this command, and also enabled on the particular VLAN by using the ip dhcp snooping command on page 78.9.

For DHCP snooping to operate on a VLAN, it must:

- be enabled globally on the switch by using this command
- be enabled on the particular VLAN by using the ip dhcp snooping command on page 78.9
- have at least one port connected to a DHCP server configured as a trusted port by using the ip dhcp snooping trust command on page 78.20

If you disable the DHCP snooping service by using the no variant of this command, all DHCP snooping configuration (including ARP security, but excluding maximum bindings and ACLs) is removed from the running configuration, and the DHCP snooping database is deleted from active memory. If you re-enable the service, the switch:

- repopulates the DHCP snooping database from the dynamic lease entries in the database backup file (in NVS by default—see the ip dhcp snooping database command on page 78.15). The lease expiry times are updated.

The DHCP snooping service cannot be enabled on a switch that is configured with any of the following features, or vice versa:

- web authentication (auth-web enable command on page 65.28)
- roaming authentication (auth roaming enable command on page 65.17, auth roaming disconnected command on page 65.15)
- guest VLAN authentication (auth guest-vlan command on page 65.9).
- DHCP relay agent option (ip dhcp-relay agent-option command on page 86.14)

Any ACLs on a port that permit traffic matching DHCP snooping entries and block other traffic, will block all traffic if DHCP snooping is disabled on the port. If you disable DHCP snooping on the switch using this command, you must also remove any DHCP snooping ACLs from the ports to maintain connectivity (no access-group command on page 56.4).

Example To enable DHCP snooping on the switch, use the command:

```
awplus# configure terminal
awplus(config)# service dhcp-snooping
```

To disable DHCP snooping on the switch, use the command:

```
awplus# configure terminal
awplus(config)# no service dhcp-snooping
```

Related Commands
ip dhcp snooping
ip dhcp snooping database
ip dhcp snooping max-bindings
show ip dhcp snooping

show arp security

Use this command to display ARP security configuration.

Syntax `show arp security`

Mode User Exec and Privileged Exec

Example To display ARP security configuration on the switch use the command:

```
awplus# show arp security
```

Figure 78-1: Example output from the **show arp security** command

```
awplus# show arp security

ARP Security Information:
  Total VLANs enabled ..... 2
  Total VLANs disabled ..... 11
  vlan1 ..... Disabled
  vlan2 ..... Disabled
  vlan3 ..... Disabled
  vlan4 ..... Disabled
  vlan5 ..... Disabled
  vlan100 ..... Disabled
  vlan101 ..... Disabled
  vlan102 ..... Disabled
  vlan103 ..... Disabled
  vlan104 ..... Disabled
  vlan105 ..... Enabled
  vlan1000 ..... Disabled
  vlan1001 ..... Enabled
```

Table 78-1: Parameters in the output from the **show arp security** command

Parameter	Description
`Total VLANs enabled`	The number of VLANs that have ARP security enabled.
`Total VLANs disabled`	The number of VLANs that have ARP security disabled.

Related Commands
arp security
show arp security interface
show arp security statistics

show arp security interface

Use this command to display ARP security configuration for the specified ports or all ports.

Syntax `show arp security interface [<port-list>]`

Parameter	Description
<port-list>	The ports to display ARP security information about. The port list can include switch ports, and static or dynamic aggregated links.

Mode User Exec and Privileged Exec

Example To display ARP security configuration for ports, use the command:

```
awplus# show arp security interface
```

Figure 78-2: Example output from the **show arp security interface** command

```
awplus#show arp security interface

Arp Security Port Status and Configuration:

  Port: Provisioned ports marked with brackets, e.g. (portx.y.z)
  KEY:  LG = Log
        TR = Trap
        LD = Link down

Port         Action
-------------------------------
port1.0.1    -- -- --
port1.0.2    -- -- --
port1.0.3    LG TR LD
port1.0.4    LG -- --
port1.0.5    LG -- --
port1.0.6    LG TR --
port1.0.7    LG -- LD
...
```

Table 78-2: Parameters in the output from the **show arp security interface** command

Parameter	Description
`Action`	The action the switch takes when it detects an ARP security violation on the port.
`Port`	The port. Parentheses indicate that ports are configured for provisioning.
`LG, Log`	Generate a log message
`TR, Trap`	Generate an SNMP notification (trap).
`LD, Link down`	Shut down the link.

Related Commands
arp security violation
show arp security
show arp security statistics
show log

snmp-server enable trap

show arp security statistics

Use this command to display ARP security statistics for the specified ports or all ports.

Syntax `show arp security statistics [detail] [interface <port-list>]`

Parameter	Description
`detail`	Display detailed statistics.
`interface <port-list>`	Display statistics for the specified ports.

Mode User Exec and Privileged Exec

Example To display the brief statistics for the ARP security, use the command:

```
awplus# show arp security statistics
```

Figure 78-3: Example output from the **show arp security statistics** command

```
awplus# show arp security statistics

DHCP Snooping ARP Security Statistics:

               In          In
 Interface     Packets     Discards
---------------------------------
 port1.0.3     20          20
 port1.0.4     30          30
 port1.0.12    120         0
```

Table 78-3: Parameters in the output from the **show arp security statistics** command

Parameter	Description
`Interface`	A port name. Parentheses indicate that ports are configured for provisioning.
`In Packets`	The total number of incoming APR packets that are processed by DHCP Snooping ARP Security
`In Discards`	The total number of ARP packets that are dropped by DHCP Snooping ARP Security.

Figure 78-4: Example output from the show arp security statistics detail command

```
awplus#show arp security statistics detail

DHCP Snooping ARP Security Statistics:

Interface ..................... port1.0.3
  In Packets .................. 20
  In Discards ................. 20
    No Lease .................. 20
    Bad Vlan .................. 0
    Bad Port .................. 0
    Source Ip Not Allocated .... 0

Interface ..................... port1.0.4
  In Packets .................. 30
  In Discards ................. 30
    No Lease .................. 30
    Bad Vlan .................. 0
    Bad Port .................. 0
    Source Ip Not Allocated .... 0

Interface ..................... port1.0.12
  In Packets .................. 120
  In Discards ................. 0
    No Lease .................. 0
    Bad Vlan .................. 0
    Bad Port .................. 0
    Source Ip Not Allocated .... 0
```

Related Commands

arp security
arp security violation
clear arp security statistics
show arp security
show arp security interface
show log

show debugging arp security

Use this command to display the ARP security debugging configuration.

Syntax `show debugging arp security`

Mode User and Privileged Exec

Example To display the debugging settings for ARP security on the switch, use the command:

```
awplus# show debugging arp security
```

Figure 78-5: Example output from the **show debugging arp security** command

```
awplus# show debugging arp security

ARP Security debugging status:
  ARP Security debugging is off
```

Related Commands arp security violation
debug arp security

show debugging ip dhcp snooping

Use this command to display the DHCP snooping debugging configuration.

Syntax `show debugging ip dhcp snooping`

Mode User Exec and Privileged Exec

Example To display the DHCP snooping debugging configuration, use the command:

```
awplus# show debugging ip dhcp snooping
```

Figure 78-6: Example output from the **show debugging ip dhcp snooping** command

```
awplus# show debugging ip dhcp snooping

DHCP snooping debugging status:
  DHCP snooping debugging is off
  DHCP snooping all debugging is off
  DHCP snooping acl debugging is off
  DHCP snooping binding DB debugging is off
  DHCP snooping packet debugging is off
  DHCP snooping detailed packet debugging is off
```

Related Commands debug ip dhcp snooping
show log

show ip dhcp snooping

Use this command to display DHCP snooping global configuration on the switch.

Syntax `show ip dhcp snooping`

Mode User Exec and Privileged Exec

Example To display global DHCP snooping configuration on the switch, use the command:

```
awplus# show ip dhcp snooping
```

Figure 78-7: Example output from the **show ip dhcp snooping** command

```
DHCP Snooping Information:
  DHCP Snooping service ............. Enabled
  Option 82 insertion ............... Enabled
  Option 82 on untrusted ports ...... Not allowed
  Binding delete by client .......... Disabled
  Binding delete by link down ....... Disabled
  Verify MAC address ................ Disabled
  SNMP DHCP Snooping trap ........... Disabled

DHCP Snooping database:
  Database location ................. nvs
  Number of entries in database ..... 2

DHCP Snooping VLANs:
  Total VLANs enabled ............... 1
  Total VLANs disabled .............. 9
  vlan1 ............. Enabled
  vlan2 ............. Disabled
  vlan3 ............. Disabled
  vlan4 ............. Disabled
  vlan5 ............. Disabled
  vlan100 ........... Disabled
  vlan101 ........... Disabled
  vlan105 ........... Disabled
  vlan1000 .......... Disabled
  vlan1001 .......... Disabled
```

Related Commands
service dhcp-snooping
show arp security
show ip dhcp snooping acl
show ip dhcp snooping agent-option
show ip dhcp snooping binding
show ip dhcp snooping interface

show ip dhcp snooping acl

Use this command to display information about the Access Control Lists (ACL) that are using the DHCP snooping database.

Syntax

```
show ip dhcp snooping acl

show ip dhcp snooping acl [detail|hardware] [interface
   [<interface-list>]]
```

Parameter	Description
`detail`	Detailed DHCP Snooping ACL information.
`hardware`	DHCP Snooping hardware ACL information.
`interface`	ACL Interface information.
<interface-list>	The interfaces to display information about.

Mode User Exec and Privileged Exec

Example To display DHCP snooping ACL information, use the command:

```
awplus# show ip dhcp snooping acl
```

Figure 78-8: Example output from the **show ip dhcp snooping acl** command

```
awplus#show ip dhcp snooping acl

DHCP Snooping Based Filters Summary:

                       Maximum   Template  Attached
Interface    Bindings  Bindings  Filters   Hardware Filters
-------------------------------------------------------------
 port1.0.1   1         520       0         0
 port1.0.2   1         3         2         6
 port1.0.3   1         2         4         8
 port1.0.4   1         2         7         14
 port1.0.5   0         2         6         12
 port1.0.6   0         1         0         0
 port1.0.7   0         1         0         0
 port1.0.8   0         1         0         0
 port1.0.9   0         1         0         0
 port1.0.10  0         1         0         0
 port1.0.11  0         1         0         0
 port1.0.12  0         1         0         0
(port2.0.1 ) 0         520       0         0
(port2.0.2 ) 0         1         0         0
```

To display DHCP snooping hardware ACL information, use the command:

```
awplus# show ip dhcp snooping acl hardware
```

Figure 78-9: Example output from the **show ip dhcp snooping acl hardware** command

```
awplus#show ip dhcp snooping acl detail interface port1.0.4

DHCP Snooping Based Filters in Hardware:

Interface    Access-list(/ClassMap)        Source IP         Source MAC
-------------------------------------------------------------------------
 port1.0.2   dhcpsn1                       10.10.10.10       aaaa.bbbb.cccc
 port1.0.2   dhcpsn1                       20.20.20.20       0000.aaaa.bbbb
 port1.0.2   dhcpsn1                       0.0.0.0           0000.0000.0000
 port1.0.2   dhcpsn1                       0.0.0.0           0000.0000.0000
 port1.0.2   dhcpsn1                       0.0.0.0           0000.0000.0000
 port1.0.2   dhcpsn1                       0.0.0.0           0000.0000.0000
 port1.0.3   dhcpsn2/cmap1                 30.30.30.30       aaaa.bbbb.dddd
 port1.0.3   dhcpsn2/cmap1                 40.40.40.40       0000.aaaa.cccc
 port1.0.3   dhcpsn2/cmap1                 50.50.50.50       0000.aaaa.dddd
 port1.0.3   dhcpsn2/cmap1                 60.60.60.60       0000.aaaa.eeee
 port1.0.3   dhcpsn2/cmap1                 0.0.0.0           0000.0000.0000
 port1.0.3   dhcpsn2/cmap1                 0.0.0.0           0000.0000.0000
 port1.0.3   dhcpsn2/cmap1                 0.0.0.0           0000.0000.0000
 port1.0.3   dhcpsn2/cmap1                 0.0.0.0           0000.0000.0000
 port1.0.4   dhcpsn3/cmap2                 70.70.70.70
 port1.0.4   dhcpsn3/cmap2                 80.80.80.80
 port1.0.4   dhcpsn2/cmap1                 70.70.70.70
 port1.0.4   dhcpsn2/cmap1                 80.80.80.80
 port1.0.4   dhcpsn1                       70.70.70.70
 port1.0.4   dhcpsn1                       80.80.80.80
```

To display detailed DHCP snooping ACL information for port 1.0.4, use the command:

```
awplus# show ip dhcp snooping acl detail interface port1.0.4
```

Figure 78-10: Example output from the **show ip dhcp snooping acl detail interface** command

```
awplus#show ip dhcp snooping acl detail interface port1.0.4

DHCP Snooping Based Filters Information:

 port1.0.4 : Maximum Bindings ........... 2
 port1.0.4 : Template filters ........... 7
 port1.0.4 : Attached hardware filters .. 14
 port1.0.4 : Current bindings ........... 1, 1 free
 port1.0.4    Client 1 ................ 120.120.120.120
 port1.0.4 : Templates: cheese (via class-map: cmap2)
 port1.0.4 :  10 permit ip dhcpsnooping 100.0.0.0/8
 port1.0.4 : Template: dhcpsn2 (via class-map: cmap1)
 port1.0.4 :  10 permit ip dhcpsnooping any
 port1.0.4 :  20 permit ip dhcpsnooping 10.0.0.0/8
 port1.0.4 :  30 permit ip dhcpsnooping 20.0.0.0/8
 port1.0.4 :  40 permit ip dhcpsnooping 30.0.0.0/8
 port1.0.4 : Template: dhcpsn1 (via access-group)
 port1.0.4 :  10 permit ip dhcpsnooping any mac dhcpsnooping abcd.0000.0000 00
 00.ffff.ffff
 port1.0.4 : 20 permit ip dhcpsnooping any
```

Related Commands access-list hardware (named)
show access-list (IPv4 Hardware ACLs)

show ip dhcp snooping agent-option

Use this command to display DHCP snooping Option 82 information for all interfaces, a specific interface or a range of interfaces.

Syntax `show ip dhcp snooping agent-option [interface <interface-list>]`

Parameter	Description
`interface`	Specify the interface.
`<interface-list>`	The name of the interface or interface range.

Mode User Exec and Privileged Exec

Examples To display DHCP snooping Option 82 information for all interfaces, use the command:

```
awplus# show ip dhcp snooping agent-option
```

To display DHCP snooping Option 82 information for `port1.0.1`, use the command:

```
awplus# show ip dhcp snooping agent-option interface
port1.0.1
```

To display DHCP snooping Option 82 information for `vlan1`, use the command:

```
awplus# show ip dhcp snooping agent-option interface
vlan1
```

To display DHCP snooping Option 82 information for `port2.0.1`, `port4.0.2` and ports in the range from `port4.0.10` to `port4.0.15`, use the command:

```
awplus# show ip dhcp snooping agent-option inteface
port2.0.1,port4.0.2,port4.0.10-port4.0.15
```

Output Figure 78-11: Example output from the **show ip dhcp snooping agent-option** command

```
awplus#show ip dhcp snooping agent-option

DHCP Snooping Option 82 Configuration:

  Key:      C Id = Circuit Id Format
            R Id = Remote Id
            S Id = Subscriber Id

  Option 82 insertion ................ Enabled
  Option 82 on untrusted ports ...... Not allowed

-----------------------------------------------------------------
 vlan1       C Id = vlanifindex
             R Id = Access-Island-01-M1
 vlan2       C Id = vlantriplet
             R Id = Access-Island-01-M1
 vlan3       C Id = vlantriplet
             R Id = Access-Island-01-M3
 vlan4       C Id = vlantriplet
             R Id = 0000.cd28.074c
 vlan5       C Id = vlantriplet
             R Id = 0000.cd28.074c
 vlan6       C Id = vlantriplet
             R Id = 0000.cd28.074c
 port1.0.1   S Id =
 port1.0.2   S Id =
 port1.0.3   S Id = phone_1
 port1.0.4   S Id =
 port1.0.5   S Id =
 port1.0.6   S Id = phone_2
 port1.0.7   S Id = PC_1
 port1.0.8   S Id =
 port1.0.9   S Id =
 port1.0.10  S Id =
 port1.0.11  S Id =
 port1.0.12  S Id =
```

Related Commands

ip dhcp snooping agent-option
ip dhcp snooping agent-option circuit-id vlantriplet
ip dhcp snooping agent-option remote-id
ip dhcp snooping subscriber-id
show ip dhcp snooping
show ip dhcp snooping interface

show ip dhcp snooping binding

Use this command to display all dynamic and static entries in the DHCP snooping binding database.

Syntax `show ip dhcp snooping binding`

Mode User Exec and Privileged Exec

Example To display entries in the DHCP snooping database, use the command:

```
awplus# show ip dhcp snooping binding
```

Figure 78-12: Example output from the **show ip dhcp snooping binding** command

```
awplus# show ip dhcp snooping binding
DHCP Snooping Bindings:

Client           MAC              Server                        Expires
IP Address       Address          IP Address       VLAN  Port   (sec)       Type
-------------------------------------------------------------------------------
1.2.3.4          aaaa.bbbb.cccc   --               7     1.0.10  Infinite   Stat
1.2.3.6          any              --               4077  1.0.10  Infinite   Stat
1.3.4.5          any              --               1     sa1     Infinite   Stat
111.111.100.101  0000.0000.0001   111.112.1.1      1     1.0.10  4076       Dyna
111.111.101.108  0000.0000.0108   111.112.1.1      1     1.0.10  4084       Dyna
111.111.101.109  0000.0000.0109   111.112.1.1      1     1.0.10  4085       Dyna
111.211.100.101  --               --               1     1.0.2   2147483325 Dyna
111.211.100.109  00b0.0000.0009   111.112.111.111  1     1.0.2   21         Dyna
111.211.101.101  00b0.0000.0101   111.112.111.111  1     1.0.2   214        Dyna

Total number of bindings in database: 9
```

Table 78-4: Parameters in the output from the **show ip dhcp snooping binding** command

Parameter	Description
`Client IP Address`	The IP address of the DHCP client.
`MAC Address`	The MAC address of the DHCP client.
`Server IP Address`	The IP address of the DHCP server.
`VLAN`	The VLAN associated with this entry.
`Port`	The port the client is connected to.
`Expires (sec)`	The time in seconds until the lease expires.
`Type`	The source of the entry: ■ Dyna: dynamically entered by snooping DHCP traffic, configured by the ip dhcp snooping binding command, or loaded from the database backup file. ■ Stat: added statically by the ip source binding command
`Total number of bindings in database`	The total number of dynamic and static lease entries in the DHCP snooping database.

Related Commands
ip dhcp snooping binding
ip dhcp snooping max-bindings
show ip source binding

show ip dhcp snooping interface

Use this command to display information about DHCP snooping configuration and leases for the specified ports, or all ports.

Syntax `show ip dhcp snooping interface [<port-list>]`

Parameter	Description
<port-list>	The ports to display DHCP snooping configuration information for. If no ports are specified, information for all ports is displayed.

Mode User Exec and Privileged Exec

Example To display DHCP snooping information for all ports, use the command:

```
awplus# show ip dhcp snooping interface
```

Figure 78-13: Example output from the **show ip dhcp snooping interface** command

```
awplus#show ip dhcp snooping interface

DHCP Snooping Port Status and Configuration:

  Port: Provisioned ports marked with brackets, e.g. (portx.y.z)
  Action: LG = Log
          TR = Trap
          LD = Link down

                        Full    Max
 Port         Status     Leases  Leases  Action     Subscriber-ID
-------------------------------------------------------------------------------
 port1.0.1    Untrusted  1       1       LG -- --
 port1.0.2    Untrusted  0       50      LG TR LD   Building 1 Level 1
 port1.0.3    Untrusted  0       50      LG -- --
 port1.0.4    Untrusted  0       50      LG -- --   Building 1 Level 2
 port1.0.5    Untrusted  0       50      LG -- LD   Building 2 Level 1
 port1.0.6    Untrusted  0       1       LG -- --
 port1.0.7    Untrusted  0       1       LG -- --
 port1.0.8    Untrusted  0       1       LG -- --
 port1.0.9    Untrusted  0       1       -- TR --
 port1.0.10   Untrusted  0       1       -- -- LD
 port1.0.11   Trusted    0       1       -- -- --
 port1.0.12   Trusted    0       1       -- -- --
```

Table 78-5: Parameters in the output from the **show ip dhcp snooping interface** command

Parameter	Description
`Port`	The port interface name.
`Status`	The port status: untrusted (default) or trusted.
`Full Leases`	The number of entries in the DHCP snooping database for the port.
`Max Leases`	The maximum number of entries that can be stored in the database for the port.
`Action`	The DHCP snooping violation actions for the port.
`Subscriber ID`	The subscriber ID for the port. If the subscriber ID is longer than 34 characters, only the first 34 characters are displayed. To display the whole subscriber ID, use the show running-config dhcp command on page 7.43.

Related Commands

show ip dhcp snooping
show ip dhcp snooping statistics
show running-config dhcp

show ip dhcp snooping statistics

Use this command to display DHCP snooping statistics.

Syntax

```
show ip dhcp snooping statistics [detail] [interface
   <interface-list>]
```

Parameter	Description
`detail`	Display detailed statistics.
`interface <interface-list>`	Display statistics for the specified interfaces. The interface list can contain switch ports, static or dynamic link aggregators (channel groups), or VLANs.

Mode User Exec and Privileged Exec

Example To show the current DHCP snooping statistics for all interfaces, use the command:

```
awplus# show ip dhcp snooping statistics
```

Figure 78-14: Example output from the **show ip dhcp snooping statistics** command

```
awplus# show ip dhcp snooping statistics

DHCP Snooping Statistics:

              In            In BOOTP      In BOOTP      In
 Interface    Packets       Requests      Replies       Discards
-----------------------------------------------------------------
 vlan1        444           386           58            223
 port1.0.1    386           386           0             223
 port1.0.2    0             0             0             0
 port1.0.3    0             0             0             0
 port1.0.4    0             0             0             0
 port1.0.5    0             0             0             0
 port1.0.6    0             0             0             0
 port1.0.7    0             0             0             0
 port1.0.8    0             0             0             0
 port1.0.9    0             0             0             0
 port1.0.10   0             0             0             0
 port1.0.11   0             0             0             0
 port1.0.12   58            0             58            0
```

Figure 78-15: Example output from the **show ip dhcp snooping statistics detail** command

```
awplus# show ip dhcp snooping statistics detail

DHCP Snooping Statistics:

Interface ..................................... port1.0.1, All counters 0
Interface ..................................... port1.0.2, All counters 0
Interface ..................................... port1.0.3, All counters 0
Interface ..................................... port1.0.4
  In Packets .................................. 50
    In BOOTP Requests ......................... 25
    In BOOTP Replies .......................... 25
  In Discards ................................. 1
    Invalid BOOTP Information ................. 0
    Invalid DHCP ACK .......................... 0
    Invalid DHCP Release or Decline ........... 0
    Invalid IP/UDP Header ..................... 0
    Max Bindings Exceeded ..................... 1
    Option 82 Insert Error .................... 0
    Option 82 Received Invalid ................ 0
    Option 82 Received On Untrusted Port ...... 0
    Option 82 Transmit On Untrusted Port ...... 0
    Reply Received On Untrusted Port .......... 0
    Source MAC/CHADDR Mismatch ................ 0
    Static Entry Already Exists ............... 0
Interface ..................................... port1.0.5, All counters 0
Interface ..................................... port1.0.6, All counters 0
Interface ..................................... port1.0.7, All counters 0
Interface ..................................... port1.0.8, All counters 0
Interface ..................................... port1.0.9, All counters 0
Interface ..................................... port1.0.10, All counters 0
Interface ..................................... port1.0.11, All counters 0
Interface ..................................... port1.0.12, All counters 0
```

Table 78-6: Parameters in the output from the **show ip dhcp snooping statistics** command

Parameter	Description
`Interface`	The interface name.
`In Packets`	The total number of incoming packets that are processed by DHCP Snooping.
`In BOOTP Requests`	The total number of incoming BOOTP Requests.
`In BOOTP Replies`	The total number of incoming BOOTP Replies.
`In Discards`	The total number of incoming packets that have been discarded.
`Invalid BOOTP Information`	Packet contained invalid BOOTP information, such as an invalid BOOTP.OPCode.
`Invalid DHCP ACK`	A DHCP ACK message was discarded, for reasons such as missing Server Option or Lease Option.
`Invalid DHCP Release or Decline`	A DHCP Release or Decline message was discarded, for reasons such as mismatch between received interface and current binding information.
`Invalid IP/UDP Header`	A problem was detected in the IP or UDP header of the packet.
`Max Bindings Exceeded`	Accepting the packet would cause the maximum number of bindings on a port to be exceeded.
`Option 82 Insert Error`	An error occurred while trying to insert option 82 information.

Table 78-6: Parameters in the output from the **show ip dhcp snooping statistics** command(cont.)

Parameter	Description
`Option 82 Received Invalid`	The option 82 information received did not match the information inserted by DHCP Snooping.
`Option 82 Received On Untrusted Port`	A packet containing option 82 was received on an untrusted port.
`Option 82 Transmit On Untrusted Port`	A packet containing option 82 was to be sent on an untrusted port.
`Reply Received On Untrusted Port`	A BOOTP reply was received on an untrusted port.
`Source MAC/CHADDR Mismatch`	The L2 Source MAC address of the packet did not match the client hardware address field (BOOTP.CHADDR).
`Static Entry Already Exists`	An entry could not be added as a static entry already exists.

Related Commands

clear ip dhcp snooping statistics
ip dhcp snooping
ip dhcp snooping violation

show ip source binding

Use this command to display static entries in the DHCP snooping database. These are the entries that have been added by using the ip source binding command on page 78.23.

Syntax `show ip source binding`

Mode User Exec and Privileged Exec

Example To display static entries in the DHCP snooping database information, use the command:

```
awplus# show ip source binding
```

Figure 78-16: Example output from the **show ip source binding** command

```
awplus# show ip source binding

IP Source Bindings:

Client       MAC                                Expires
IP Address   Address          VLAN  Port        (sec)      Type
-------------------------------------------------------------------
 1.1.1.1     0000.1111.2222   1     port1.0.1   Infinite   Static
```

Table 78-7: Parameters in the output from the **show ip source binding** command

Parameter	Description
`Client IP Address`	The IP address of the DHCP client.
`MAC Address`	The MAC address of the DHCP client.
`VLAN`	The VLAN ID the packet is received on.
`Port`	The Layer 2 port name the packet is received on.
`Expires (sec)`	Always infinite for static bindings, or when the leave time in the DHCP message was 0xffffffff (infinite).
`Type`	DHCP Snooping binding type: Static

Related Commands
ip source binding
show ip dhcp snooping binding

Part 6: Network Availability

- Chapter 79 VRRP Introduction and Configuration
- Chapter 80 VRRP Commands
- Chapter 81 EPSR Introduction and Configuration
- Chapter 82 EPSR Commands

Chapter 79: VRRP Introduction and Configuration

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Introduction

This chapter describes the Virtual Router Redundancy Protocol (VRRP) feature provided by the switch, and how to configure the switch to participate in a virtual router.

One function of a switch is to act as a gateway to the WAN for hosts on a LAN. On larger LANs, two or more switches may act as the gateway, and hosts use a dynamic routing protocol, such as RIP or OSPF, to determine the gateway switch to use as the next hop in order to reach a specific IP destination. However, there are a number of factors, such as administrative or processing overhead, that may make it undesirable to use a dynamic routing protocol. One alternative is to use static routing; however, if the statically configured first hop switch fails, the hosts on the LAN are unable to communicate with those on the WAN.

The Virtual Router Redundancy Protocol defined in RFC 2338 provides a solution to the problem by combining two or more physical switches into a logical grouping called a virtual router (VR). The physical switches then operate together to provide a single logical gateway for hosts on the LAN.

Note If there are PIM-SM routers using VRRP the Bootstrap Router (BSR) function will not work properly.

Virtual Router Redundancy Protocol

The virtual router has a virtual MAC address that is known by all its participating switches or routers. The virtual MAC address is derived from the virtual router identifier - a user-defined value from 1 to 255. At the network level, all hosts on the LAN are configured with a common IP address that is used as the first hop. This IP address is typically owned by the virtual router's preferred individual switch or router. When available, this device performs the duties of the virtual router, and is referred to as the master. The switch that owns the IP address associated with the virtual router is referred to as the preferred master. When a virtual router is configured so that none of the participating switches owns the IP address, the virtual router has no preferred master.

When a switch takes the role of master for a virtual router, it is responsible for the following:

- Responding to ARP packets that contain IP addresses associated with the virtual router. The ARP response contains the virtual MAC address of the virtual router so that the hosts on the LAN associate the virtual MAC address with their configured first-hop IP address.
- Forwarding packets with a destination link layer MAC address equal to the virtual router MAC address.
- Accepting packets addressed to the IP addresses associated with the virtual router, but only if it actually owns the address(es).
- Broadcasting advertisement packets at regular intervals (at the specified advertisement interval) to inform backup switches that it is still acting as the master switch.

In accordance with the RFC standard, a user does not receive a response to ping or Telnet packets sent to the VR address unless the switch owns this address.

Each of the other switches participating in the virtual router is considered to be a backup switch. A switch can be part of several different virtual routers on one LAN, but all the virtual routers must have different virtual router identifiers (VRID). When a switch has the role of backup for a virtual router, it must be able to perform the following tasks:

- Receive advertisement packets from the master and check that the information contained in them is consistent with their own configuration; ignoring and discarding advertisement packets that do not match.
- Assume the role of master for the virtual router if an advertisement packet is not received for a given period, (the master-down time), based on the specified advertisement interval, (for example: awplus(config-router)# advertisement-interval 5 will set the advertisement-interval to 5 seconds). The master-down time is approximately three times the advertisement interval.
- Assume the role of master if it receives an advertisement packet from another switch with a lower priority than its own, and if preempt mode is on.

If the master switch fails, the backup switch assumes control and starts processing traffic.
If a backup switch is about to assume the role of master of the VR because it has not received an advertisement for the master-down period, it first checks the operational status of the interface to which the VR is attached. If the interface is down, it does not enter the master state. Instead, it stays in the backup state and checks the interface again after another master-down period, assuming it does not receive an advertisement during that time.

VRRP Configuration

VRRP is disabled by default. Once you have defined a virtual router session, you must enable VRRP to make the session operational for a given interface. You can then enable or disable the virtual router as shown:

To enable VRRP

`awplus(config)#`	
`router vrrp 1 vlan2`	Create a new VRRP session on the router, specify the virtual router ID (VRID) for the session, and specify the interface (`vlan2`) that will participate in virtual routing.
`awplus(config-router)#`	
`enable`	Enable the VRRP session on the switch.
`awplus(config-router)#`	
`exit`	Return to the Global Configuration mode.
`awplus(config)#`	Global Configuration mode prompt.

To disable VRRP

`awplus(config)#`	
`router vrrp 1 vlan2`	Specify an existing VRRP session, specify the virtual router ID (VRID) for the session, and specify the interface (`vlan2`) that will participate in virtual routing.
`awplus(config-router)#`	
`disable`	Disable the VRRP session on the switch.
`awplus(config-router)#`	
`exit`	Return to the Global Configuration mode.
`awplus(config)#`	Global Configuration mode prompt.

A virtual router must be defined on at least two switches before it operates correctly. Use the following steps to configure virtual routing on a switch. Note that this example assumes that VLAN 2 already exists on the switch. See "Configuring VLANs" on page 16.3.

To configure virtual routing on a switch

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router vrrp 1 vlan2`	Create a new VRRP session on the router, specify the VRID for the session, and specify the interface (vlan2) that will participate in virtual routing.

To configure virtual routing on a switch(cont.)

`awplus(config-router)#`	
`virtual-ip 10.10.10.50 master`	Set the virtual IP address for the VRRP session. Define the default state (master or backup) of the VRRP router within the virtual router.
`awplus(config-router)#`	
`priority 255`	Set the VRRP priority for the switch.
`awplus(config-router)#`	
`enable`	Enable the VRRP session on the switch.
`awplus(config-router)#`	
`exit`	Return to the Global Configuration mode.
`awplus(config)#`	Global Configuration mode prompt.

To destroy a virtual router on the LAN, it must be removed from all participating switches. Use the following commands to remove a virtual router so that the switch no longer participates in virtual routing.

To remove the virtual router VRRP 1 from a switch

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`no router vrrp 1 vlan2`	Remove the VRRP session on the switch for the specified interface `vlan2`.
`awplus(config-router)#`	
`exit`	Return to the Global Configuration mode.
`awplus(config)#`	Global Configuration mode prompt.

Alternatively, you can simply disable the virtual router and retain the configuration.

To disable the router and retain the configuration

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router vrrp 1 vlan2`	Select the VRRP session on the switch, specify the VRID for the session, and specify the interface (`vlan2`) used for virtual routing.
`awplus(config-router)#`	
`disable`	Disable the VRRP session on the switch.
`awplus(config-router)#`	
`exit`	Return to the Global Configuration mode.
`awplus(config)#`	Global Configuration prompt.

VRRP election and preempt

If the switch that is the current VRRP master becomes unavailable, the master role is taken by the switch with the next highest priority. The priority is a value from 1 to 255, with a default of 100. The value 255 is reserved for the switch that owns the virtual router's IP address. The new master takes over all the responsibilities of the original master.

By default, when a switch becomes available that has a higher priority than the master, this switch takes over as master. This is referred to as preempt mode and can be set on or off. Even with preempt mode off, the switch that owns the IP address always becomes the master when available. Preempt mode should be the same for all switches in the virtual router.

If two switches are configured with the same priority and a conflict occurs when they both transition to master simultaneously, the one with the highest IP address has higher priority. Due to timing differences the conflict may not always occur and simply the first switch to respond will become the master.

Hosts on the LAN can continue sending packets to the virtual MAC address they originally associated with the first hop IP address, even though the switch that owns the IP address is not currently available. When the original switch becomes available again, and if it is a preferred switch (i.e. it owns the virtual router IP address) then it resumes the role of master.

Use the following commands to set the priority and preempt mode when you create the virtual router:

To set the priority and preempt mode for VRRP 1

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`router vrrp 1 vlan2`	Select the VRRP session on the switch, specify the VRID for the session, and specify the interface (`vlan2`) used for virtual routing.
`awplus(config-router)#`	
`priority 255`	Set the VRRP priority for the switch
`awplus(config-router)#`	
`preempt true`	Select the preempt mode for VRRP 1.
`awplus(config-router)#`	
`enable`	Enable the VRRP session on the switch.
`awplus(config-router)#`	
`exit`	Return to the Global Configuration mode.
`awplus(config)#`	Global Configuration prompt

The advertisement interval determines the rate that the master sends its advertisement packets. This rate must be the same value for all switches in the virtual router. The default advertisement interval of 1second can be used for most networks. However, you can modify this interval by using the advertisement-interval command, as shown in the following procedure:

To set the advertisement interval to 5 seconds on VRRP1

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config#`	
`router vrrp 1 vlan2`	Select the VRRP session on the switch, specify the VRID for the session, and specify the interface (`vlan2`) used for virtual routing.
`awplus(config-router)#`	
`advertisement-interval 5`	Set the advertisement interval to `5` seconds.

VRRP authentication

Each of the switches in the virtual router can be configured for plaintext authentication, or no authentication. Authentication is appropriate where there is either a security risk, or the configuration is complex.

Plaintext password authentication protects against accidental miscommunication and prevents a switch from inadvertently backing up another switch. This kind of miscommunication could occur, for example, where multiple virtual routers exist on the same LAN.

The authentication type and, in the case of plaintext authentication, the password, must be the same for all switches in the virtual router. By default, the virtual router has no authentication. Authentication must be defined against the relevant interface in the interface configuration mode as shown: This example assumes that VLAN 2 already exists on the switch. See “Configuring VLANs” on page 16.3.

To set the authentication string “guest” to VLAN 2

`awplus(config)#`	
`router vrrp 1 vlan2`	Enable VRRP on the switch, specify the VRID for the session, and specify the interface (`vlan2`) used for virtual routing.
`awplus(config-if)#`	
`ip vrrp authentication mode text`	Apply text mode authentication to interface `vlan2`.
`awplus(config-if)#`	
`ip vrrp authentication string guest`	Specify the authentication string or password used by the key.
`Switch_A(config-if)#`	
`exit`	Exit the Interface Configuration mode and enter the Global Configuration mode.
`awplus(config)#`	
`exit`	Return to the Privileged Exec mode prompt
`awplus#`	Privileged Exec mode prompt

In order to maintain consistent authentication level, each switch in the virtual router must have at least the minimum allowable level of security that meets the network environment.

VRRP debugging

VRRP debugging displays data that is useful for troubleshooting. To enable or disable debugging use the following commands:

To select and deselect VRRP debugging

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`debug vrrp [all|events|packet]`	Enable the selected debugging type.
`awplus(config)#`	
`no debug vrrp [all|events|packet]`	Disable the selected debugging type.

It is important that all switches involved in a virtual router are configured with the same values for the following:

- VRRP virtual router identifier
- IP address
- advertisement interval
- preempt mode
- authentication type
- password

Inconsistent configuration causes advertisement packets to be rejected and the virtual router cannot perform properly.

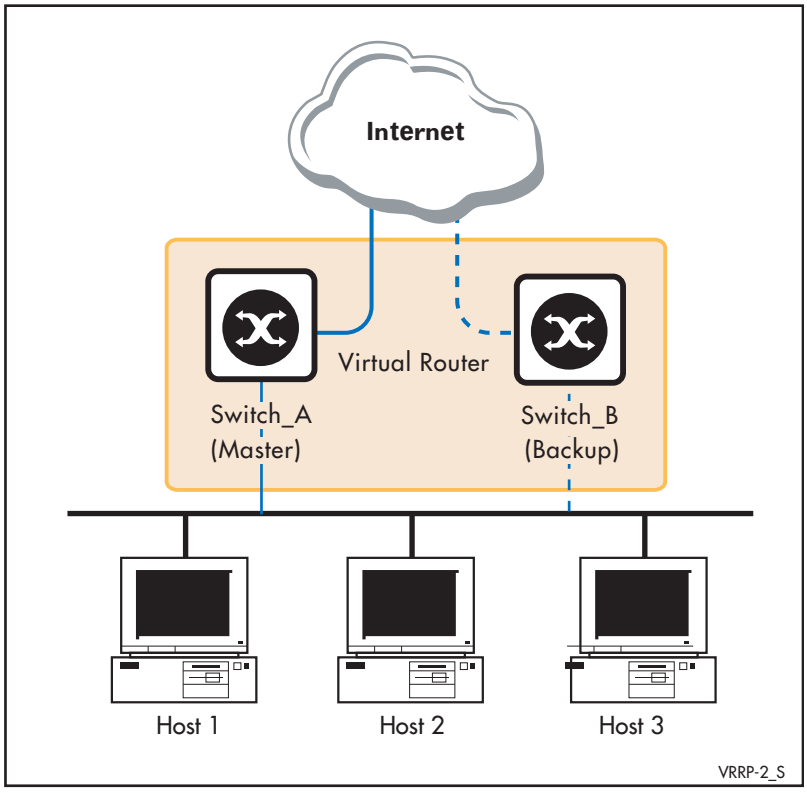
Configuration examples

The following examples show how to configure a virtual router in a LAN:

- Preferred Master with Backup Switch
- Authenticated Virtual Router with No Preferred Master

Master with backup switch

This example show how to configure a basic virtual router with a preferred master and a backup.



Switch_A owns the IP address of the virtual router, and always assumes the role of master whenever it is available. Switch_B is the backup, and assumes the role of master, backing up this IP address if A becomes unavailable. No authentication is used for this simple virtual router.

Step 1: Configure Switch_A

At this point we assume that you have already created VLAN 2 on Switch_A. See "Configuring VLANs" on page 16.3.

Configure IP

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`hostname Switch_A`	Assign a host name to `Switch_A`.
`Switch_A(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) that will participate in virtual routing to first configure an IP address for `vlan2`.
`Switch_A(config-if)#`	
`ip address 192.168.1.1/24`	Specify the IP address and mask for interface `vlan2`.

Create the Virtual Router

`Switch_A(config)#`	
`spanning-tree mode stp`	Configure STP for interfaces on `Switch_A`.
`Switch_A(config)#`	
`router vrrp 1 vlan2`	Create a new VRRP session on the router, specify the VRID for the session, and specify the interface (`vlan2`) that will participate in virtual routing.
`Switch_A(config-router)#`	
`virtual-ip 192.168.1.1 master`	Set the virtual IP address for the VRRP session. Define the default state of the VRRP router within the virtual router.
`Switch_A(config-router)#`	
`enable`	Enable the VRRP session on the router.
`Switch_A(config-router)#`	
`exit`	Exit the Router Configuration mode and enter the Global Configuration mode.
`Switch_A(config)#`	
`exit`	Exit the Global Configuration mode and enter the Privileged Exec mode.
`Switch_A#`	Privileged Exec mode prompt.

Step 2: Configure Switch_B

At this point we assume that you have already created VLAN 2 on Switch_B. See "Configuring VLANs" on page 16.3.

Configure IP

`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`hostname Switch_B`	Assign a host name to `Switch_B`.
`Switch_B(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) that will participate in virtual routing.
`Switch_B(config)#`	
`ip address 192.168.1.2/24`	Specify the IP address and mask for interface

Create the Virtual Router

`Switch_B(config)#`	
`router vrrp 1 vlan2`	Create a new VRRP session on the router, specify the VRID for the session, and specify the interface (`vlan2`) that will participate in virtual routing.
`Switch_B(config-router)#`	
`virtual-ip 192.168.1.1 backup`	Set the virtual IP address for the VRRP session. Define the default state of the VRRP router within the virtual router.
`Switch_B(config-router)#`	
`enable`	Enable the VRRP session on the router.
`Switch_B(config-router)`	
`exit`	Exit the Interface Configuration mode and enter the Global Configuration mode.
`Switch_B(config)#`	
`exit`	Return to the Privileged Exec mode.
`Switch_B#`	Privileged Exec mode prompt.

Authenticated Virtual Router with an Independent Preferred Master

This example shows how to configure a virtual router with its own IP address. The address is not owned by any of the switches participating in the virtual router. Switch A has a higher priority for becoming the master, Switch B has the next highest priority, and Switch C takes the master role when A or B are unavailable. The default preempt mode (preempt on) ensures that the switch with the highest priority (when it is available) always takes the master role from a lower priority switch acting as master. Plaintext authentication protects against accidental misconfiguration.

Although the switch with the highest priority will be master, it is important to remember that when creating VRRP you must also define the default role. In the following example Switch_A will be defined as being the master.

At this point we assume that you have already created VLAN 2 on Switches A, B and C. See "Configuring VLANs" on page 16.3.

Step 1: Configure IP

On switch_A, add an IP interface to the virtual router.

`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`hostname Switch_A`	Assign a host name to `Switch_A`.
`Switch_A(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) that will participate in virtual routing.
`Switch_A(config)#`	
`ip address 192.168.1.1/24`	Add the IP address and mask for interface `vlan2`.

On switch_B, add a different IP interface to virtual router.

`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`hostname Switch_B`	Assign a host name to `Switch_B`.
`Switch_B(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) that will participate in virtual routing.
`Switch_B(config)#`	
`ip address 192.168.1.2/24`	Add the IP address and mask for interface `vlan2`.

On switch_C, add a third IP interface to the virtual router.

`awplus#`	
`configure terminal`	Enter Global Configuration mode.
`awplus(config)#`	
`hostname Switch_C`	Assign a host name to `Switch_C`.
`Switch_C(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) that will participate in virtual routing.
`Switch_C(config)#`	
`ip address 192.168.1.3/24`	Add the IP address and mask for interface `vlan2`.

Step 2: Create the virtual router

On switch A, create virtual router `vrrp2` with IP address `192.168.1.4`, plaintext authentication with password `trip4e`, and a high priority.

To configure the virtual router on switch_A

`Switch_A#`	
`configure terminal`	Enter the Global Configuration mode.
`Switch_A(config)#`	
`router vrrp2 vlan2`	Create a new VRRP session on the router, specify the VRID for the session, and specify the interface (`vlan2`) that will participate in virtual routing.
`Switch_A(config-router)#`	
`virtual-ip 192.168.1.4 backup`	Set the virtual IP address for the VRRP session. Define the default state of the VRRP router within the virtual router.
`Switch_A(config-router)#`	
`preempt-mode on`	Turn on preempt mode.
`Switch_A(config-router)#`	
`priority 254`	Set the VRRP priority of 254 for the switch.
`Switch_A(config-router)#`	
`enable`	Enable VRRP on the switch.
`Switch_A(config-router)#`	
`exit`	Return to the Global Configuration mode.
`Switch_A(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) that will participate in virtual routing.
`Switch_A(config-if)#`	
`ip vrrp authentication mode text`	Apply text mode authentication to `vlan2`.

To configure the virtual router on switch_A

`Switch_A(config-if)#`	
`ip vrrp authentication string trip4e`	Specify the authentication string `trip4e` used by the key.
`Switch_A(config)#`	
`exit`	Return to the Privileged Exec mode prompt.
`Switch_A#`	Privileged Exec mode prompt.

On switch B, create the same virtual router, but with a lower priority.

To configure the virtual router on switch_B

`Switch_B#`	
`configure terminal`	Enter the Global Configuration mode.
`Switch_B(config)#`	
`router vrrp2 vlan2`	Create a new VRRP session on the router, specify the VRID for the session, and specify the interface (`vlan2`) that will participate in virtual routing.
`Switch_B(config-router)#`	
`virtual-ip 192.168.1.4 backup`	Set the virtual IP address for the VRRP session. Define the default state of the VRRP router within the virtual router.
`Switch_B(config-router)#`	
`preempt-mode on`	Turn on preempt mode.
`Switch_B(config-router)#`	
`priority 200`	Set the VRRP priority of 200 for the switch.
`Switch_B(config-router)#`	
`enable`	Enable VRRP on the switch.
`Switch_A(config-router)#`	
`exit`	Return to the Global Configuration mode.
`Switch_B(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) that will participate in virtual routing.

To configure the virtual router on switch_B

`Switch_B(config-if)#`	
`ip vrrp authentication mode text`	Apply text mode authentication to `vlan2`.
`Switch_B(config-if)#`	
`ip vrrp authentication string trip4e`	Specify the authentication string `trip4e` used by the key.
`Switch_B(config-if)#`	
`exit`	Return to the Global Configuration mode.
`Switch_B(config)#`	
`exit`	Return to the Privileged Exec mode prompt.
`Switch_B#`	Privileged Exec mode prompt.

On switch C, create the same virtual router with the default priority of 100.

To configure the virtual router on switch_C

`Switch_C#`	
`configure terminal`	Enter the Global Configuration mode.
`Switch_C(config)#`	
`router vrrp2 vlan2`	Create a new VRRP session on the router, specify the VRID for the session, and specify the interface (`vlan2`) that will participate in virtual routing.
`Switch_C(config-router)#`	
`virtual-ip 192.168.1.4 backup`	Set the virtual IP address for the VRRP session. Define the default state (master or backup) of the VRRP router within the virtual router.
`Switch_C(config-router)#`	
`preempt-mode on`	Turn on preempt mode.
`Switch_C(config-router)#`	
`priority 100`	Set the VRRP priority of 100 for the switch.
`Switch_C(config-router)#`	
`enable`	Enable VRRP on the switch.
`Switch_A(config-router)#`	
`exit`	Return to the Global Configuration mode.
`Switch_C(config)#`	
`interface vlan2`	Specify the interface (`vlan2`) that will participate in virtual routing.
`Switch_C(config-if)#`	
`ip vrrp authentication mode text`	Apply text mode authentication to `vlan2`.
`Switch_C(config-if)#`	
`ip vrrp authentication string trip4e`	Specify the authentication string `trip4e` used by the key.
`Switch_B(config-if)#`	
`exit`	Return to the Global Configuration mode.
`Switch_C(config)#`	
`exit`	Return to the Privileged Exec mode prompt
`Switch_C#`	Privileged Exec mode prompt

The default preempt mode ensures that the highest priority switch available always takes the master role. However, if there are no significant disadvantages to the lower priority switches having the master role, and if changes where the switch takes the master role are to be avoided (for example, when a high cost is associated with each change) then you should instead set the preempt mode to off.

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Command List

This chapter provides an alphabetical reference for commands used to configure the Virtual Router Redundancy Protocol (VRRP). For more information, see Chapter 79, VRRP Introduction and Configuration.

For information about modifying or redirecting the output from show commands to a file, see "Controlling "show" Command Output" on page 1.41.

advertisement-interval

Use this command to configure the advertisement interval of the virtual router. This is the length of time, in seconds, between each advertisement sent from the master to its backup(s).

Use the no variant of this command to remove an advertisement interval of the virtual router, which has been set using the advertisement-interval command.

Syntax

```
advertisement-interval <1-255>
no advertisement-interval
```

Parameter	Description
<1-255>	Specifies the advertisement interval in seconds.

Default The default advertisement interval is 1 second.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router vrrp 5 vlan2
awplus(config-router)# interface vlan2
awplus(config-router)# advertisement-interval 6

awplus# configure terminal
awplus(config)# router vrrp 5
awplus(config-router)# interface vlan2
awplus(config-router)# no advertisement-interval
```

circuit-failover

Use this command to enable the VRRP circuit failover feature.

Use the no variant of this command to disable this feature.

Syntax

```
circuit-failover <interface> <1-253>
no circuit-failover [<interface> <1-253>]
```

Parameter	Description
<interface>	The interface of the router that will participate in the virtual router. Interface must exist on the router.
<1-253>	Delta value. The value by which virtual routers decrement their priority value during a circuit failover event. Configure this value to be greater than the difference of priorities on the master and backup routers.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router vrrp 1
awplus(config-router)# interface vlan1
awplus(config-router)# circuit-failover vlan2 30

awplus# configure terminal
awplus(config)# router vrrp 1
awplus(config-router)# interface vlan1
awplus(config-router)# no circuit-failover
```

Related Commands router vrrp (interface)

debug vrrp

Use this command to specify debugging options for VRRP. The all parameter turns on all the debugging options.

Use the no variant of this command to disable this function.

Syntax

```
debug vrrp [all]
no debug vrrp [all]
```

Mode Privileged Exec and Global Configuration

Examples

```
awplus# configure terminal
awplus(config)# debug vrrp all

awplus# configure terminal
awplus(config)# no debug vrrp
```

Related Commands undebug vrrp

debug vrrp events

Use this command to specify debugging options for VRRP event troubleshooting.

Use the no variant of this command to disable this function.

Syntax

```
debug vrrp events
no debug vrrp events
```

Mode Privileged Exec and Global Configuration

Usage The debug vrrp events command enables the display of debug information related to VRRP internal events.

Examples

```
awplus# configure terminal
awplus(config)# debug vrrp events

awplus# configure terminal
awplus(config)# no debug vrrp events
```

Related Commands undebug vrrp events

debug vrrp packet

Use this command to specify debugging options for VRRP packets.

Use the no variant of this command to disable this function.

Syntax

```
debug vrrp packet [send|recv]
no debug vrrp packet [send|recv]
```

Parameter	Description
send	Specifies the debug option set for sent packets.
recv	Specifies the debug option set for received packets.

Mode Privileged Exec and Global Configuration

Usage The debug vrrp packet command enables the display of debug information related to the sending and receiving of packets.

Examples

```
awplus# configure terminal
awplus(config)# debug vrrp packet send

awplus# configure terminal
awplus(config)# no debug vrrp packet
```

Related Commands undebug vrrp packet

disable (VRRP)

Use this command to disable a VRRP session on the router to stop it participating in virtual routing.

Syntax `disable`

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router vrrp 5
awplus(config-router)# interface vlan2
awplus(config-router)# disable
```

Related Commands enable (VRRP)

enable (VRRP)

Use this command to enable the VRRP session on the router to make it participate in virtual routing.

Syntax `enable`

Mode Router Configuration

Usage You must configure the virtual IP address and define the interface for the VRRP session (using the virtual-ip and interface commands) before using this command.

Example

```
awplus# configure terminal
awplus(config)# router vrrp 5
awplus(config-router)# interface vlan2
awplus(config-router)# enable
```

Related Commands disable (VRRP)
show vrrp

interface (VRRP) (deprecated)

This command has been deprecated and will be removed in a later software version.

Use the router vrrp (interface) command to configure VRRP and define the interface that will participate in virtual routing to send and receive advertisement messages.

Use this command to define the physical interface that will participate in virtual routing. This interface is used for two purposes - to send/receive advertisement messages and to forward on behalf of the virtual router when in master state. Note that you can also specify the interface within the circuit-failover and the router vrrp commands without specifying the interface later.

Syntax `interface <interface>`

Parameter	Description
<interface>	Specify the name of the interface that will participate in the virtual routing. Interface must exist on the router.

Mode Router Configuration

Usage Use the no variant of this command to remove the specified interface from participating in virtual routing. Note that the interface is now specified in the router vrrp (interface) command.

Example To configure an interface on which VRRP is enabled enter the commands shown below:

```
awplus# configure terminal
awplus(config)# router vrrp 5
awplus(config-router)# interface vlan2
```

Related Commands router vrrp (interface)

ip vrrp authentication mode

Use this command to enable clear text password authentication used for VRRP packets.

Use the ip vrrp authentication string command after this command to specify the password.

Use the no variant of this command to reset to the default of no text authentication.

Syntax

```
ip vrrp authentication mode text
no ip vrrp authentication mode [text]
```

Parameter	Description
`text`	Specifies the clear text or simple password authentication.

Default No text authentication.

Mode Interface Configuration for a VLAN interface.

Usage RFC 3768 *Virtual Router Redundancy Protocol (VRRP)* recommends no authentication. VRRP authentication commands are available for backwards compatibility the earlier VRRP RFC 2338.

See "VRRP authentication" on page 79.7 for further information about VRRP Authentication.

Examples The following example shows text authentication configured on the `vlan2` interface ensuring authentication packets received on this interface.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip vrrp authentication mode text
```

The following example resets to the default setting for no text authentication on `vlan2`.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip vrrp authentication mode
```

Related Commands ip vrrp authentication string

ip vrrp authentication string

Use this command to specify the authentication string or password used by a key.

Use this command after ip vrrp authentication mode that enables clear text authentication.

Use the no variant of this command to remove a configured authentication string.

Syntax

```
ip vrrp authentication string <password>
no ip vrrp authentication string
```

Parameter	Description
<password>	The authentication string or password.

Mode Interface Configuration for a VLAN interface.

Example In the following example, the interface `vlan2` is configured to have an authentication string as `guest`, any receiving packet in that interface should have the same string as password.

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip vrrp authentication mode text
awplus(config-if)# ip vrrp authentication string guest
```

See "VRRP authentication" on page 79.7 for further information about VRRP Authentication.

Related Commands ip vrrp authentication mode

preempt-mode

Use this command to configure preempt mode. If set to true, the highest priority backup will always be the master when the default master is unavailable. If set to false, a higher priority backup will not preempt a lower priority backup who is acting as master.

Syntax `preempt-mode {true|false}`

Parameter	Description
`true`	Preemption enabled.
`false`	Preemption disabled.

Default The default is true.

Mode Router Configuration

Usage When the master router fails, the backup routers come online in priority order—highest to lowest. Preempt mode means that a higher priority back up router will take over the master role from a lower priority back up. Preempt mode on true allows a higher priority backup router to relieve a lower priority backup router.

See "VRRP election and preempt" on page 79.6 for further information on preempt mode.

Example

```
awplus# configure terminal
awplus(config)# router vrrp 4
awplus(config-router)# interface vlan2
awplus(config-router)# preempt-mode false
```

Related Commands circuit-failover
priority

priority

Use this command to configure the VRRP router priority within the virtual router. The highest priority router is Master (unless preempt-mode is false).

Use the no variant of this command to remove the VRRP router priority within the virtual router, which has been set using the priority command.

Syntax

```
priority <1-255>
no priority
```

Parameter	Description
<1-255>	The priority. For the master router, use 255 for this parameter; otherwise use any number from the range <1-254>.

Default Defaults for priority are: master router = 255; backup = 100.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router vrrp 3
awplus(config-router)# interface vlan2
awplus(config-router)# priority 101
```

Related Commands circuit-failover
preempt-mode

router vrrp (interface)

Use this command to configure VRRP and define the interface that will participate in virtual routing to send and receive advertisement messages. This command allows you to enter the Router Configuration mode.

Use the no variant of this command to remove the VRRP configuration. Disable the VRRP session before using the no variant of this command.

Syntax

```
router vrrp <vrid> <interface>
no router vrrp <vrid> <interface>
```

Parameter	Description
<vrid>	*<1-255>* The ID of the virtual router session to create.
<interface>	Specify the name of the interface that will participate in the virtual routing. The interface must exist on the router.

Mode Global Configuration

Usage Use the required *<interface>* placeholder to define the interface that will participate in virtual routing. This interface is used for two purposes - to send/receive advertisement messages and to forward on behalf of the virtual router when in master state.

Example

```
awplus# configure terminal
awplus(config)# router vrrp 5 vlan2
awplus(config-router)#

awplus# configure terminal
awplus(config)# no router vrrp 5 vlan2
awplus(config-router)#
```

Related Commands circuit-failover
interface (VRRP) (deprecated)

show debugging vrrp

Use this command to display the set VRRP debugging option.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show debugging vrrp`

Mode User Exec and Privileged Exec

Example

```
awplus# show debugging vrrp
```

show running-config router vrrp

Use this command to show the configuration for VRRP.

Note This command is available only if VRRP is enabled.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show running-config router vrrp`

Mode Privileged Exec, Global Configuration, Line Configuration, and Interface Configuration.

Example

```
awplus# show running-config router vrrp
```

Output Figure 80-1: Example output from the **show running-config router vrrp** command

```
!
router vrrp 2 vlan2
 circuit-failover vlan1 3
 advertisement-interval 4
!
```

show vrrp

Use this command to display information about all VRRP sessions. This command shows a summary when the optional brief parameter is used.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show vrrp [brief]`

Parameter	Description
`brief`	Brief summary of VRRP sessions.

Mode User Exec and Privileged Exec

Example To display information about all VRRP sessions, enter the command:

```
awplus# show vrrp
```

To display brief summary output about VRRP sessions, enter the command:

```
awplus# show vrrp brief
```

Output Figure 80-2: Example output from the **show vrrp** command

```
awplus#show vrrp
VrId <1>
 State is Master
 Virtual IP is 10.0.0.222 (Not IP owner)
 Interface is vlan2
 Priority is 100
 Advertisement interval is 1 sec
 Preempt mode is TRUE
```

Figure 80-3: Example output from the **show vrrp brief** command

```
awplus#show vrrp brief
Interface        Grp  Prio Own  Pre  State      Master addr      Group addr
 vlan10            1   200   N    P  Master     192.168.10.4     192.168.10.253
 vlan10            2   150   N    P  Backup     192.168.10.4     192.168.10.254
 vlan11            3   200   N    P  Master     192.168.11.4     192.168.11.253
 vlan11            4   150   N    P  Backup     192.168.11.4     192.168.11.254
```

Related Commands enable (VRRP)

show vrrp counters

This command displays VRRP SNMP counters on the console, as described in the VRRP MIB and RFC2787, for debugging use while you configure VRRP with commands in this chapter.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show vrrp counters`

Mode User Exec and Privileged Exec

Usage The output has a section for global counters and a section of counters for each VRRP instance configured. See the descriptions of the counters below the sample output as per RFC2787.

Note Note that the counters displayed with this commands are the same counters as described in RFC 2787 (Copyright (C) The Internet Society (2000). All Rights Reserved) except for the `Monitored Circuit Up` and `Monitored Circuit Down` counters which are additions beyond the MIB.

Example To display information about VRRP SNMP counters on the console, enter the command:

```
awplus# show vrrp counters
```

Figure 80-4: Example output from the **show vrrp counters** command

```
awplus#show vrrp counters
VRRP Global Counters:
  Checksum Errors .... 230
  Version Errors ..... 0
  VRID Errors ........ 230

VRRP IPv4 counters for VR 10/vlan10:
  Master Transitions ........ 0
  Received Advertisements ... 0
  Internal Errors ........... 0
  TTL Errors ................ 0
  Received Priority 0 Pkt ... 0
  Sent Priority 0 Pkt ....... 0
  Received Invalid Type ..... 0
  Address List Errors ....... 0
  Packet Length Errors ...... 0
  Invalid Authentications ... 0
  Authentication Mismatch ... 0
  Authentication Failures ... 0
  Monitored Circuit Up ...... 0
  Monitored Circuit Down..... 0

VRRP IPv4 counters for VR 100/vlan100:
  Master Transitions ........ 1
  Received Advertisements ... 1614
  Internal Errors ........... 0
  TTL Errors ................ 0
  Received Priority 0 Pkt ... 0
  Sent Priority 0 Pkt ....... 0
  Received Invalid Type ..... 0
  Address List Errors ....... 0
  Packet Length Errors ...... 0
  Invalid Authentications ... 0
  Authentication Mismatch ... 0
  Authentication Failures ... 0
  Monitored Circuit Up ...... 0
  Monitored Circuit Down..... 2
```

Table 80-1: Global counters with descriptions for the **show vrrp counters** command:

Counter	Description
Checksum Errors	The total number of VRRP packets received with an invalid VRRP checksum value.
Version Errors	The total number of VRRP packets received with an unknown or unsupported version number.
VRID Errors	The total number of VRRP packets received with an invalid VRID for this virtual router.

Table 80-2: Per VR counters with descriptions for the **show vrrp counters** command:

Counter	Description
Master Transitions	The total number of times that this virtual router's state has transitioned to MASTER.
Received Advertisements	The total number of VRRP advertisements received by this virtual router.
Internal Errors	The total number of VRRP advertisement packets received for which the advertisement interval is different than the one configured for the local virtual router.
TTL Errors	The total number of VRRP packets received by the virtual router with IP TTL (Time-To-Live) not equal to 255.
Received Priority 0 Pkt	The total number of VRRP packets received by the virtual router with a priority of '0'.
Sent Priority 0 Pkt	The total number of VRRP packets sent by the virtual router with a priority of '0'.
Received Invalid Type	The number of VRRP packets received by the virtual router with an invalid value in the 'type' field.
Address List Errors	The total number of packets received for which the address list does not match the locally configured list for the virtual router.
Packet Length Errors	The total number of packets received with a packet length less than the length of the VRRP header.
Invalid Authentications	The total number of packets received with an unknown authentication type.
Authentication Mismatch	The total number of packets received with 'Auth Type' not equal to the locally configured authentication method
Authentication Failures	The total number of VRRP packets received that do not pass the authentication check.
Monitored Circuit Up	The total number of times the monitored circuit has generated the UP event.
Monitored Circuit Down	The total number of times the monitored circuit has generated the down event.

show vrrp (session)

Use this command to display information for a particular VRRP session.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show vrrp <vrid> <interface>`

Parameter	Description
<vrid>	*<1-255>* The virtual router ID for which to display information. Session must already exist.
<interface>	The interface to display information about, for instance, `vlan2`.

Mode User Exec and Privileged Exec

Usage See the below sample output from the show vrrp command displaying information about VRRP session 1 configured on vlan2. Output shows that a Virtual IP address has been set.

```
awplus# show vrrp 1 vlan2
```

```
awplus#show vrrp 1 vlan2
Address family IPv4
VrId <1>
 Interface is vlan2
 State is Initialize
 Virtual IP address is 10.10.11.250 (Not IP owner)
 Priority is 100
 Advertisement interval is 1 sec
 Preempt mode is TRUE
```

See the below sample output from the show vrrp command displaying information about VRRP session 1 configured on vlan3. Output shows a Virtual IP address has not been set yet.

```
awplus# show vrrp 1 vlan3
```

```
awplus#show vrrp 1 vlan3
Address family IPv4
VrId <1>
 Interface is vlan3
 State is Initialize
 Virtual IP address is unset
 Priority is 100
 Advertisement interval is 1 sec
 Preempt mode is TRUE
```

Example The following command shows information about VRRP session 5 for interface vlan2.

```
awplus# show vrrp 5 vlan2
```

undebug vrrp

Use this command to disable all VRRP debugging.

Syntax `undebug vrrp all`

Mode Privileged Exec

Example

```
awplus# undebug vrrp all
```

Related Commands debug vrrp

undebug vrrp events

Use this command to disable debugging options for VRRP event troubleshooting.

Syntax `undebug vrrp events`

Mode Privileged Exec

Example

```
awplus# undebug vrrp events
```

Related Commands debug vrrp events

undebug vrrp packet

Use this command to disable debugging options for VRRP packets.

Syntax `undebug vrrp packet [send|recv]`

Parameter	Description
`send`	Disable the debug option set for sent packets.
`recv`	Disable the debug option set for received packets.

Mode Privileged Exec

Example

```
awplus# undebug vrrp packet send
```

Related Commands debug vrrp packet

virtual-ip

Use this command to set the virtual IP address for the VRRP session. This is the IP address of the virtual router that end hosts set as their default gateway.

Use the no variant of this command to disable this feature.

Syntax

```
virtual-ip <ip-address> master
virtual-ip <ip-address> backup
no virtual-ip
```

Parameter	Description
<ip-address>	The virtual IP address of the virtual router, entered in the format A.B.C.D.
master	Sets the default state of the VRRP router within the Virtual Router as master. For master, the router must own the Virtual IP address.
backup	Sets the default state of the VRRP router within the Virtual Router as backup.

Mode Router Configuration

Example

```
awplus# configure terminal
awplus(config)# router vrrp 5
awplus(config-router)# interface vlan2
awplus(config-router)# virtual-ip 192.0.2.30 master
```

vrrp vmac

Use this command to enable or disable the Virtual MAC feature.

Syntax `vrrp vmac {enable|disable}`

Mode Global Configuration

Example To enable Virtual MAC enter:

```
awplus# configure terminal
awplus(config)# vrrp vmac enable
```

To disable Virtual MAC enter:

```
awplus# configure terminal
awplus(config)# vrrp vmac disable
```

Chapter 81: EPSR Introduction and Configuration

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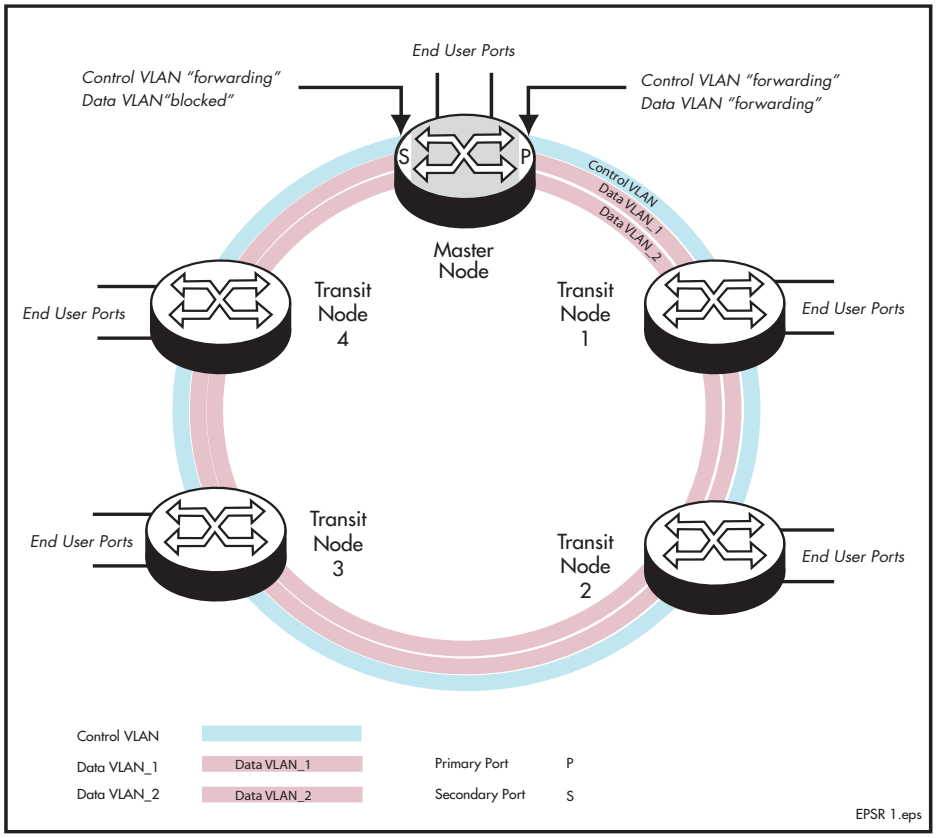
Introduction

Ethernet Protection Switching Ring (EPSR) is a protection system that prevents loops within Ethernet ring based topologies. EPSR offers a rapid detection and recovery time (in the order of 50 ms, depending on configuration) if a link or node fails. This rapid recovery time makes EPSR a more effective alternative to spanning tree options when using ring-based topologies to create high speed resilient Layer 2 networks.

Ring Components and Operation

EPSR operates only on ring-based topologies. An EPSR ring comprises a series of nodes (Ethernet bridges) connected end to end. The figure below shows a basic ring configuration. A ring comprises one master node and a number of transit nodes. Each node connects to the ring via two ports. On the master node one port is configured to be the primary port and the other, the secondary port.

Figure 81-1: Simple EPSR ring configuration



EPSR instances and domains

Each physical EPSR ring contains one or more EPSR domains. An EPSR instance can be thought of as a component of an EPSR ring domain that exists on a single node. A set of instances across the whole ring is called a "domain." Therefore a ring whose individual nodes each have two instances results in a two domain ring. Each instance contains a control VLAN and a number of data VLANs.

The EPSR control VLAN and its associated data VLANs form a Ring Domain. Although a physical ring can have more than one domain, each domain must operate as a separate logical group of VLANs and must have its own master node. This means that several domains may share the same physical network, but must operate as logically separate VLAN groups.

Control VLAN The function of the control VLAN is to monitor the ring domain and maintain its operational functions. To do this it transmits and monitors operational healthcheck messages using EPSR healthcheck control frames. The control VLAN carries no user data.

Caution

Specifying the Access Control List (ACL) filter action, send-to-cpu, could result in EPSR healthcheck messages and other control packets being dropped.

Data VLAN The data VLAN carries the user data around the ring. Several data VLANs can share a common control VLAN.

Master node The master node controls the ring operation. It issues healthcheck messages at regular intervals from its primary port and monitors their arrival back at its secondary port - after they have circled the ring. Under normal operating conditions the master node's secondary port is always in the blocking state to all data VLAN traffic. This is to prevent data loops forming within the ring. This port however, operates in the forwarding state for the traffic on the control VLAN. Loops do not occur on the control VLAN because the control messages stop at the secondary port, having completed their path around the ring.

Transit nodes The transit nodes operate as conventional Ethernet bridges, but with the additional capability of running the EPSR protocol. This protocol requires the transit nodes to forward the healthcheck messages from the master node, and respond appropriately when a ring fault is detected. The fault condition procedure is explained in "Fault Detection and Recovery" on page 81.4.

Fault Detection and Recovery

EPSR uses the following methods to detect outages in a node or a link in the ring:

- Master node polling fault detection
- Transit node unsolicited fault detection

Master node polling

The master node issues healthcheck messages from its primary port as a means of checking the condition of the EPSR network ring. These messages are sent at regular periods, controlled by the hellotime parameter of the epsr command on page 82.3. A failover timer is set each time a healthcheck message leaves the master node's primary port. The timeout value for this timer is set by the failover parameter of the epsr command on page 82.3. If the failover timer expires before the transmitted healthcheck message is received by the master node's secondary port, the master node assumes that there is a fault in the ring, and implements its fault recovery procedures. Because this method relies on a timer expiry, its operation is inherently slower than the "transit node unsolicited detection method" described next.

Transit node unsolicited

Transit node unsolicited fault detection relies on transit nodes detecting faults at their interfaces, and immediately notifying master nodes about the break. When a transit node detects a connectivity loss, it sends a "links down" message over its good link. Because a link spans two nodes, both nodes send the "links down" message back to the master node. These nodes also change their state from "links up" to "links down," and change the state of the port connecting to the broken link, from "forwarding" to "blocking."

Fault Recovery

When the master node detects an outage in the ring by using its detection methods, it does the following:

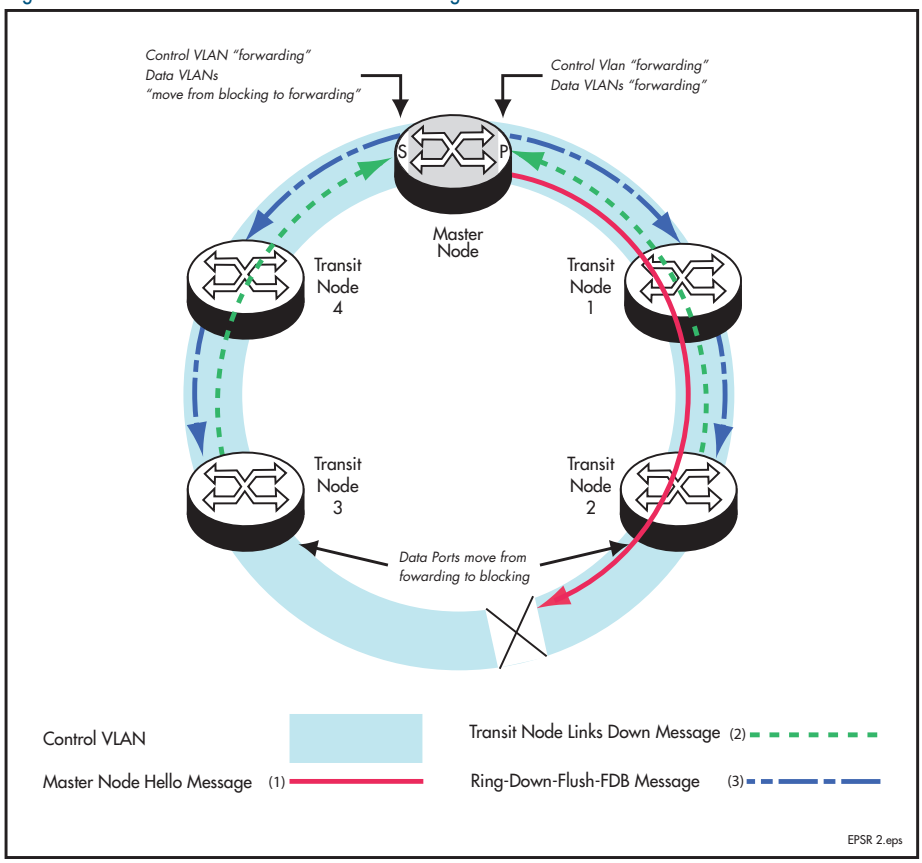
1. Declares the ring to be in a "failed" state.
2. Unblocks its secondary port to enable the data VLAN traffic to pass between its primary and secondary ports.
3. Flushes its own forwarding database (FDB) for (only) the two ring ports.
4. Sends an EPSR Ring-Down-Flush-FDB control message to all the transit nodes, via both its primary and secondary ports.

Transit nodes respond to the Ring-Down-Flush-FDB message by flushing their forward databases for each of their ring ports. As the data starts to flow in the ring's new configuration, each of the nodes (master and transit) re-learn their Layer 2 addresses. During this period, the master node continues to send health check messages over the control VLAN. This situation continues until the faulty link or node is repaired. For a multi-domain ring, this process occurs separately for each domain within the ring.

Note When VCStack is used with EPSR, the EPSR failovertime must be set to at least 5 seconds to avoid any broadcast storms during failover. Broadcast storms may occur if the switch cannot failover quickly enough before the EPSR failovertime expires. See the epsr command for further information about the EPSR failovertime. See the reboot rolling command for further information about VCStack failover.

The following figure shows the flow of control frames under fault conditions.

Figure 81-2: EPSR Fault Detection Messages



Restoring Normal Operation

Transit nodes

Once a fault in the ring or node has been rectified, the transit nodes that span the previously faulty link section detect that link connectivity has returned. They then move their appropriate ring port state, from Links-Down to Pre-Forwarding, and await the Ring-Up-Flush control message from the master node.

Once these transit nodes receive the Ring-Up-Flush message, they:

- flush their forward databases for both their ring ports.
- change the state of their ports from blocking to forwarding, which allows data to flow through their previously blocked ring ports.

Note

The transit nodes do not enter the forward state until they have received the Ring-Up-Flush message. This prevents the possibility of a loop condition occurring caused by the transit nodes moving into the forwarding state before the master node secondary port can return to the blocking state. During such a period, the ring would have no ports blocked.

Master node

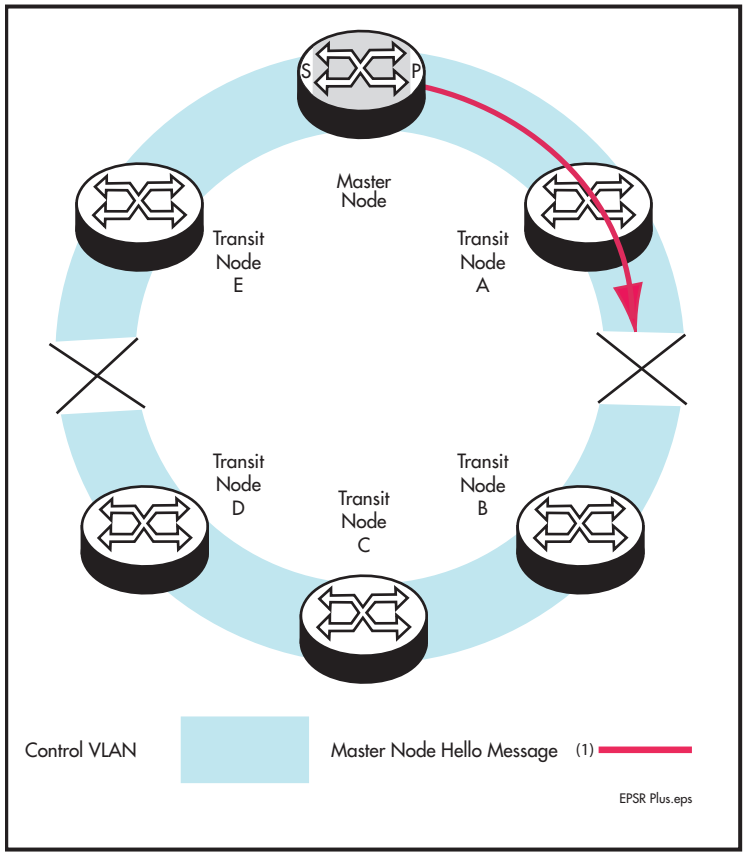
With the link restored, the healthcheck messages that are sent from the primary port of the master node now complete the loop and arrive at the master node's secondary port. The master node restores normal conditions as follows:

1. Declares the ring to be in a "complete" state.
2. Blocks its secondary port for data (non-control) traffic.
3. Flushes its forwarding database for its two ring ports.
4. Sends a Ring-Up-Flush-FDB message from its primary port, to all transit nodes.

Managing Rings with Two Breaks

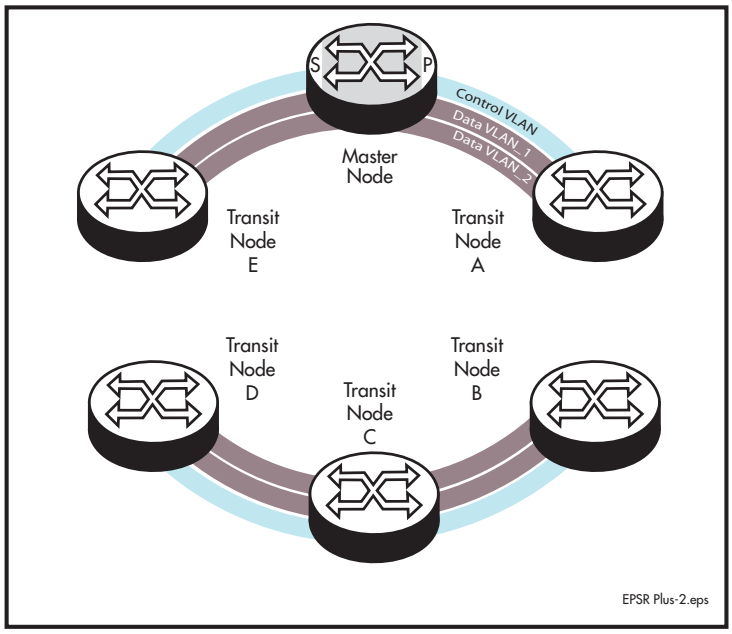
To restore a link with two breaks you need to run the EPSR Enhanced Recovery feature. Consider the network shown below:

Figure 81-3: EPSR Ring with Two Breaks



In this situation the ring will attempt to recover as previously described in "Fault Recovery" on page 81.4. This will result in the split-ring operation shown in Figure 81-4 on page 81.7.

Figure 81-4: EPSR Split Ring

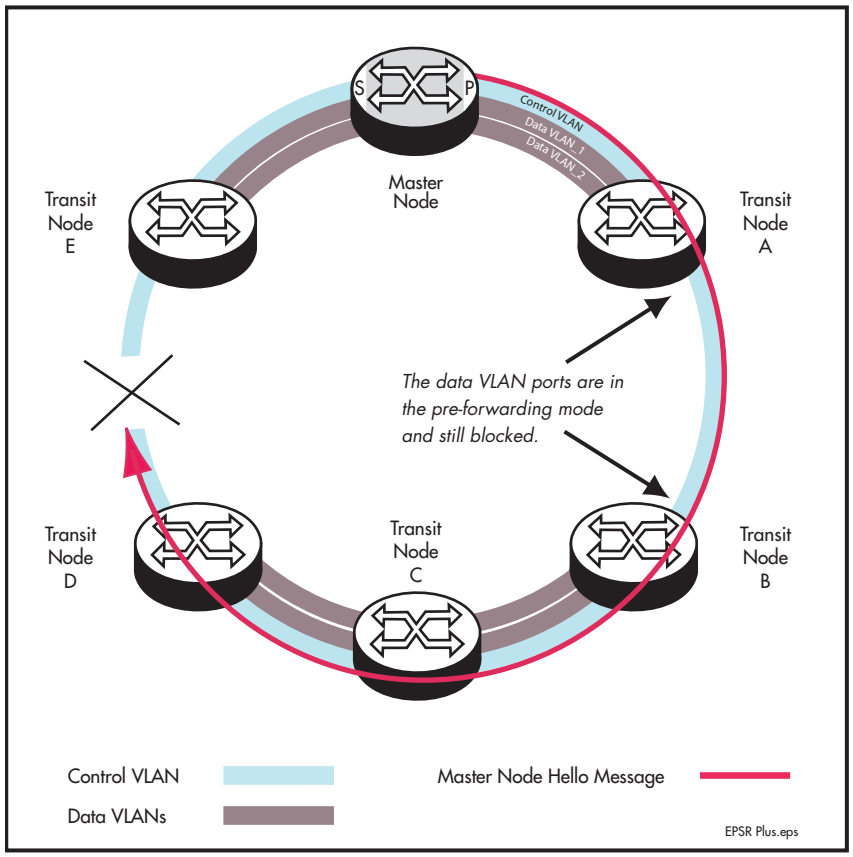


In this operational mode each portion of the ring operates as an independent link layer broadcast domain each containing the original data VLANs and control VLAN.

Recovery When One Break is Restored

Figure 81-5 on page 81.8 shows a ring with the link between nodes A and B restored. At this point the ring's behavior will depend on whether the epsr enhancedrecovery enable command on page 82.6 has been set.

Figure 81-5: EPSR Ring with One Link Restored



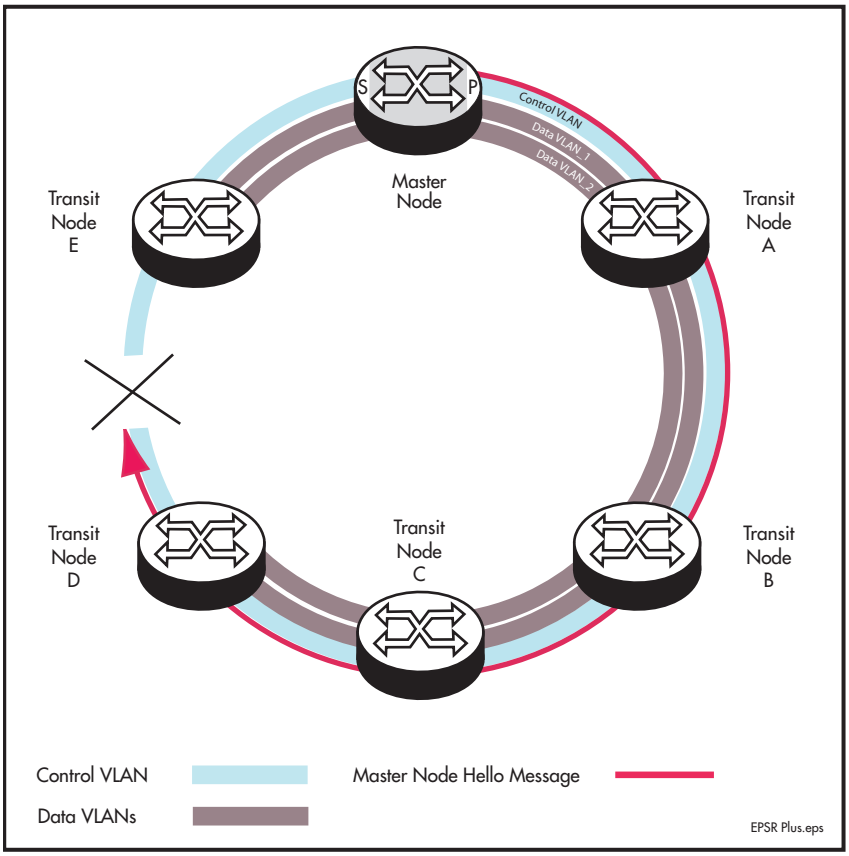
Enhanced Recovery Disabled

With the enhanced recovery feature disabled, the Hello messages will now reach the remaining ring break; however from a users perspective, the ring will remain as shown in the split state shown in Figure 81-5.

Enhanced Recovery Enabled

With the enhanced recovery feature enabled, switch nodes A and B are able to detect the restored link, and will place all their ring ports in the forwarding state. Although the ring will remain in the "failed" state because of the remaining break; communication between the nodes is restored. The network then operates as shown in Figure 81-6.

Figure 81-6: EPSR Operation in Partially Recovered State



Configuration Examples

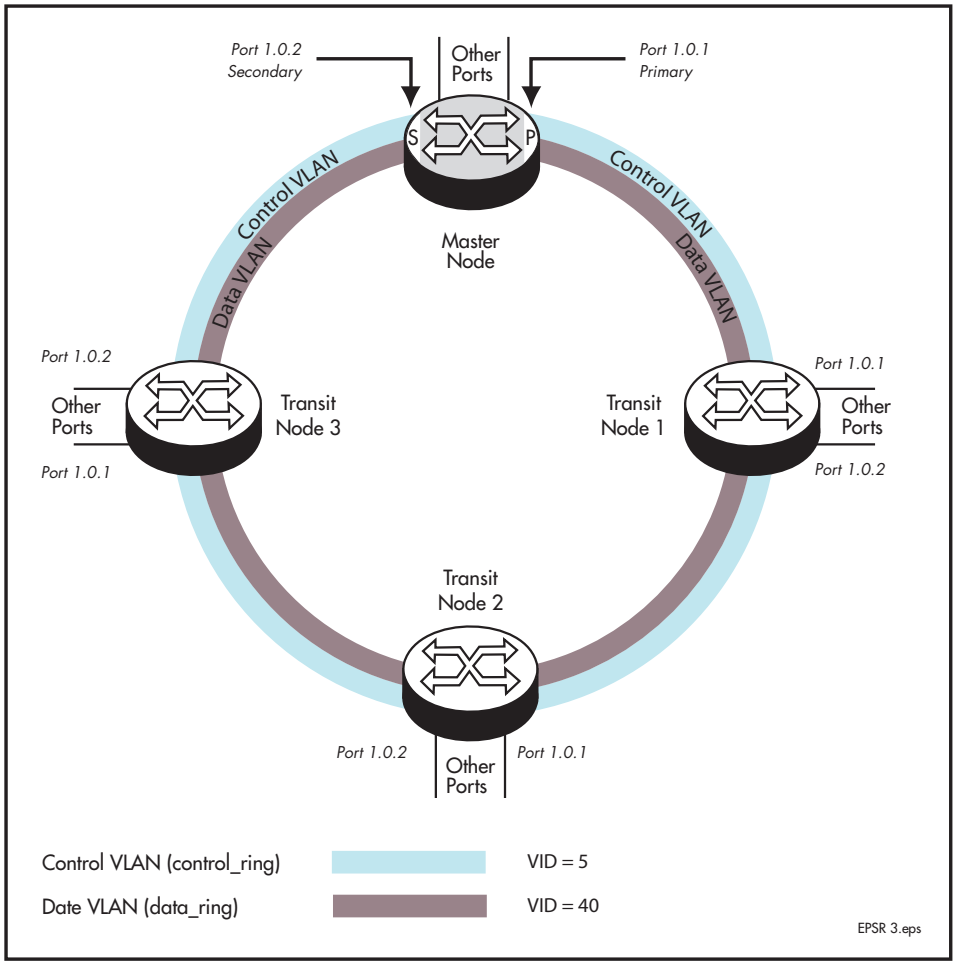
This section describes how to configure EPSR in following ways:

- Single Domain, Single Ring Network
- Single Ring, Dual Domain Network
- EPSR and Spanning Tree Operation

Single Domain, Single Ring Network

This example shows a simple single ring, single domain configuration with no connecting lobes.

Figure 81-7: EPSR single domain, single ring network



Configure the Master Node

Step 1: Create the control and data VLANs on the Master Node

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`vlan database`	Enter the VLAN Configuration mode.
`awplus(config-vlan)#`	
`vlan 5 name control_vlan state enable`	Enable VLAN 5 called `control_vlan` on the Master Node. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`vlan 40 name data_vlan state enable`	Enable VLAN 40 called `data_vlan` on the Master Node. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`exit`	Exit the VLAN Configuration mode and enter the Global Configuration mode.

Step 2: Add port1.0.1 to these VLANs

`awplus(config)#`	
`interface port1.0.1`	Specify the interface (`port1.0.1`) that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of this port to Trunk mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 5`	Enable VLAN 5 on this port.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 40`	Enable VLAN 40 on this port.
`awplus(config-if)#`	
`exit`	Exit the Interface mode and enter the Global Configuration mode.

Step 3: Add port1.0.2 to these VLANs

`awplus(config)#`	
`interface port1.0.2`	Specify the interface (`port1.0.2`) that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of this port to Trunk mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 5`	Enable VLAN 5 on this port.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 40`	Enable VLAN 40 on this port.
`awplus(config-if)#`	
`exit`	Exit the Interface Configuration mode and enter the Global Configuration mode.

Step 4: Create the EPSR Instance called “blue” on the master node, make VLAN 5 the control VLAN and port 1.0.1 the primary port

`awplus(config)#`	
`epsr configuration`	Enter the EPSR Configuration mode.
`awplus(config-epsr)#`	
`epsr blue mode master controlvlan 5 primaryport port1.0.1`	Create an EPSR instance called `blue` on `vlan5`. Make `vlan5` the control VLAN. Make `port 1.0.1` the primary port. Make this node the master.

Step 5: Add a data VLAN to the EPSR Instance called “blue” on the Master Node

`awplus(config-epsr)#`	
`epsr blue datavlan 40`	On epsr instance called `blue` make `vlan40` the data VLAN.

Step 6: Enable the EPSR Instance called “blue” on the Master Node

`awplus(config-epsr)#`	
`epsr blue state enable`	Enable the EPSR instance named `blue`.
`awplus(config-epsr)#`	
`exit`	Exit the EPSR Configuration mode.

Now you can configure the transit nodes.

Step 7: Create the Control and Data VLANs on a Transit Node

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`vlan database`	Enter the VLAN Configuration mode.
`awplus(config-vlan)#`	
`vlan 5 name control_vlan state enable`	Enable VLAN 5 called `control_vlan` on the Transit Node. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`vlan 40 name data_vlan state enable`	Enable VLAN 40 called `data_vlan` on the Transit Node. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`exit`	Exit the VLAN Configuration mode and enter the Global Configuration mode.

Step 8: Add port1.0.1 to the VLANs

`awplus(config)#`	
`interface port1.0.1`	Specify the interface (`port1.0.1`) that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of this port to Trunk mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 5`	Enable VLAN 5 on this port.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 40`	Enable VLAN 40 on this port.
`awplus(config-if)#`	
`exit`	Exit the Interface Configuration mode and enter the Global Configuration mode.

Step 9: Add port1.0.2 to the VLANs

`awplus(config)#`	
`interface port1.0.2`	Specify the interface (`port1.0.2`) that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of this port to Trunk mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 5`	Enable VLAN 5 on this port.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 40`	Enable VLAN 40 on this port.
`awplus(config-if)#`	
`exit`	Exit the Interface Configuration mode and enter the Global Configuration mode.

Step 10: Create the EPSR Instance called “blue” on a transit node, make VLAN 5 the control VLAN

`awplus(config)#`	
`epsr configuration`	Enter the EPSR Configuration mode.
`awplus(config-epsr)#`	
`epsr blue mode transit controlvlan 5`	Create an EPSR instance called `blue` on `vlan5`. Make `vlan5` the control VLAN. Make this node a transit node.

Step 11: Add a data VLAN to the EPSR Instance called “blue” on the transit node

`awplus(config-epsr)#`	
`epsr blue datavlan 40`	On the EPSR instance called `blue` make `vlan40` the data VLAN.

Step 12: Enable the EPSR Instance called “blue” on the transit node

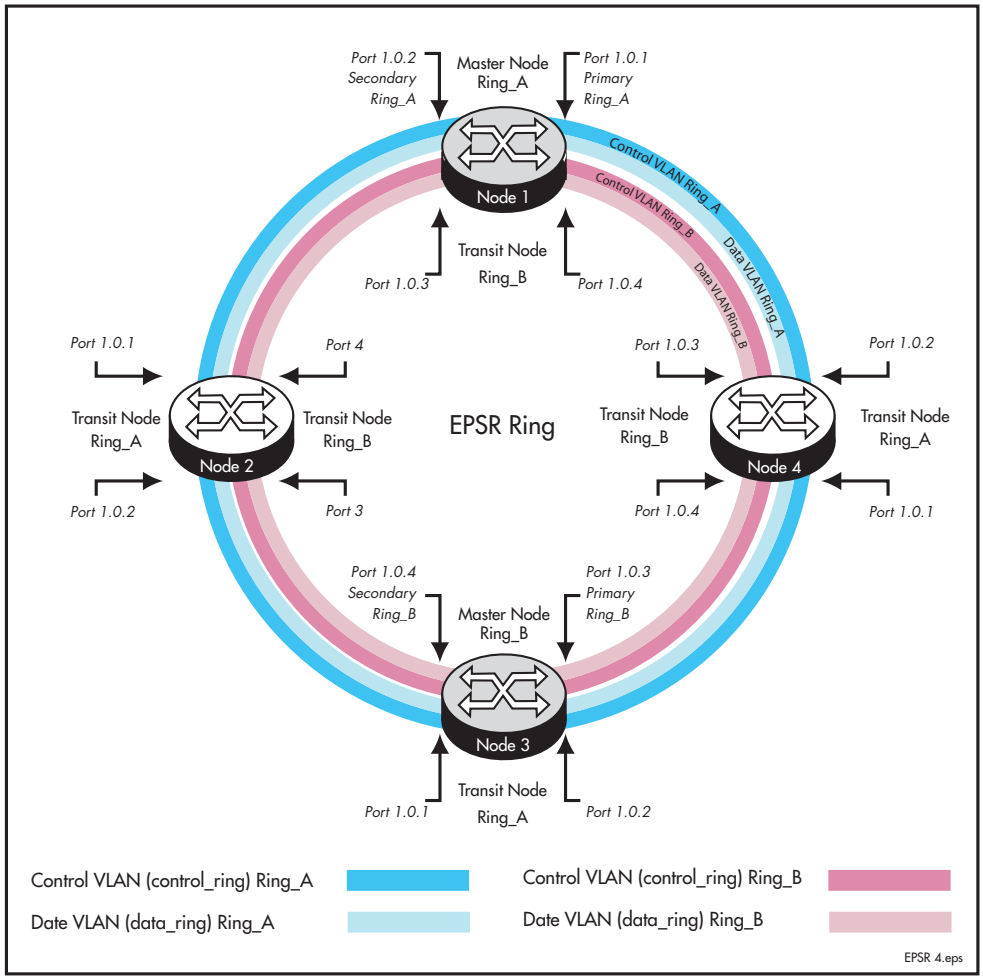
`awplus(config-epsr)#`	
`epsr blue state enable`	Enable the EPSR instance named `blue`.
`awplus(config-epsr)#`	
`exit`	Exit the EPSR Configuration mode.

Now you can use the same procedure to configure the remaining transit nodes.

Single Ring, Dual Domain Network

This example shows an EPSR configuration where two EPSR domains share the same physical ring. This configuration enables two sets of users to run totally separate Layer 2 networks. Better load distribution around the ring can be achieved by configuring different nodes to be the master for each ring.

Figure 81-8: EPSR single ring network, two domain network.

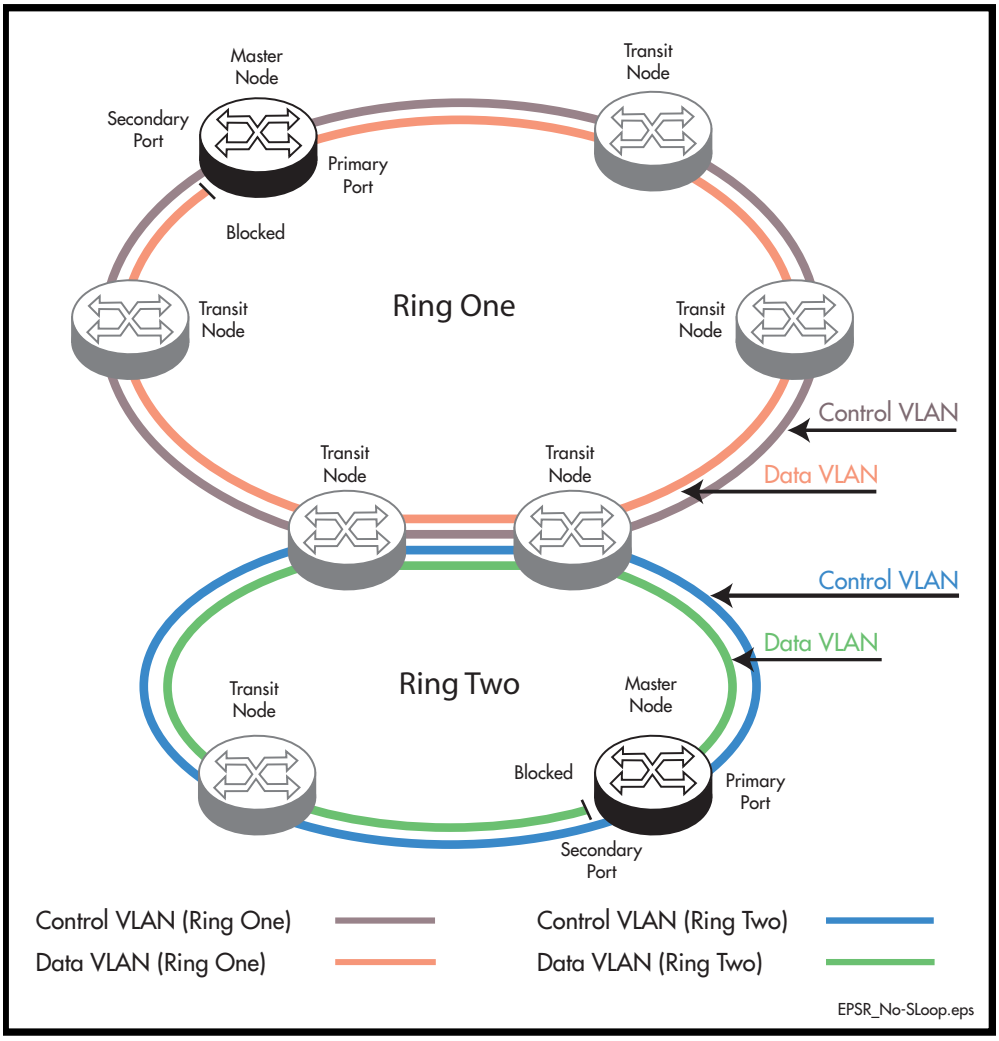


Interconnected Rings

This example shows an EPSR configuration where two rings share a common segment. This configuration will operate as two independent rings, providing that there is no data VLAN sharing between the two rings. If a break occurs in either ring then, each ring will implement its own independent recovery procedures. If a break occurs in the common segment, then each Master node will unblock its secondary port using the normal fault recovery procedure.

Where data VLANS are shared between the rings a fault condition know as “SuperLoop” can occur. The next section deals with superloops and how to manage them.

Figure 81-9: Interconnected EPSR Rings with No Data VLAN Sharing



Superloop Protection

Careful attention must be paid when creating EPSR networks with interconnecting links, to avoid an error condition known as superloops. This sections explains what superloops are and how to prevent them.

What is a an EPSR Superloop?

An EPSR superloop is a data loop whose path traverses more than a single EPSR ring. This fault condition usually occurs when there is a break in a physical segment that is shared by the two rings. For a superloop condition to occur, the two physical rings must share some of their data VLANS. Figure 81-10 on page 81.17shows an EPSR ring with a superloop condition caused by a break in the common ring segment. Figure 81-11 on page 81.18 shows the Superloop data path ring caused by the broken common ring segment. The superloop condition occurs because both rings detect the ring segment break and as a result both master nodes unblock their secondary ports.

Figure 81-10: Interconnected EPSR Rings with Data VLAN Sharing

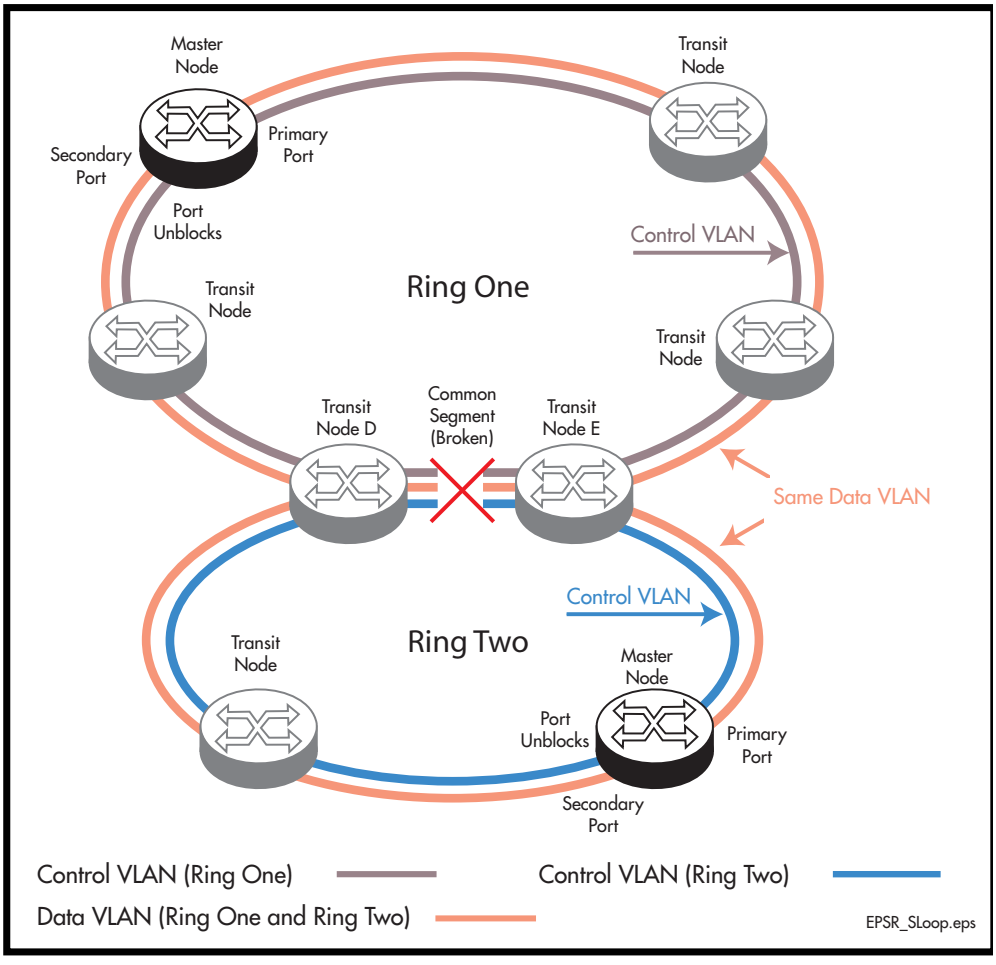
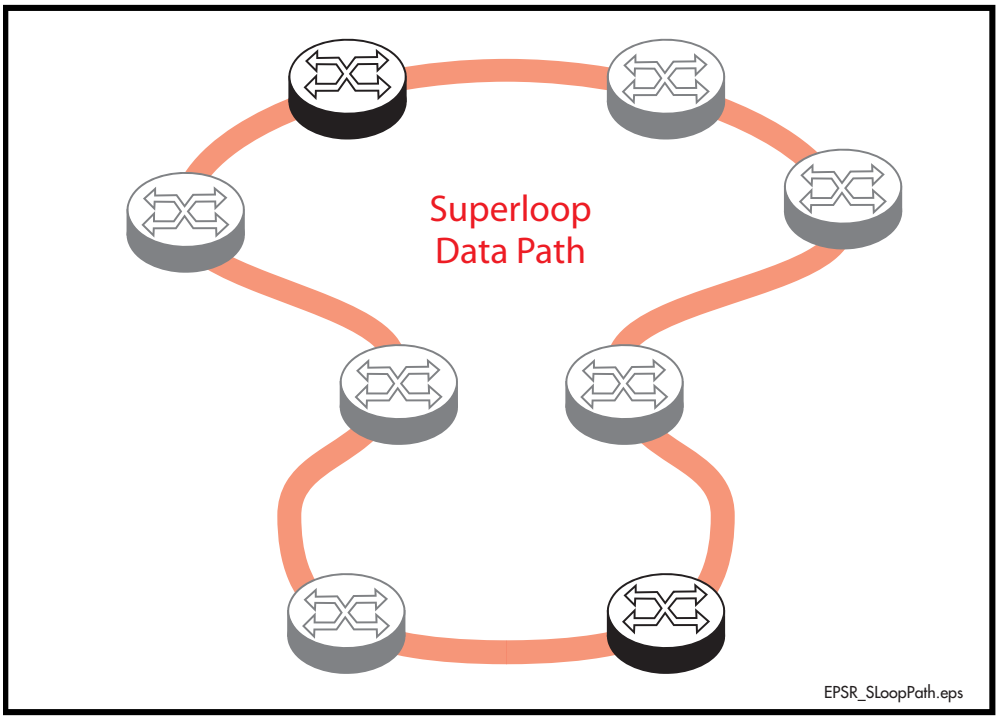


Figure 81-11: EPSR Superloop data path caused by a broken common ring segment



EPSR Superloop Prevention

Alliedware Plus version 5.4.2 onwards contains mechanisms to prevent superloops forming. The Superloop prevention facility enables rings to be assigned priority level between 0 and 127, with 1 representing the lowest priority and 127 the highest. Level 0 (the default setting) applies the functionality of no Superloop prevention. Enabling superloop prevention changes the way the EPSR nodes respond under fault conditions.

Superloop prevention is enabled for an EPSR ring instance by setting the epsr priority command on page 82.9. Setting a priority value greater than 0 applies superloop prevention to that particular instance. How the superloop function is applied will depend on the role of the node within the ring, i.e. whether it is a master node or a transit node, and its physical location within the ring. Here is how the functions of Superloop prevention modify the nodal behavior for a particular ring instance:

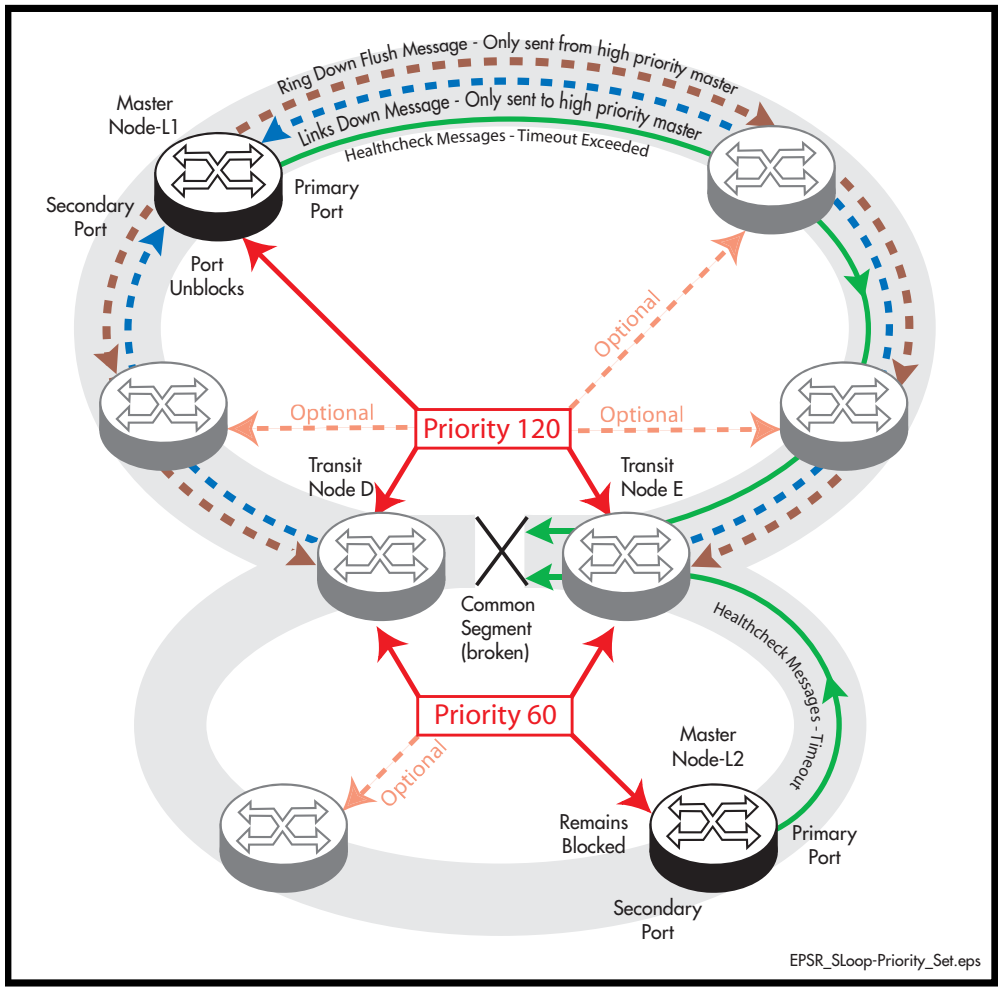
- A master node with its epsr priority set to zero will consider the superloop function to be turned off.
- A master node with its epsr priority set within the range 1-127 will consider the superloop function to be enabled, and will change its behavior in the following ways.
  - « It will not unblock its secondary port following the expiry of the Master Node Hello message timer. However, a ring-down-flush message will still be sent.
  - « It will only unblock its secondary port when it receives a Links Down message from a transit node.
- A transit node that is not connect to a shared link will be unaffected by having its epsr priority set for any of its instances.

- A transit node that is connected to a shared link will change its behavior in the following ways:
  - « It will compare its priority settings applied to each of the instances sharing the common link. So for the network of Figure 81-10 on page 81.17 Transit Node D will compare the priority setting for Ring One, with the priority setting for Ring Two.

    If the shared link fails, the transit node will only issue a Transit Node Links Down message on the ring that is configured with the highest priority.

The result of these behavior changes is that when the shared link fails, only the master node located on the higher priority ring will unblock its secondary port; because this is the only the master node that will receive the Transit Node Links Down message. Note also that the master node will receive these messages from the transit nodes at either end of the broken shared link (Nodes D and E). This concept is illustrated in

Figure 81-12: EPSR behavior under fault conditions with Superloop enabled



For this process to work requires certain configuration rules to be obeyed.

Configuration Rules for Superloop Protected EPSR Rings

The following configuration rules are advised when configuring EPSR rings that share one or more common segments.

- Allocate a priority order to each of the interconnected rings, with 127 being the highest priority and 1 the lowest.
- A higher priority ring can have its master node located in any position; although, where possible, avoid connecting a common segment to the secondary port of a master node.
- Do not locate the master node on a segment that is shared with a higher priority ring, but you "can" locate it on a common segment that is shared with a lower priority ring. In this situation however, the port that connects to the common segment must be configured as the primary port.

  For example, in Figure 81-12, the upper portion of Node D could be configured as a Master Node of the upper ring (having a priority of 120), but its lower portion must be configured as a Transit Node (having the lower priority of 60).
- On the transit nodes that connect to shared links, allocate the ring's priority to the ports that connect to each ring. Note that both of these nodes "must" be set to the same priority value.

Note

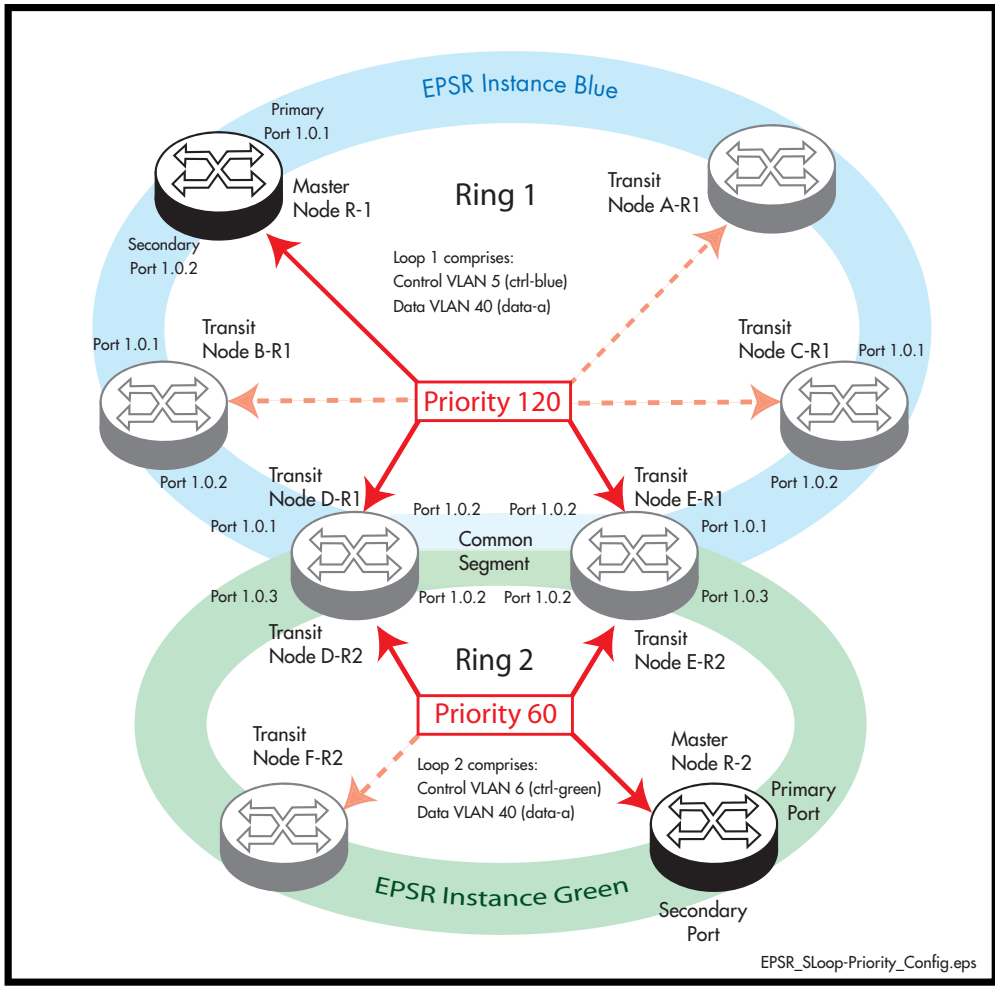
For good practice, we advise that you set all nodes within a ring to the priority assigned to that ring. So, for the network of Figure 81-12 each of the nodes that form part of the upper ring would be configured with a priority of 120, and each of the nodes that form the lower ring would all be configured with a priority of 60.

Configuring a Basic Superloop Protected Two Ring EPSR Network

Configuration Example

This section shows how to configure a basic EPSR network such as that shown in Figure 81-13 below

Figure 81-13: EPSR Two Shared Ring Example



The configuration suggested comprises the following basic steps:

- “On Ring 1- Configure the Master Node R-1” on page 81.22
- “On Ring 1 - Configure the Transit Nodes A to C” on page 81.24
- “On Ring 2 - Configure the Master Node R-2” on page 81.26
- “On Rings 1 and 2 - Configure the Transit Nodes D and E” on page 81.28
- “On Ring 2 - Configure the Transit Node F” on page 81.34

On Ring 1- Configure the Master Node R-1

Step 1: Create the control and data VLANs (Configure on the Master Node R-1)

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`vlan database`	Enter the VLAN Configuration mode.
`awplus(config-vlan)#`	
`vlan 5 name ctrl-blue state enable`	Enable VLAN 5 called ctrl-blue on the Master Node R-1. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`vlan 40 name data-a state enable`	Enable VLAN 40 called data-a on the Master Node R-1. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`exit`	Exit the VLAN Configuration mode and enter the Global Configuration mode.

Step 2: Add the control VLAN (ctrl-blue) to the Ring Ports

`awplus(config)#`	
`interface port1.0.1,port1.0.2`	Specify the two ring ports (`port1.0.1 and port1.0.2`) that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of these ports to Trunk mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 5`	Enable VLAN 5 on these ports.
`awplus#`	
`switchport trunk native vlan none`	Remove the native VLAN from these ring ports.

Step 3: Create the EPSR Instance called “blue”, make VLAN 5 the control VLAN and port 1.0.1 the primary port (Configure on the Master Node R-1)

`awplus(config)#`	
`epsr configuration`	Enter the EPSR Configuration mode.
`awplus(config-epsr)#`	
`epsr blue mode master controlvlan 5 primaryport port1.0.1`	Create an EPSR instance called `blue` on `vlan 5`. Make `vlan 5` the control VLAN. Make `port 1.0.1` the primary port. Make this node the master.

Step 4: Add a data VLAN to the EPSR Instance called “blue” (Configure on the Master Node R-1)

`awplus(config-epsr)#`	
`epsr blue datavlan 40`	On epsr instance called blue data-a the data VLAN.

Step 5: Assign a priority to the ring instance (Configure on the Master Node R-1)

`awplus(config-epsr)#`	
`epsr blue priority 120`	Set the ring instance priority to the value selected for the ring. The priority value selected is 120.
`awplus(config-epsr)#`	
`exit`	Exit the EPSR Configuration mode.

Step 6: Enable the EPSR Instance called “blue” (Configure on the Master Node R-1)

`awplus(config-epsr)#`	
`epsr blue state enable`	Enable the EPSR instance named `blue`.
`awplus(config-epsr)#`	
`exit`	Exit the EPSR Configuration mode.

Step 7: Add port1.0.1 to these VLANs (Configure on the Master Node R-1)

`awplus(config)#`	
`interface port1.0.1,port1.0.2`	Specify the EPSR ring ports (`port1.0.1 and 1.0.2`) that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 40`	Enable VLAN 40 on this port.
`awplus(config-if)#`	
`exit`	Exit the Interface mode and enter the Global Configuration mode.

On Ring 1 - Configure the Transit Nodes A to C

Step 1: Create the control and data VLANs (on Transit Nodes A to C)

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`vlan database`	Enter the VLAN Configuration mode.
`awplus(config-vlan)#`	
`vlan 5 name ctrl-blue state enable`	Enable VLAN 5 called `ctrl-blue` on the Transit Node. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`vlan 40 name data-a state enable`	Enable VLAN 40 called `data-a` on the Transit Node. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`exit`	Exit the VLAN Configuration mode and enter the Global Configuration mode.

Step 2: Add the EPSR control vlan (ctrl-blue) to EPSR ring ports

`awplus(config)#`	
`interface port1.0.1,port1.0.2`	Specify the two ring ports (`port1.0.1 and port1.0.2`) that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of this port to Trunk mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 5`	Enable VLAN 5 on these ports.
`awplus#`	
`switchport trunk native vlan none`	Remove the native VLAN from the ring ports.

Step 3: Create the EPSR Instance called “blue”, make VLAN 5 the control VLAN (on Transit Nodes A to C)

`awplus(config)#`	
`epsr configuration`	Enter the EPSR Configuration mode.
`awplus(config-epsr)#`	
`epsr blue mode transit controlvlan 5`	Create an EPSR instance called `blue` on `vlan 5`. Make `vlan 5` the control VLAN. Make this node a transit node.

Step 4: Add a data VLAN to the EPSR Instance called “blue” (on Transit Nodes A to C)

`awplus(config-epsr)#`	
`epsr blue datavlan 40`	On the EPSR instance called `blue` make `vlan 40` the data VLAN.

Step 5: Assign a priority to the ring instance (on Transit Nodes A to C)

This step is mandatory on transit nodes that connect to a common segment, and good practice on other transit nodes.

`awplus(config-epsr)#`	
`epsr blue priority 120`	Set the ring instance priority to the priority selected for the ring 120.

Step 6: Enable the EPSR Instance called “blue” (on Transit Nodes A to C)

`awplus(config-epsr)#`	
`epsr blue state enable`	Enable the EPSR instance named `blue`.
`awplus(config-epsr)#`	
`exit`	Exit the EPSR Configuration mode.

Step 7: Add the physical port 1.0.1 to VLAN 40 (on Transit Nodes A to C)

`awplus(config)#`	
`interface port1.0.1,port1.0.2`	Specify the physical ring ports (`ports1.0.1` and ports 1.0.2) that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 40`	Enable VLAN 40 on this port.
`awplus(config-if)#`	
`exit`	Exit the Interface mode and enter the Global Configuration mode.

On Ring 2 - Configure the Master Node R-2

Step 1: Create the control and data VLANs (Configure on the Master Node R-2)

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`vlan database`	Enter the VLAN Configuration mode.
`awplus(config-vlan)#`	
`vlan 6 name ctrl-green state enable`	Enable vlan 6 called ctrl-green on the Master Node R-2. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`vlan 40 name data-a state enable`	Enable VLAN 40 called data-a on the Master Node R-2. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`exit`	Exit the VLAN Configuration mode and enter the Global Configuration mode.

Step 2: Add the control VLAN (ctrl-green) to the Ring Ports

`awplus(config)#`	
`interface port1.0.1,port1.0.2`	Specify the ports (`port1.0.1 and port1.0.2`) that you are configuring, and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of these ports to Trunk mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 6`	Enable vlan 6 on these ports.
`awplus(config-if)#`	
`switchport trunk native vlan none`	Remove the native VLAN from these ring ports.

Step 3: Create the EPSR Instance called “green”, make vlan 6 the control VLAN and port1.0.1 the primary port (Configure on the Master Node R-2)

`awplus(config)#`	
`epsr configuration`	Enter the EPSR Configuration mode.
`awplus(config-epsr)#`	
`epsr green mode master controlvlan 6 primaryport port1.0.1`	Create an EPSR instance called `ctrl-green` on `vlan 6`. Make `vlan 6` the control VLAN. Make `port 1.0.1` the primary port. Make this node the master.

Step 4: Add a data VLAN to the EPSR Instance called “green” (Configure on the Master Node R-2)

`awplus(config-epsr)#`	
`epsr green datavlan 40`	On epsr instance called green make `vlan 40` the data VLAN.

Step 5: Assign a priority to the ring instance (Configure on the Master Node R-2)

This step is mandatory on transit nodes that connect to a common segment, and good practice on other transit nodes.

`awplus(config-epsr)#`	
`epsr green priority 60`	Set the ring instance priority to the value selected for the ring. The priority value selected is 60.

Step 6: Enable the EPSR Instance called “green” (Configure on the Master Node R-2)

`awplus(config-epsr)#`	
`epsr green state enable`	Enable the EPSR instance named green.
`awplus(config-epsr)#`	
`exit`	Exit the EPSR Configuration mode.

Step 7: Add ports 1.0.1 and 1.0.2 to these VLANs (Configure on the Master Node R-2)

`awplus(config)#`	
`interface port1.0.1,port1.0.2`	Specify the ports (`port1.0.1 and port1.0.2`) that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of these ports to Trunk mode.
`awplus(config-if)#`	
`exit`	Exit the Interface mode and enter the Global Configuration mode.

On Rings 1 and 2 - Configure the Transit Nodes D and E

Step 1: Create the control and data VLANs (on Transit Nodes D and E)

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`vlan database`	Enter the VLAN Configuration mode.
`awplus(config-vlan)#`	
`vlan 5 name ctrl-blue state enable`	Enable VLAN 5 called `ctrl-blue` on the Transit Node. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`vlan 40 name data-a state enable`	Enable VLAN 40 called `data-a` on the Transit Node. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`vlan 6 name ctrl-green state enable`	Enable VLAN 6 called `ctrl-green` on the Transit Node. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`exit`	Exit the VLAN Configuration mode and enter the Global Configuration mode.

Step 2: Add physical port1.0.1 to these VLANs (on Transit Nodes D and E)

`awplus(config)#`	
`interface port1.0.1`	Specify the physical `interface (port1.0.1)` that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of this port to Trunk mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 5`	Enable VLAN 5 on this port.
`awplus(config-if)#`	
`switchport trunk native vlan none`	Remove the native VLAN.
`awplus(config-if)#`	
`exit`	Exit the Interface mode and enter the Global Configuration mode.

Step 3: Add physical port port1.0.2 to these VLANs (on Transit Nodes D and E)

`awplus(config)#`	
`interface port1.0.2`	Specify the physical `interface (port1.0.2)` that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of this port to Trunk mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 5`	Enable VLAN 5 (ctrl-blue) on this port.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 6`	Enable VLAN 6 (ctrl-green) on this port.
`awplus(config-if)#`	
`switchport trunk native vlan none`	Remove the native VLAN.
`awplus(config-if)#`	
`exit`	Exit the Interface mode and enter the Global Configuration mode.

Step 4: Add physical port1.0.3 to these VLANs (on Transit Nodes D and E)

`awplus(config)#`	
`interface port1.0.3`	Specify the physical `interface (port1.0.3)` that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of this port to Trunk mode.

`awplus(config-if)#`	
`switchport trunk allowed vlan add 6`	Enable VLAN 6 on this port.
`awplus(config-if)#`	
`switchport trunk native vlan none`	Remove the native VLAN.
`awplus(config-if)#`	
`exit`	Exit the Interface mode and enter the Global Configuration mode.

Step 5: Create the EPSR Instance called “blue” on a transit node, make VLAN 5 the control VLAN (on Transit Nodes D and E)

`awplus(config)#`	
`epsr configuration`	Enter the EPSR Configuration mode.
`awplus(config-epsr)#`	
`epsr blue mode transit controlvlan 5`	Create an EPSR instance called `blue` on `vlan 5`. Make `vlan 5` the control VLAN. Make this node a transit node.

Step 6: Add a data VLAN to the EPSR Instance called “blue” (on Transit Nodes D and E)

`awplus(config-epsr)#`	
`epsr blue datavlan 40`	On the EPSR instance called `blue` make `vlan 40` the data VLAN.

Step 7: Assign a priority to the ring instance (on Transit Nodes D and E)

This step is mandatory on transit nodes that connect to a common segment, and good practice on other transit nodes.

`awplus(config-epsr)#`	
`epsr blue priority 120`	Set the ring instance priority to 120 - the value selected for the ring.
`awplus(config-epsr)#`	
`exit`	Exit the EPSR Configuration mode.

Step 8: Enable the EPSR Instance called “blue” (on Transit Nodes D and E)

`awplus(config-epsr)#`	
`epsr blue state enable`	Enable the EPSR instance named `blue`.
`awplus(config-epsr)#`	
`exit`	Exit the EPSR Configuration mode.

Step 9: Create the EPSR Instance called “green” on a transit node, make VLAN 6 the control VLAN (on Transit Nodes D and E)

`awplus(config-epsr)#`	
`epsr green mode transit controlvlan 6`	Create an EPSR instance called `green` on `vlan 6`. Make `vlan 6` the control VLAN. Make this node a transit node.

Step 10: Add a data VLAN to the EPSR Instance called "green" (on Transit Nodes D and E)

`awplus(config-epsr)#`	
`epsr green datavlan 40`	On the EPSR instance called `green` make `vlan 40` the data VLAN.

Step 11: Assign a priority to the ring instances (on Transit Nodes D and E)

This step is mandatory on transit nodes that connect to a common segment, and good practice on other transit nodes.

`awplus(config-epsr)#`	
`epsr green priority 60`	Set the ring instance priority to 60 - this being the priority selected for the ring.
`awplus(config-epsr)#`	
`exit`	Exit the EPSR Configuration mode.

Step 12: Enable the EPSR Instance called "green" (on Transit Nodes D and E)

`awplus(config-epsr)#`	
`epsr green state enable`	Enable the EPSR instance named `green`.
`awplus(config-epsr)#`	
`exit`	Exit the EPSR Configuration mode.

Step 13: Add the physical port 1.0.1 to these VLANs (on Transit Nodes D and E)

`awplus(config)#`	
`interface port1.0.1`	Specify the physical interface (`port1.0.1`) that you are configuring, and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of this port to Trunk mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 40`	Enable VLAN 40 on this port.
`awplus(config-if#`	
`switchport trunk native vlan none`	Remove the native VLAN
`awplus(config-if)#`	
`exit`	Exit the Interface Configuration mode and enter the Global Configuration mode.

Step 14: Add the physical port1.0.2to these VLANs (on Transit Nodes D and E)

`awplus(config)#`	
`interface port1.0.2`	Specify the physical interface (`port1.0.2`) that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of this port to Trunk mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 40`	Enable VLAN 40 on this port.
`awplus(config-if#`	
`switchport trunk native vlan none`	Remove the native VLAN
`awplus(config-if)#`	
`exit`	Exit the Interface Configuration mode and enter the Global Configuration mode.

Step 15: Add the physical port1.03to these VLANs (on Transit Nodes D and E)

`awplus(config)#`	
`interface port1.0.3`	Specify the physical interface (`port1.0.3`) that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of this port to Trunk mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 40`	Enable VLAN 40 on this port.
`awplus(config-if#`	
`switchport trunk native vlan none`	Remove the native VLAN
`awplus(config-if)#`	
`exit`	Exit the Interface Configuration mode and enter the Global Configuration mode.

On Ring 2 - Configure the Transit Node F

Step 1: Create the control and data VLANs (on Transit Node F)

`awplus#`	
`configure terminal`	Enter the Global Configuration mode.
`awplus(config)#`	
`vlan database`	Enter the VLAN Configuration mode.
`awplus(config-vlan)#`	
`vlan 6 name ctrl-green state enable`	Enable VLAN 6 called `ctrl-green` on the Transit Node. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`vlan 40 name data-a state enable`	Enable VLAN 40 called `data-a` on the Transit Node. Specifying the enable state allows forwarding of frames on the VLAN-aware node.
`awplus(config-vlan)#`	
`exit`	Exit the VLAN Configuration mode and enter the Global Configuration mode.

Step 2: Create the EPSR Instance called “green” on a transit node, make VLAN 6 the control VLAN (on Transit Node F)

`awplus(config)#`	
`epsr configuration`	Enter the EPSR Configuration mode.
`awplus(config-epsr)#`	
`epsr green mode transit controlvlan 6`	Create an EPSR instance called `green` on `vlan 6`. Make `vlan 6` the control VLAN. Make this node a transit node.

Step 3: Add a data VLAN to the EPSR Instance called “green” (on Transit Node F)

`awplus(config-epsr)#`	
`epsr green datavlan 40`	On the EPSR instance called `green` make `vlan 40` the data VLAN.

Step 4: Enable the EPSR Instance called “green” (on Transit Node F)

`awplus(config-epsr)#`	
`epsr green state enable`	Enable the EPSR instance named `green`.
`awplus(config-epsr)#`	
`exit`	Exit the EPSR Configuration mode.

Step 5: Assign a priority to the ring instance (on Transit Node F)

This step is mandatory on transit nodes that connect to a common segment, and good practice on other transit nodes.

`awplus(config-epsr)#`	
`epsr green priority 120`	Set the ring instance priority to the priority selected for the ring 120.
`awplus(config-epsr)#`	
`exit`	Exit the EPSR Configuration mode.

Step 6: Add the physical port port1.0.1 to VLANs 6 and 40 (on Transit Node F)

`awplus(config)#`	
`interface port1.0.1`	Specify the physical interface (`port1.0.1`) that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of this port to Trunk mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 6`	Enable VLAN 6 on this port.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 40`	Enable VLAN 40 on this port.
`awplus(config-if)#`	
`exit`	Exit the Interface mode and enter the Global Configuration mode.

Step 7: Add the physical port port1.0.2 to VLANs 6 and 40 (on Transit Node F)

`awplus(config)#`	
`interface port1.0.2`	Specify the interface (`port1.0.2`) that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport mode trunk`	Set the switching characteristics of this port to Trunk mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 6`	Enable VLAN 6 on this port.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 40`	Enable VLAN 40 on this port.
`awplus(config-if)#`	
`exit`	Exit the Interface Configuration mode and enter the Global Configuration mode.

Sample Show Output

For the above network configuration, running the command show epsr on node R1 will display the following output when operating normally. Note the blocked state of its secondary port.

Figure 81-14: Output from the **show epsr** command run on Master Node R1 - with Ring 1 - EPSR Instance blue operating normally

```
 EPSR Information
-----------------------------------------------------------------
 Name .....................blue
 Mode .....................Master
 Status ...................Enabled
 State ....................Complete
 Control Vlan .............5
 Data VLAN(s) .............40
 Interface Mode ...........Ports Only
 Primary Port .............port1.0.1
   Status .................Forwarding
   Is On Common Segment ...No
   Blocking Control .......Physical
 Secondary Port ...........port1.0.2
   Status .................Blocked
   Is On Common Segment ...No
   Blocking Control .......Physical
 Hello Time ...............1 s
 Failover Time ............2 s
 Ring Flap Time ...........0 s
 Trap .....................Enabled
 Enhanced Recovery ........Disabled
 Priority .................120
-----------------------------------------------------------------
```

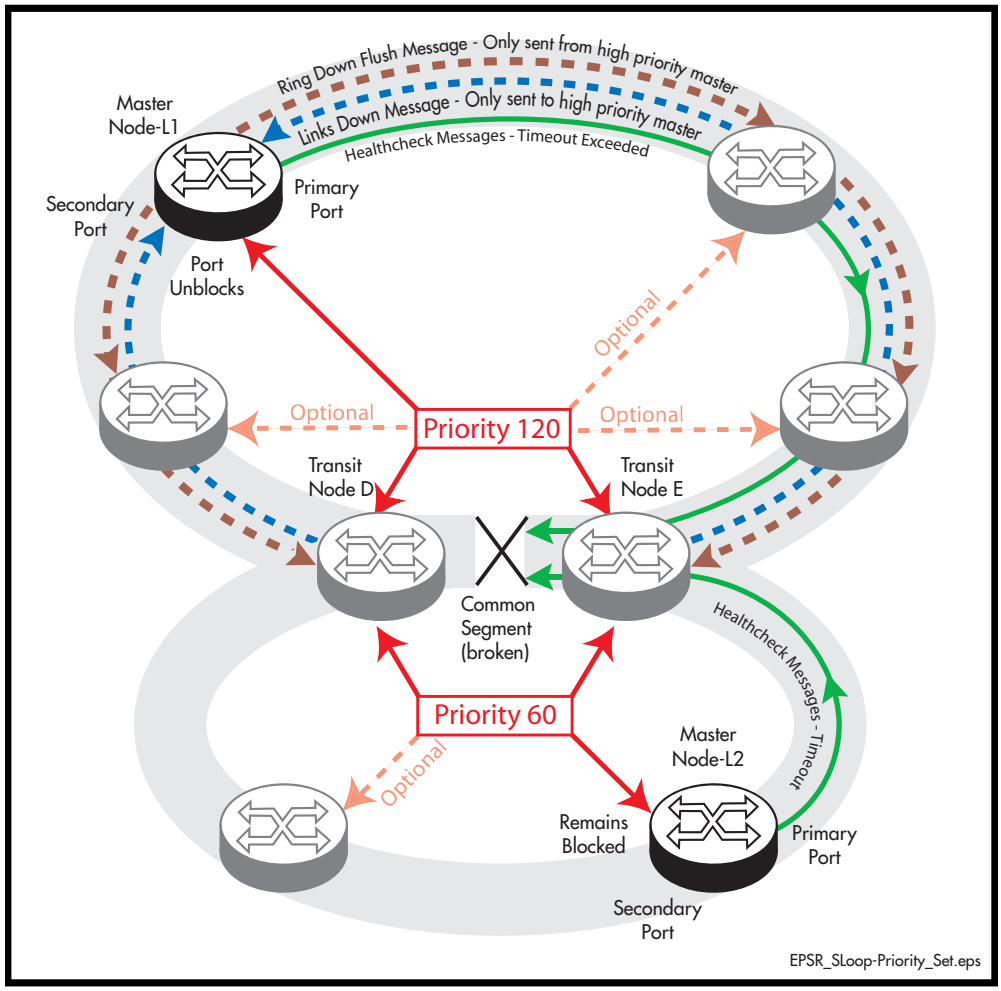
If a fault occurs somewhere within the blue network ring the Master Node-R1 would respond by placing its secondary port into the forwarding state. Figure Figure 81-15 displays its resultant state. Note that the state of its secondary port has now moved from Blocked, Forwarding.

Figure 81-15: Output from the **show epsr** command run on Master Node R2, where a break exists within the Ring 1 - EPSR instance blue.

```
 EPSR Information
-----------------------------------------------------------------
 Name .....................blue
 Mode .....................Master
 Status ...................Enabled
 State ....................Failed
 Control Vlan .............6
 Data VLAN(s) .............40
 Interface Mode ...........Ports Only
 Primary Port .............port1.0.1
   Status .................Forwarding
   Is On Common Segment ...No
   Blocking Control .......Physical
 Secondary Port ...........port1.0.2
   Status .................Forwarding
   Is On Common Segment ...No
   Blocking Control .......Physical
 Hello Time ...............1 s
 Failover Time ............2 s
 Ring Flap Time ...........0 s
 Trap .....................Enabled
 Enhanced Recovery ........Disabled
 Priority .................60
-----------------------------------------------------------------
```

If a fault occurs in the common segment of the ring then the Master Node-R2 being on the lower priority ring would detect a timeout of its transmitted Healthcheck Message. It would also detect the absence of the expected Ring Down Flush message, see Figure 81-16. The Master node then assumes that there is a break somewhere in the Common Segment, and will display the status shown in Figure 81-17.

Figure 81-16: EPSR behavior with a faulty common segment and Superloop enabled



Note that the secondary port on Master Node-L2 remains in the blocked state; its state now appears in show output as being as blocked (for superloop prevention), See Figure 81-17.

The Master-L1 on the blue ring will also detect a timeout in the healthcheck message, but because ring 1 has the higher priority (of 120), it will receive a Links Down message from each of the Transit Nodes (D and E) that connect to the common segment. As a result, the state of the Master Node will be as shown in Figure Figure 81-17; note particularly the change in its Secondary Port status.

Figure 81-17: Output from the **show epsr** command run on Master Node L2 (green)

```
 EPSR Information
-----------------------------------------------------------------
 Name .....................green
 Mode .....................Master
 Status ...................Enabled
 State ....................Failed
 Control Vlan .............6
 Data VLAN(s) .............40
 Interface Mode ...........Ports Only
 Primary Port .............port1.0.1
   Status .................Forwarding
   Is On Common Segment ...No
   Blocking Control .......Physical
 Secondary Port ...........port1.0.2
   Status .................Blocked (for superloop prevention)
   Is On Common Segment ...No
   Blocking Control .......Physical
 Hello Time ...............1 s
 Failover Time ............2 s
 Ring Flap Time ...........0 s
 Trap .....................Enabled
 Enhanced Recovery ........Disabled
 Priority .................60
-----------------------------------------------------------------
```

Adding a new data VLAN to a functioning superloop topology

This example shows how to add another data VLAN called data-b to the superloop topology. We recommend that you apply the configuration steps in the order shown.

1. Add VLAN to the common segment (for both instances)
2. Add VLAN to blue master
3. Add VLAN to other blue transits
4. Add VLAN to green master
5. Add VLAN to other green transits

On Ring 1 EPSR Instance Blue - Configure each of the Transit Nodes that Connect to the Common Segment

Select one of the transit nodes that connects to the common segment, and carry out the following steps:

Step 1: Add VLAN 50 to the VLAN database and set its state to enable

`awplus#`	
`configure terminal`	Enter terminal config mode
`awplus(config)#`	
`vlan database`	Enter the EPSR Configuration mode.
`awplus(config-epsr)#`	
`vlan 50 name data-b enable`	Create vlan 50, name it data-b and enable it.

Step 2: Add the VLAN 50 to the EPSR Instances called “blue”and “green” on the transit nodes

`awplus(config)#`	
`epsr configuration`	Enter the EPSR Configuration mode.
`awplus(config-epsr)#`	
`epsr blue datavlan 50`	On the EPSR instance called `blue` add `vlan 50` as a data VLAN.
`awplus(config-epsr)#`	
`epsr green datavlan 50`	On the EPSR instance called `green` add `vlan 50` as a data VLAN.

Step 3: Add the common physical port (port1.0.2 in this example) to VLAN 50

`awplus(config)#`	
`interface port1.0.2`	Specify the physical interface (`port1.0.2`) that you are configuring and enter the Interface Configuration mode.

awplus(config-if)#	
switchport trunk allowed vlan add 50	Enable VLAN 50 on this port.
awplus(config-if)#	
exit	Exit the Interface mode and enter the Global Configuration mode.

Step 4: Add physical port1.0.1 to VLAN 50

awplus(config)#	
interface port1.0.1	Specify the interface (port1.0.1) that you are configuring and enter the Interface Configuration mode.
awplus(config-if)#	
switchport trunk allowed vlan add 50	Enable VLAN 50 on this port.
awplus(config-if)#	
exit	Exit the Interface Configuration mode and enter the Global Configuration mode.

Step 5: Add physical port1.0.3 to VLAN 50

`awplus(config)#`	
`interface port1.0.3`	Specify the interface (`port1.0.3`) that you are configuring and enter the Interface Configuration mode.
`awplus(config-if)#`	
`switchport trunk allowed vlan add 50`	Enable VLAN 50 on this port.
`awplus(config-if)#`	
`exit`	Exit the Interface Configuration mode and enter the Global Configuration mode.

Select the next transit node that connects to the common segment, and repeat the above steps:

On Ring 1 EPSR Instance Blue - Add VLAN 50 to the Master Node

Carry out this process using the same basic procedure shown in of Steps 1 to 5

On Ring 1 EPSR Instance Blue - Add VLAN 50 to the Transit Nodes

Carry out this process using the same basic procedure shown in of Steps 1 to 5

On Ring 2 EPSR Instance Green - Add VLAN 50 to the Master Node

Carry out this process using the same basic procedure shown in of Steps 1 to 5

On Ring 2 EPSR Instance Green - Add VLAN 50 to the remaining Transit Node

Carry out this process using the same basic procedure shown in of Steps 1 to 5

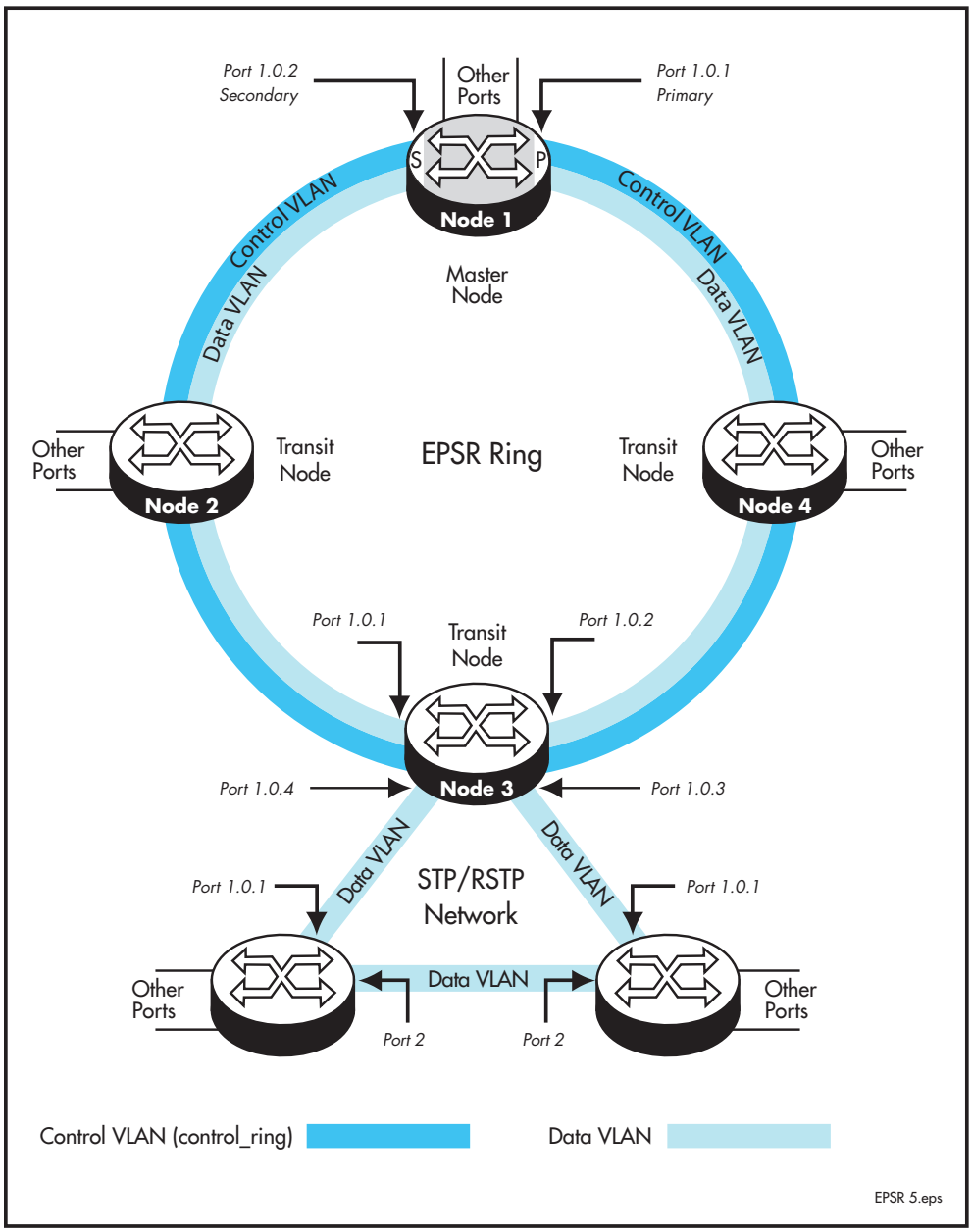
EPSR and Spanning Tree Operation

EPSR and the Spanning Tree protocol (STP) address data loop prevention, although they do it differently. EPSR is manually configured to explicitly identify which links are broken in the defined ring, whereas STP/RSTP calculates where to break links based on user-provided values (metrics) that are compared to determine the "best" (or lowest cost) paths for data traffic.

At the practical level you can use these two techniques to create complementary hybrid EPSR /STP configurations. This configuration might have a high speed fibre loop topology backbone-controlled and managed using EPSR. Lobes could extend out from each loop node into a user mesh network. Any loops in this mesh network would be controlled and managed using STP/RSTP. Note that EPSR and STP cannot share the same ports.

The following figure shows a basic combined EPSR / STP network.

Figure 81-18: EPSR and spanning tree operation



Chapter 82: EPSR Commands

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Command List

This chapter provides an alphabetical reference for commands used to configure EPSR. For more information, see Chapter 81, EPSR Introduction and Configuration.

For information about modifying or redirecting the output from show commands to a file, see

"Controlling "show" Command Output" on page 1.41.

debug epsr

This command enables EPSR debugging.

The no variant of this command disables EPSR debugging.

Syntax

```
debug epsr {info|msg|pkt|state|timer|all}
no debug epsr {info|msg|pkt|state|timer|all}
```

Parameter	Description
`info`	Send general EPSR information to the console. Using this parameter with the no debug epsr command will explicitly exclude the above information from being sent to the console.
`msg`	Send the decoded received and transmitted EPSR packets to the console. Using this parameter with the no debug epsr command will explicitly exclude the above packets from being sent to the console.
`pkt`	Send the received and transmitted EPSR packets as raw ASCII text to the console. Using this parameter with the no debug epsr command will explicitly exclude the above packets from being sent to the console.
`state`	Send EPSR state transitions to the console. Using this parameter with the no debug epsr command will explicitly exclude state transitions from being sent to the console.
`timer`	Send EPSR timer information to the console. Using this parameter with the no debug epsr command will explicitly exclude timer information from being sent to the console.
`all`	Send all EPSR debugging information to the console. Using this parameter with the no debug epsr command will explicitly exclude any debugging information from being sent to the console.

Mode Privileged Exec

Examples To enable state transition debugging, use the command:

```
awplus# debug epsr state
```

To disable EPSR packet debugging, use the command:

```
awplus# no debug epsr pkt
```

Related Commands undebug epsr

epsr

This command sets the timer values for an EPSR instance. It is only valid for master nodes.

The no variant of this command destroys an EPSR instance.

Syntax

```
epsr <epsr-name> {hellotime <1-32767>|failovertime <2-65535>|
   ringflaptime <0-65535>}

no epsr <epsr-name>
```

Parameter	Description
<epsr-name>	Name of the EPSR instance.
`hellotime` *<1-32767>*	The interval between transmitting health check messages in seconds.
`failovertime` *<2-65535>*	The period a master waits for a health check before declaring a broken ring in seconds.
`ringflaptime` *<0-65535>*	The minimum period that a master must remain in the failed state in seconds.

Mode EPSR Configuration

Examples To set the hellotimer to 5 seconds for the EPSR instance called `blue`, use the command:

```
awplus(config-epsr)# epsr blue hellotime 5
```

Note The failovertime must be at least twice the hellotime, or the hellotime must be less than equal to half the failovertime. Do not set hellotime at or below failovertime.

Note When VCStack is used with EPSR, the EPSR failovertime must be set to at least 5 seconds to avoid any broadcast storms during failover. Broadcast storms may occur if the switch cannot failover quickly enough before the EPSR failovertime expires. See the reboot rolling command for further information about VCStack failover.

To destroy an EPSR instance called `blue`, use the command:

```
awplus(config-epsr)# no epsr blue
```

Related Commands

epsr mode master controlvlan primaryport
epsr mode transit controlvlan
epsr configuration
epsr datavlan
epsr state
epsr trap
show epsr

epsr configuration

Use this command to enter EPSR Configuration mode so that EPSR can be configured.

Syntax

```
epsr configuration
```

Mode

Global Configuration

Example

To change to EPSR mode, use the command:

```
awplus(config)# epsr configuration
```

Related Commands

epsr mode master controlvlan primaryport
epsr
show epsr

epsr datavlan

This command adds a data VLAN or a range of VLAN identifiers to a specified EPSR instance.

The no variant of this command removes a data vlan or data vlan range from an EPSR instance.

Syntax

```
epsr <epsr-name> datavlan {<vlanid>|<vlanid-range>}
no epsr <epsr-name> datavlan {<vlanid>|<vlanid-range>}
```

Parameter	Description
<epsr-name>	Name of the EPSR instance.
`datavlan`	Adds a data VLAN to be protected by the EPSR instance.
<vlanid>	The VLAN's VID - a number between 1 and 4094 excluding the number selected for the control VLAN.
<vlanid-range>	Specify a range of VLAN identifiers using a hyphen to separate identifiers.

Mode EPSR Configuration

Usage We suggest setting the epsr controlvlan to vlan2 using the epsr mode master controlvlan primaryport and epsr mode transit controlvlan commands, then setting the EPSR data VLAN between to be a value 3 and 4094 using the epsr datavlan command.

Examples To add `vlan3` to the EPSR instance called `blue`, use the command:

```
awplus(config-epsr)# epsr blue datavlan vlan3
```

To add `vlan2` and `vlan3` to the EPSR instance called `blue`, use the command:

```
awplus(config-epsr)# epsr blue datavlan vlan2-vlan3
```

To remove `vlan3` from the EPSR instance called `blue`, use the command:

```
awplus(config-epsr)# no epsr blue datavlan vlan3
```

To remove `vlan2` and `vlan3` from the EPSR instance called `blue`, use the command:

```
awplus(config-epsr)# no epsr blue datavlan vlan2-vlan3
```

Related Commands

epsr mode master controlvlan primaryport
epsr mode transit controlvlan
show epsr

epsr enhancedrecovery enable

This command enables EPSR's enhanced recovery mode. Enhanced recovery mode enables a ring to apply additional recovery procedures when a ring with more than one break, partially mends. For more information see, "Managing Rings with Two Breaks" on page 81.7.

The no variant of this command disables the enhancedrecovery mode.

Syntax

```
epsr <epsr-name> enhancedrecovery enable
no epsr <epsr-name> enhancedrecovery enable
```

Parameter	Description
<epsr-name>	Name of the EPSR instance.

Default Default is enhancedrecovery mode disabled.

Mode EPSR Configuration

Example To apply enhanced recovery on the EPSR instance called `blue`, use the command:

```
awplus(config-epsr)# epsr blue enhancedrecovery enable
```

Related Commands show epsr

epsr mode master controlvlan primaryport

This command creates a master EPSR instance.

Syntax `epsr <epsr-name> mode master controlvlan <2-4094> primaryport <port>`

Parameter	Description
`<epsr-name>`	Name of the EPSR instance.
`mode`	Determines the node is acting as a master.
`master`	Sets switch to be the master node for the named EPSR ring.
`controlvlan`	The VLAN that will transmit EPSR control frames.
`<2-4094>`	VLAN id.
`primaryport`	Primary port for the EPSR instance.
`<port>`	The primary port. The port may be a switch port (e.g. `port1.0.4`) or a static channel group (e.g. `sa3`). It cannot be a dynamic (LACP) channel group.

Note

The software allows you to configure more than two ports or static channel groups to the control VLAN within a single switch or stacked node. However, we advise against this because in certain situations it can produce unpredictable results.

If the control VLAN contains more than two ports (or static channels) an algorithm selects the two ports or channels with the lowest number to be the ring ports. However if the switch has only one channel group is defined to the control vlan, EPSR will not operate on the secondary port.

EPSR does not support Dynamic link aggregation (LACP).

Mode EPSR Configuration

Example To create a master EPSR instance called `blue` with `vlan2` as the control VLAN and `port1.0.1` as the primary port, use the command:

```
awplus(config-epsr)# epsr blue mode master controlvlan vlan2
                     primaryport port1.0.1
```

Related Commands epsr mode transit controlvlan
show epsr

epsr mode transit controlvlan

This command creates a transit EPSR instance.

Syntax `epsr <epsr-name> mode transit controlvlan <2-4094>`

Parameter	Description
<epsr-name>	Name of the EPSR instance.
`mode`	Determines the node is acting as a transit node.
`transit`	Sets switch to be the transit node for the named EPSR ring.
`controlvlan`	The VLAN that will transmit EPSR control.
<2-4094>	VLAN id.

Note

The software allows you to configure more than two ports or static channel groups to the control VLAN within a single switch or stacked node. However, we advise against this because in certain situations it can produce unpredictable results.

If the control VLAN contains more than two ports (or static channels) an algorithm selects the two ports or channels with the lowest number to be the ring ports. However if the switch has only one channel group is defined to the control vlan, EPSR will not operate on the secondary port.

EPSR does not support Dynamic link aggregation (LACP).

Mode EPSR Configuration

Example To create a transit EPSR instance called `blue` with `vlan2` as the control VLAN, use the command:

```
awplus(config-epsr)# epsr blue mode transit controlvlan vlan2
```

Related Commands

epsr mode master controlvlan primaryport
epsr mode transit controlvlan
show epsr

epsr priority

This command sets the priority of an EPSR instance on an EPSR node. Priority is used to prevent superloops forming under fault conditions with particular ring configurations. Setting a node to a value greater than one, also has the effect of turning on superloop protection.

The no variant of this command returns the priority of the EPSR instance back to its default value of 0, which also disables EPSR Superloop prevention.

Syntax

```
epsr <epsr-name> priority <0-127>
no <epsr-name> priority
```

Parameter	Description
<epsr-name>	Name of the EPSR instance.
`priority`	The priority of the ring instance selected by the epsr-name parameter.
<0-127>	The priority to be applied (0 is the lowest priority and represents no superloop protection.

Default The default priority of an EPSR instance on an EPSR node is 0. The negated form of this command resets the priority of an EPSR instance on an EPSR node to the default value.

Mode EPSR Configuration

Example To set the priority of the EPSR instance called `blue` to the highest priority (127), use the command:

```
awplus(config-epsr)# epsr blue priority 127
```

To reset the priority of the EPSR instance called `blue` to the default (0), use the command:

```
awplus(config-epsr)# no epsr blue priority
```

Related Commands epsr configuration

epsr state

This command enables or disables an EPSR instance.

Syntax `epsr <epsr-name> state {enabled|disabled}`

Parameter	Description
`<epsr-name>`	The name of the EPSR instance.
`state`	The operational state of the ring.
`enabled`	EPSR instance is enabled.
`disabled`	EPSR instance is disabled.

Mode EPSR Configuration

Example To enable the EPSR instance called `blue`, use the command:

```
awplus(config-epsr)# epsr blue state enabled
```

Related Commands epsr mode master controlvlan primaryport
epsr mode transit controlvlan

epsr trap

This command enables SNMP traps for an EPSR instance. The traps will be sent when the EPSR instance changes state.

The no variant of this command disables SNMP traps for an EPSR instance. The traps will no longer be sent when the EPSR instance changes state.

Syntax

```
epsr <epsr-name> trap
no epsr <epsr-name> trap
```

Parameter	Description
<epsr-name>	Name of the EPSR instance.
`trap`	SNMP trap for the EPSR instance.

Mode EPSR Configuration

Example To enable traps for the EPSR instance called `blue`, use the command:

```
awplus(config-epsr)# epsr blue trap
```

To disable traps for the EPSR instance called `blue`, use the command:

```
awplus(config-epsr)# no epsr blue trap
```

Related Commands
epsr mode master controlvlan primaryport
epsr mode transit controlvlan
show epsr

show debugging epsr

This command shows the debugging modes enabled for EPSR.

Syntax

```
show debugging epsr
```

Mode User Exec and Privileged Exec

Example To show the enabled debugging modes, use the command:

```
awplus# show debugging epsr
```

Related Commands
debug epsr

show epsr

This command displays information about all EPSR instances.

Syntax `show epsr`

Mode User Exec and Privileged Exec

Example To show the current settings of all EPSR instances, use the command:

```
awplus# show epsr
```

Output The following examples show the output display for a non superloop topology network.

Figure 82-1: Example output from the **show epsr** command run on a Master Node

```
EPSR Information
------------------------------------------------------------------
 Name ....................... test2
 Mode ........................ Transit
 Status ...................... Enabled
 State ....................... Links-Up
 Control Vlan ................ 2
 Data VLAN(s) ................ 10
 Interface Mode .............. Ports Only
 First Port .................. port1.0.1
 First Port Status ........... Down
 First Port Direction ........ Unknown
 Second Port ................. port1.0.2
 Second Port Status .......... Down
 Second Port Direction ....... Unknown
 Trap ........................ Enabled
 Master Node ................. Unknown
 Enhanced Recovery ........... Disabled
------------------------------------------------------------------
```

Figure 82-2: Example output from the **show epsr** command run on a Transit Node

```
EPSR Information
------------------------------------------------------------------
 Name ....................... test4
 Mode ........................ Master
 Status ...................... Enabled
 State ....................... Complete
 Control Vlan ................ 4
 Data VLAN(s) ................ 20
 Interface Mode .............. Ports Only
 Primary Port ................ port1.0.3
 Primary Port Status ......... Forwarding
 Secondary Port .............. port1.0.4
 Secondary Port Status ....... Forwarding
 Hello Time .................. 1 s
 Failover Time ............... 2 s
 Ring Flap Time .............. 0 s
 Trap ........................ Enabled
 Enhanced Recovery ........... Disabled
------------------------------------------------------------------
```

The following examples show the output display for a superloop topology network.

The following examples show the output display for superloop topology network.

Figure 82-3: Example output from the **show lacp** command run on a Master Node

```
 EPSR Information
----------------------------------------------------------------
 Name ....................... test4
 Mode ....................... Master
 Status ..................... Enabled
 State ...................... Complete
 Control Vlan ............... 4
 Data VLAN(s) ............... 20
 Interface Mode ............. Ports Only
 Primary Port ............... port1.0.3
   Status ................... Forwarding (logically blocking)
   Is On Common Segment ..... No
   Blocking Control ......... Physical
 Secondary Port ............. port1.0.4
   Status ................... Blocked
   Is On Common Segment ..... No
   Blocking Control ......... Physical
 Hello Time ................. 1 s
 Failover Time .............. 2 s
 Ring Flap Time ............. 0 s
 Trap ....................... Enabled
 Enhanced Recovery .......... Disabled
 SLP Priority ............... 12
----------------------------------------------------------------
```

Table 82-1: Parameters displayed in the output of the **show lacp** command

Parameter on Master Node	Parameter on Transit Node	Description
Name	Name	The name of the EPSR instance.
Mode	Mode	The mode in which the EPSR instance is configured - either Master or Transit
Status	Status	Indicates whether the EPSR instance is enabled or disabled
State	State	Indicates state of the EPSR instance's state machine. Master states are: Idle, Complete, and Failed. Transit states are Links-Up, Links-Down, and Pre-Forwarding.
Control Vlan	Control Vlan	Displays the VID of the EPSR instance's control VLAN.
Data VLAN(s)	Data VLAN(s)	The VID(s) of the instance's data VLANs.
Interface Mode	Interface Mode	Whether the EPSR instance's ring ports are both physical ports (Ports Only) or are both static aggregators (Channel Groups Only).
Primary Port	First Port	The EPSR instance's primary ring port.
- Status	- Status	Whether the ring port is forwarding (Forwarding) or blocking (Blocked), or has link down (Down), and if forwarding or blocking, "(logical)" indicates the instance has only logically set the blocking state of the port because it does not have physical control of it.
	- Direction	The ring port on which the last EPSR control packet was received is indicated by "Upstream". The other ring port is then "Downstream"

Table 82-1: Parameters displayed in the output of the **show lacp** command

Parameter on Master	Parameter on Transit	Description(cont.)
- Is On Common Segment	- Is On Common Segment	Whether the ring port is on a shared common segment link to another node, and if so, "(highest rank)" indicates it is the highest priority instance on that common segment.
- Blocking Control	- Blocking Control	Whether the instance has "physical" or "logical" control of the ring port's blocking in the instance's data VLANs.
Secondary Port	Second Port	The EPSR instance's secondary port.
- Status	- Status	Whether the ring port is forwarding (Forwarding) or blocking (Blocked), or has link down (Down), and if forwarding or blocking, "(logical)" indicates the instance has only logically set the blocking state of the port, because it does not have physical control of it. Note that on a master configured for SuperLoop Prevention (non-zero priority) its secondary ring port can be physically forwarding, but logically blocking. This situation arises when it is not the highest priority node in the topology (and so does not receive LINKS-DOWN messages upon common segment breaks) and a break on a common segment in its ring is preventing reception of its own health messages.
	- Direction	The ring port on which the last EPSR control packet was received is indicated by "Upstream". The other ring port is then "Downstream"
- Is On Common Segment	- Is On Common Segment	Whether the ring port is on a shared common segment link to another node, and if so, "(highest rank)" indicates it is the highest priority instance on that common segment
- Blocking Control	- Blocking Control	Whether the instance has "physical" or "logical" control of the ring port's blocking in the instance's data VLANs
Hello Time		The EPSR instance's setting for the interval between transmissions of health check messages (in seconds)
Failover Time		The time (in seconds) the EPSR instance waits to receive a health check message before it decides the ring is down
Ring Flap Time		The minimum time the EPSR instance must remain in the failed state
Trap	Trap	Whether the EPSR instance has EPSR SNMP traps enabled
Enhanced Recovery	Enhanced Recovery	Whether the EPSR instance has enhanced recovery mode enabled
SLP Priority	SLP Priority	The EPSR instance's priority (for SuperLoop Prevention)

Figure 82-4: Example output from the **show lacp** command run on a Transit Node

```
EPSR Information
---------------------------------------------------------------
 Name ....................... test2
 Mode ........................ Transit
 Status ...................... Enabled
 State ....................... Links-Up
 Control Vlan ................ 2
 Data VLAN(s) ................ 10
 Interface Mode .............. Ports Only
 First Port .................. port1.0.1
   Status .................... Forwarding
   Direction ................. Downstream
   Is On Common Segment ...... Yes (highest rank)
   Blocking Control .......... Physical
 Second Port ................. port1.0.2
   Status .................... Forwarding
   Direction ................. Upstream
   Is On Common Segment ...... No
   Blocking Control .......... Physical
 Trap ........................ Enabled
 Master Node ................. Unknown
 Enhanced Recovery ........... Disabled
 SLP Priority ................ 10

 Name ....................... test3
 Mode ........................ Transit
 Status ...................... Enabled
 State ....................... Links-Up
 Control Vlan ................ 3
 Data VLAN(s) ................ 10
 Interface Mode .............. Ports Only
 First Port .................. port1.0.1
   Status .................... Forwarding (logical)
   Direction ................. Downstream
   Is On Common Segment ...... Yes
   Blocking Control .......... Logical
 Second Port ................. port1.0.3
   Status .................... Forwarding
   Direction ................. Upstream
   Is On Common Segment ...... No
   Blocking Control .......... Physical
 Trap ........................ Enabled
 Master Node ................. Unknown
 Enhanced Recovery ........... Disabled
 SLP Priority ................ 9
---------------------------------------------------------------
```

Related Commands

epsr mode master controlvlan primaryport
epsr mode transit controlvlan
show epsr counters

show epsr word

This command displays information about the specified EPSR instance.

Syntax `show epsr <epsr-name>`

Parameter	Description
<epsr-name>	Name of the EPSR instance.

Mode User Exec and Privileged Exec

Example To show the current settings of the EPSR instance called `blue`, use the command:

```
awplus# show epsr blue
```

Related Commands
epsr mode master controlvlan primaryport
epsr mode transit controlvlan
show epsr counters

show epsr word counters

This command displays counter information about the specified EPSR instance.

Syntax `show epsr <epsr-name> counters`

Parameter	Description
<epsr-name>	Name of the EPSR instance.

Mode User Exec and Privileged Exec

Example To show the counters of the EPSR instance called `blue`, use the command:

```
awplus# show epsr blue counters
```

Related Commands
epsr mode master controlvlan primaryport
epsr mode transit controlvlan
show epsr

show epsr counters

This command displays counter information about all EPSR instances.

Syntax `show epsr counters`

Mode User Exec and Privileged Exec

Example To show the counters of all EPSR instances, use the command:

```
awplus# show epsr counters
```

Related Commands epsr mode master controlvlan primaryport
epsr mode transit controlvlan
show epsr

undebug epsr

This command applies the functionality of the no debug epsr command on page 82.2.

Part 7: Network Management

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- Chapter 84 NTP Commands
- Chapter 85 Dynamic Host Configuration Protocol (DHCP) Introduction
- Chapter 86 Dynamic Host Configuration Protocol (DHCP) Commands
- Chapter 87 SNMP Introduction
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Chapter 83: NTP Introduction and Configuration

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Introduction

This chapter describes the Network Time Protocol (NTP) service provided by the switch, and how to configure and monitor NTP on the switch.

NTP is a protocol for synchronizing the time clocks on a collection of network devices using a distributed client/server mechanism. NTP uses UDP (User Datagram Protocol) as the transport mechanism. NTP evolved from the Time Protocol (RFC 868) and the ICMP Timestamp message (RFC 792).

NTP provides protocol mechanisms to specify the precision and estimated error of the local clock and the characteristics of the reference clock to which it may be synchronized.

For detailed information about the commands used to configure NTP, see Chapter 84, NTP Commands.

Overview

NTP uses a subnetwork with primary reference clocks, gateways, secondary reference clocks, and local hosts. These are organized into a hierarchy with the more accurate clocks near the top and less accurate ones near the bottom.

A number of primary reference clocks, synchronized to national standards, are connected to widely accessible resources (such as backbone gateways or switches) operating as primary time servers. The primary time servers use NTP between them to crosscheck clocks, to mitigate errors due to equipment or propagation failures, and to distribute time information to local secondary time servers. The secondary time servers redistribute the time information to the remaining local hosts.

The hierarchical organization and distribution of time information reduces the protocol overhead, and allows selected hosts to be equipped with cheaper but less accurate clocks. NTP provides information which organizes this hierarchy on the basis of precision or estimated error.

- An NTP entity may be in one of the following operating modes; however, the switch's implementation of NTP supports two modes: client and server.
- An NTP entity operating in a client mode sends periodic messages to its peers, requesting synchronization by its peers.
- An NTP entity enters the server mode temporarily when it receives a client request message from one of its peers, and remains in server mode until the reply to the request has been transmitted.
- An NTP entity operating in symmetric active mode sends messages announcing its willingness to synchronize and be synchronized by its peers.
- An NTP entity enters symmetric passive mode in response to a message from a peer operating in Symmetric Active mode. An NTP entity operating in this mode announces its willingness to synchronize and be synchronized by its peers.
- An NTP entity operating in broadcast mode periodically sends messages announcing its willingness to synchronize all of its peers but not to be synchronized by any of them.

The same message format is used for both requests and replies. When a request is received, the server interchanges addresses and ports, fills in or overwrites certain fields in the message, recalculates the checksum, and returns it immediately. The information included in the NTP message allows each client/ server peer to determine the timekeeping characteristics of its peers, including the expected accuracies of their clocks. Each peer uses this information and selects the best time from possibly several other clocks, updates the local clock, and estimates its accuracy.

There is no provision in NTP for peer discovery, acquisition, or authentication. Data integrity is provided by the IP and UDP checksums. No reachability, circuit-management, duplicate-detection, or retransmission facilities are provided or necessary.

By its very nature clock synchronization requires long periods of time (hours or days) and multiple comparisons in order to maintain accurate timekeeping. The more comparisons performed, the greater the accuracy of the timekeeping.

NTP on the Switch

The implementation of NTP on the switch is based on the following RFCs:

- RFC 958, Network Time Protocol (NTP)
- RFC 1305, Network Time Protocol (Version 3) Specification, Implementation and Analysis
- RFC 1510, The Kerberos Network Authentication Service (V5)

Two modes of operation are supported: client and server. The switch is in client mode most of the time where it polls the configured peer at least once every preconfigured minimum time period.

The peer that the switch refers to must be a more accurate clock source than the switch itself or another switch directly connected to a more accurate clock source. The switch operates as a secondary time server. It cannot operate as a primary time server unless the primary clock source is operating in server mode. A primary clock source usually operates in broadcast mode, which is not supported by the switch's implementation of NTP. There is no support for clock selection or filtering. When the switch receives a valid reply from the peer, it synchronizes its own internal clock according to the information from the reply.

If the switch receives a synchronization request from an NTP client, it temporarily changes to server mode. It replies to the request with the current time from the switch's internal clock along with other information useful for synchronization. The switch's internal clock is accurate to 0.005 seconds.

Troubleshooting

Problem The switch is not assigning the time to devices on the LAN.

Solutions

- Check that the NTP peer's IP address is entered correctly.
- Check that the NTP peer can reach the switch, by pinging the switch from the NTP peer.

Problem The switch's clock does not synchronize with the NTP peer.

Solution

- The switch's clock can synchronize with the NTP peer only when its initial time is similar to the NTP peer's time (after setting the UTC offset). Manually set the switch's time so that it is approximately correct, and enable NTP again.
- Check that the UTC offset is correct.

Problem The switch's time is incorrect, even though it assigns the correct time to devices on the LAN.

Solution The UTC offset is probably incorrect, or needs to be adjusted for the beginning or end of summer time.

Configuration Example

NTP requires the IP module to be enabled and configured correctly.

The switch's implementation of NTP supports two modes: client and server mode. When a synchronization request is received from a client (e.g. a PC on a LAN), the switch enters server mode and responds with time information derived from the switch's own internal clock. Periodically the switch enters client mode, sending synchronization requests to a predefined peer to synchronize its own internal clock. The peer is assumed to be a primary clock source or another switch connected directly to a primary clock source.

This example illustrates how to configure two switches, one at a Head Office and one at a Regional Office, to provide a network time service. The Head Office switch is connected to a primary time server and provides the most accurate time information. The switch at the Regional Office uses the Head Office switch as its peer to avoid the cost of an additional WAN connection but provides slightly less accurate time information.

To configure NTP on the switch, the NTP module must be enabled and an NTP peer must be defined. NTP transfers time information in UTC format.

To set the switch to automatically change the time when summer time starts and ends, enable a summer time offset setting.

Example configuration parameters for a network time service:

Site	Regional Office	Head Office
Switch Name	RG1	HO1
IP Address of Switch	192.168.35.114	192.168.35.113
IP Address of Peer	192.168.35.113	192.168.13.3

Step 1: Enable NTP and define the NTP peer.

The NTP feature must be enabled on all switches that are to provide a network time service. Each switch must have a peer defined where the switch synchronizes its own internal clock. Enable NTP on the Head Office switch and specify a primary time server as the peer by using the commands:

```
awplus# configure terminal
awplus(config)# ntp peer 192.168.13.3
```

Note that you can also specify an IPv6 address for an NTP peer:

```
awplus# configure terminal
awplus(config)# ntp peer 2001:0db8:010d::1
```

Step 2: Configure the NTP parameters.

On each switch, the offset of local time from UTC time must be specified. In this example, both switches are in the same time zone, which is 12 hours ahead of UTC time. Use the following commands on both switches:

```
awplus(config)# clock timezone utc plus 12
```

Note that the range of offset is `<0-12>`.

Step 3: Check the NTP configuration.

Check the NTP configuration on each switch by using the command:

```
awplus# show ntp status
```

This command displays the following information on the Head Office switch.

```
Clock is synchronized, stratum 0, actual frequency is 0.0000
Hz, precision is 20 reference time is 00000000.00000000
(6:28:16.000 UTC Fri Feb  7 2036)clock offset is 0.000 msec,
root delay is 0.000 msec root dispersion is 0.000 msec,
```

Chapter 84: NTP Commands

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Command List

This chapter provides an alphabetical reference for commands used to configure the Network Time Protocol (NTP). For more information, see Chapter 83, NTP Introduction and Configuration.

For information about modifying or redirecting the output from show commands to a file, see "Controlling "show" Command Output" on page 1.41.

ntp access-group

This command creates an NTP access group, and applies a basic IP access list to it. This allows you to control access to NTP services.

The no variant of this command removes the configured NTP access group.

Syntax

```
ntp access-group [peer|query-only|serve|serve-only]
    [<1-99>|<1300-1999>]

no ntp access-group [peer|query-only|serve|serve-only]
```

Parameter	Description
`peer`	Allows time requests and NTP control queries, and allows the system to synchronize itself to a system whose address passes the access list criteria.
`query-only`	Allows only NTP control queries from a system whose address passes the access list criteria.
`serve`	Allows time requests and NTP control queries, but does not allow the system to synchronize itself to a system whose address passes the access list criteria.
`serve-only`	Allows only time requests from a system whose address passes the access list criteria.
<1-99>	Standard IP access list.
<1300-1999>	Expanded IP access list.

Mode Global Configuration

Example To create an NTP peer access group for an extended IP access list, use the commands:

```
awplus# configure terminal
awplus(config)# ntp access-group peer 1998
```

To disable the NTP peer access group created above, use the commands:

```
awplus# configure terminal
awplus(config)# no ntp access-group peer
```

ntp authenticate

This command enables NTP authentication. This allows NTP to authenticate the associations with other systems for security purposes.

The no variant of this command disables NTP authentication.

Syntax

```
ntp authenticate
no ntp authenticate
```

Mode Global Configuration

Example To enable NTP authentication, use the commands:

```
awplus# configure terminal
awplus(config)# ntp authenticate
```

To disable NTP authentication, use the commands:

```
awplus# configure terminal
awplus(config)# no ntp authenticate
```

ntp authentication-key

This command defines each of the authentication keys. Each key has a key number, a type, and a value. Currently, the only key type supported is MD5.

The no variant of this disables the authentication key assigned previously using ntp authentication-key.

Syntax

```
ntp authentication-key <keynumber> md5 <key>
no ntp authentication-key <keynumber> md5 <key>
```

Parameter	Description
<keynumber>	*<1-4294967295>* The key number.
<key>	The authentication key.

Mode Global Configuration

Example To define an authentication key number `134343` and a key value `mystring`, use the commands:

```
awplus# configure terminal
awplus(config)# ntp authentication-key 134343 md5 mystring
```

To disable the authentication key number `134343` with the key value `mystring`, use the commands:

```
awplus# configure terminal
awplus(config)# no ntp authentication-key 134343 md5 mystring
```

ntp broadcastdelay

Use this command to set the estimated round-trip delay for broadcast packets.

Use the no variant of this command to reset the round-trip delay for broadcast packets to the default offset of 0 microseconds.

Syntax

```
ntp broadcastdelay <delay>
no ntp broadcastdelay
```

Parameter	Description
<delay>	*<1-999999>* The broadcast delay in microseconds.

Default 0 microsecond offset, which can only be applied with the no variant of this command.

Mode Global Configuration

Example To set the estimated round-trip delay to 23464 microseconds for broadcast packets, use these commands:

```
awplus# configure terminal
awplus(config)# ntp broadcastdelay 23464
```

To reset the estimated round-trip delay for broadcast packets to the default setting (0 microseconds), use these commands:

```
awplus# configure terminal
awplus(config)# no ntp broadcastdelay
```

ntp master

Use this command to make the device to be an authoritative NTP server, even if the system is not synchronized to an outside time source. Note that no stratum number is set by default.

Use the no variant of this command to stop the device being the designated NTP server.

Syntax

```
ntp master [<stratum>]
no ntp master
```

Parameter	Description
<stratum>	*<1-15>* The stratum number.

Mode Global Configuration

Usage The stratum number is null by default and must be set using this command. The stratum levels define the distance from the reference clock and exist to prevent cycles in the hierarchy. Stratum 1 is used to indicate time servers, which are more accurate than Stratum 2 servers.

Examples To stop the switch from being the designated NTP server use the commands:

```
awplus# configure terminal
awplus(config)# no ntp master
```

To make the switch the designated NTP server with stratum number 2 use the commands:

```
awplus# configure terminal
awplus(config)# ntp master 2
```

ntp peer

Use this command to configure an NTP peer association. An NTP association is a peer association if this system is willing to either synchronize to the other system, or allow the other system to synchronize to it.

Use the no variant of this command to remove the configured NTP peer association.

Syntax

```
ntp peer {<peeraddress>|<peername>}

ntp peer {<peeraddress>|<peername>}
   [prefer] [key <key>] [version <version>]

no ntp peer {<peeraddress>|<peername>}
```

Parameter	Description
<peeraddress>	Specify the IP address of the peer, entered in the form `A.B.C.D` for an IPv4 address, or in the form `X:X::X.X` for an IPv6 address.
<peername>	Specify the peer hostname. The peer hostname can resolve to an IPv4 and an IPv6 address.
`prefer`	Prefer this peer when possible.
`key` *<key>*	*<1-4294967295>* Configure the peer authentication key.
`version` *<version>*	*<1-4>* Configure for this NTP version.

Mode Global Configuration

Examples See the following commands for options to configure NTP peer association, key and NTP version for the peer with an IPv4 address of `192.0.2.23`:

```
awplus# configure terminal
awplus(config)# ntp peer 192.0.2.23
awplus(config)# ntp peer 192.0.2.23 prefer
awplus(config)# ntp peer 192.0.2.23 prefer version 4
awplus(config)# ntp peer 192.0.2.23 prefer version 4 key 1234
awplus(config)# ntp peer 192.0.2.23 version 4 key 1234
awplus(config)# ntp peer 192.0.2.23 version 4
awplus(config)# ntp peer 192.0.2.23 key 1234
```

To remove an NTP peer association for this peer with an IPv4 address of `192.0.2.23`, use the following commands:

```
awplus# configure terminal
awplus(config)# no ntp peer 192.0.2.23
```

See the following commands for options to configure NTP peer association, key and NTP version for the peer with an IPv6 address of 2001:0db8:010d::1:

```
awplus# configure terminal
awplus(config)# ntp peer 2001:0db8:010d::1
awplus(config)# ntp peer 2001:0db8:010d::1 prefer
awplus(config)# ntp peer 2001:0db8:010d::1 prefer version 4
awplus(config)# ntp peer 2001:0db8:010d::1 prefer version 4 key
1234
awplus(config)# ntp peer 2001:0db8:010d::1 version 4 key 1234
awplus(config)# ntp peer 2001:0db8:010d::1 version 4
awplus(config)# ntp peer 2001:0db8:010d::1 key 1234
```

To remove an NTP peer association for this peer with an IPv6 address of 2001:0db8:010d::1, use the following commands:

```
awplus# configure terminal
awplus(config)# no ntp peer 2001:0db8:010d::1
```

ntp server

Use this command to configure an NTP server. This means that this system will synchronize to the other system, and not vice versa.

Use the no variant of this command to remove the configured NTP server.

Syntax

```
ntp server {<serveraddress>|<servername>}

ntp server {<serveraddress>|<servername>}
    [prefer] [key <key>] [version <version>]

no ntp server {<serveraddress>|<servername>}
```

Parameter	Description
<serveraddress>	Specify the IP address of the peer, entered in the form `A.B.C.D` for an IPv4 address, or in the form `X:X::X.X` for an IPv6 address.
<servername>	Specify the server hostname. The server hostname can resolve to an IPv4 and an IPv6 address.
`prefer`	Prefer this server when possible.
`key` *<key>*	*<1-4294967295>* Configure the server authentication key.
`version` *<version>*	*<1-4>* Configure for this NTP version.

Mode Global Configuration

Examples See the following commands for options to configure an NTP server association, key and NTP version for the server with an IPv4 address of `192.0.1.23`:

```
awplus# configure terminal
awplus(config)# ntp server 192.0.1.23
awplus(config)# ntp server 192.0.1.23 prefer
awplus(config)# ntp server 192.0.1.23 prefer version 4
awplus(config)# ntp server 192.0.1.23 prefer version 4 key 1234
awplus(config)# ntp server 192.0.1.23 version 4 key 1234
awplus(config)# ntp server 192.0.1.23 version 4
awplus(config)# ntp server 192.0.1.23 key 1234
```

To remove an NTP peer association for this peer with an IPv4 address of `192.0.1.23`, use the following commands:

```
awplus# configure terminal
awplus(config)# no ntp server 192.0.1.23
```

See the following commands for options to configure an NTP server association, key and NTP version for the server with an IPv6 address of 2001:0db8:010e::2:

```
awplus# configure terminal
awplus(config)# ntp server 2001:0db8:010e::2
awplus(config)# ntp server 2001:0db8:010e::2 prefer
awplus(config)# ntp server 2001:0db8:010e::2 prefer version 4
awplus(config)# ntp server 2001:0db8:010e::2 prefer version 4
key 1234
awplus(config)# ntp server 2001:0db8:010e::2 version 4 key 1234
awplus(config)# ntp server 22001:0db8:010e::2 version 4
awplus(config)# ntp server 2001:0db8:010e::2 key 1234
```

To remove an NTP peer association for this peer with an IPv6 address of 2001:0db8:010e::2, use the following commands:

```
awplus# configure terminal
awplus(config)# no ntp server 2001:0db8:010e::2
```

ntp trusted-key

This command defines a list of trusted authentication keys. If a key is trusted, this system will be ready to synchronize to a system that uses this key in its NTP packets.

Use the no variant of this command to remove a configured trusted authentication key.

Syntax

```
ntp trusted-key <1-4294967295>
no ntp trusted-key <1-4294967295>
```

Parameter	Description
<*1-4294967295*>	The specific key number.

Mode Global Configuration

Example To define a trusted authentication key numbered `234675`, use the following commands:

```
awplus# configure terminal
awplus(config)# ntp trusted-key 234676
```

To remove the trusted authentication key numbered `234675`, use the following commands:

```
awplus# configure terminal
awplus(config)# no ntp trusted-key 234676
```

show counter ntp

This command displays packet counters for NTP.

Syntax `show counter ntp`

Mode User Exec and Privileged Exec

Output Figure 84-1: Example output from the **show counter ntp** command

```
NTP counters
Pkts Sent                .......... 0
Pkts Received            .......... 70958
Pkts Processed           .......... 0
Pkts current version     .......... 0
Pkts old version         .......... 0
Pkts unknown version     .......... 0
Pkts access denied       .......... 70958
Pkts bad length          .......... 0
Pkts bad auth            .......... 0
Pkts rate exceed         .......... 0
```

Table 84-1: Parameters in the output from the **show counter ntp** command

Parameter	Description
`Pkts Sent`	Total number of NTP client and server packets sent by your device.
`Pkts Received`	Total number of NTP client and server packets received by your device.
`Pkts Processed`	The number of packets processed by NTP. NTP processes a packet once it has determined that the packet is valid by checking factors such as the packet's authentication, format, access rights and version.
`Pkts current version`	The number of version 4 NTP packets received.
`Pkts old version`	The number of NTP packets received that are from an older version, down to version 1, of NTP. NTP is compatible with these versions and processes these packets.
`Pkts unknown version`	The number of NTP packets received that are an earlier version than version 1, or a higher version than version 4. NTP cannot process these packets.
`Pkts access denied`	The number of NTP packets received that do not match any access list statements in the NTP access-groups. NTP drops these packets.
`Pkts bad length`	The number of NTP packets received that do not conform to the standard packet length. NTP drops these packets.
`Pkts bad auth`	The number of NTP packets received that failed authentication. NTP drops these packets. Packets can only fail authentication if NTP authentication is enabled with the ntp authenticate command.
`Pkts rate exceed`	The number of packets dropped because the packet rate exceeded its limits.

Example To display counters for NTP, use the command:

```
awplus# show counter ntp
```

show ntp associations

Use this command to display the status of NTP associations. Use the detail option for displaying detailed information about the associations.

Syntax `show ntp associations [detail]`

Mode User Exec and Privileged Exec

Example See the sample output of the show ntp associations and show ntp associations detail commands displaying the status of NTP associations

Figure 84-2: Example output from the **show ntp associations** command

```
awplus#show ntp associations
  address          ref clock       st  when  poll reach   delay  offset    disp
 ~192.0.2.23       INIT            16     -   512   000     0.0     0.0     0.0
 * master (synced), # master (unsynced), + selected, - candidate, ~ configured
awplus#
```

Figure 84-3: Example output from the **show ntp associations detail** command

```
awplus#show ntp associations detail
192.0.2.23 configured, sane, valid, leap_sub, stratum 16
ref ID INIT, time 00000000.00000000 (06:28:16.000 UTC Thu Feb  7 2036)
our mode client, peer mode unspec, our poll intvl 512, peer poll intvl 1024
root delay 0.00 msec, root disp 0.00, reach 000,
delay 0.00 msec, offset 0.0000 msec, dispersion 0.00
precision 2**-19,
org time 00000000.00000000 (06:28:16.000 UTC Thu Feb  7 2036)
rcv time 00000000.00000000 (06:28:16.000 UTC Thu Feb  7 2036)
xmt time cf11f2a4.cedde5e4 (00:39:00.808 UTC Tue Feb  2 2010)
filtdelay =  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
filtoffset =  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
filterror =  16000.00  16000.00  16000.00  16000.00  16000.00  16000.00  16000.0
0  16000.00
```

Table 84-2: Parameters in the output from the **show ntp associations** command

Parameter	Description
address	Peer IP address
ref clock	IP address for reference clock
st	Stratum. The number of hops between the server and the accurate time source.
poll	Time between NTP requests from the device to the server.
reach	Shows whether or not the NTP server responded to the last request.
delay	Round trip delay between the device and the server.
offset	Difference between the device clock and the server clock.
disp	Lowest measure of error associated with peer offset based on delay.

show ntp status

Use this command to display the status of the Network Time Protocol (NTP).

Syntax `show ntp status`

Mode User Exec and Privileged Exec

Example See the sample output of the show ntp status command displaying information about the Network Time Protocol.

Figure 84-4: Example output from the s**how ntp status** command

```
awplus#sh ntp status
Clock is synchronized, stratum 3, reference is 127.127.1.0
actual frequency is 0.0000 Hz, precision is 2**-19
reference time is cf11f3f2.c7c081a1 (00:44:34.780 UTC Tue Feb  2
2010)
clock offset is 0.000 msec, root delay is 0.000 msec
root dispersion is 7947729.000 msec,
awplus#
```

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Introduction

This chapter describes the Dynamic Host Configuration Protocol (DHCP) support provided by your device. This includes how to configure your device to:

- act as a DHCP and BOOTP server
- act as a DHCP relay agent
- use the DHCP client to obtain IP addresses for its own interfaces

Note that you can configure your device to operate as both a DHCP relay agent and a DHCP/BOOTP server.

BOOTP

Bootstrap Protocol (BOOTP) is a UDP-based protocol that enables a booting host to dynamically configure itself without external interventions. A BOOTP server responds to requests from BOOTP clients for configuration information, such as the IP address the client should use. BOOTP is defined in RFC 951, Bootstrap Protocol (BOOTP).

RFC 1542, Clarifications and Extensions for the Bootstrap Protocol, defines extensions to the BOOTP protocol, including the behavior of a DHCP relay agent.

DHCP

DHCP is widely used to dynamically assign host IP addresses from a centralized server that reduces the overhead of administrating IP addresses. DHCP helps conserve the limited IP address space because IP addresses no longer need to be permanently assigned to hosts. DHCP centrally manages IP address assignment for a large number of subscribers.

DHCP is based on BOOTP, and is defined in RFC 2131. It extends the BOOTP mechanism by providing:

- a method for passing configuration information to hosts on a TCP/IP network
- automatic allocation of reusable network addresses
- other additional configuration options

When your device is configured as a DHCP server, it allocates IP addresses and other IP configuration parameters to clients (hosts), when the client requests them. This lets you configure your IP network without manually configuring every client. Note that each client must also be configured to receive its IP address automatically.

As well as addresses, a DHCP server assigns a wide range of parameters to clients, including subnet information and mask, domain and hostname, server addresses, keepalive times, MTUs, boot settings, encapsulation settings, time settings, and TCP settings.

DHCP is designed to interoperate with BOOTP clients and DHCP clients, without the BOOTP clients needing any change to their initialization software.

DHCP Relay Agents

DHCP relay agents pass BOOTP and DHCP messages between servers and clients. Networks where the DHCP or BOOTP server does not reside on the same IP subnet as its clients need the intermediate routers to act as relay agents. A maximum number of 400 DHCP relay agents (one per interface) can be configured on the device. Once this limit has been reached, any further attempts to configure DHCP relay agents will not be successful.

Configuring the DHCP Server

The DHCP server uses address pools when responding to DHCP client requests. Address pools contains specific IP configuration details that the DHCP server can allocate to a client. You can configure multiple address pools on the device for different networks.

To configure a pool, you must:

- Create the Pool and enter its configuration mode.
- Define the Network the pool applies to.
- Define the Range of IP addresses that the server can allocate to clients. You can specify multiple address ranges for each pool.
- Set the Lease for the clients. This defines whether the clients receive a dynamic, permanent, or static IP address.
- Set the Options (standard and user-defined) that the clients of a pool require when configuring their IP details.

After configuring the address pools, you can then enable the DHCP server by using the command:

```
awplus(config)# service dhcp-server
```

For networks where you do not want the server to respond to BOOTP requests, you can configure the DHCP server so that it ignores them, by using the command:

```
awplus(config)# ip dhcp bootp ignore
```

Create the Pool

A DHCP pool is identified by a name. To create a DHCP pool and enter the configuration mode for the pool, use the command:

```
awplus(config)# ip dhcp pool <pool-name>
```

Define the Network

Define the network that the DHCP clients are in. You can define one network per address pool. Use the following command to define the network after defining the DHCP pool first:

```
awplus(dhcp-config)# network
```

- For remote clients, set the network address to the network of the remote clients. The network command does not need to match a specific interface's network, because the DHCP server listens on all IP interfaces for DHCP requests.
- For locally connected clients, ensure that the desired interface has an IP address and subnet mask defined; use the ip address IPADDR command to set a static address. Enter the configuration mode for the pool, and set the DHCP address pool's network to match the interface's network. Pools that span multiple interfaces are possible only if the interface networks are contiguous.

Define the Range

Configure an IP address range for the pool. This range must be in the same subnet as the pool's network setting. Use the command:

```
awplus(dhcp-config)# range <ip-address> [<ip-address>]
```

The first IPv4 address specifies the low end of the range, while the second IP address is the high end. You can set the range to a single IP address by specifying only one IP address.

Set the Lease

The DHCP server assigns IP settings to hosts for specific times (the lease time). Each DCHP pool has one lease time setting. You can use DHCP to allocate the following types of addresses:

- A dynamic IP addresses
  These are available to a host for a limited amount of time. When the lease expires, the server can reallocate the IP address to another device. To set the lease time for the DHCP pool so that it assigns dynamic IP addresses, use the command:

  ```
  awplus(dhcp-config)# lease <days> <hours> <minutes>
                       [<seconds>]
  ```

- A permanent IP addresses
  These are available to a host for an unlimited amount of time. To set the lease time to assign permanent IP addresses, use the command:

  ```
  awplus(dhcp-config)# lease infinite
  ```

- A static IP addresses
  These are allocated to a particular client. The DHCP server recognizes the client by its MAC address. This lets you use DHCP to manage most of your network automatically, while having unchanging IP addresses on key devices such as servers. To assign a static IP address to a device, use the command:

  ```
  awplus(dhcp-config)# host <ip-address> <mac-address>
  ```

BOOTP requests can be satisfied by pools with leases set to infinity.

Enable DHCP Leasequery

The DHCP Leasequery protocol (RFC 4388) allows a device or process, for example a DHCP relay agent, to obtain IP address information directly from the DHCP server using DHCPLEASEQUERY messages.

DHCPLEASEQUERY messages support three query regimes:

- IP address

  Only an IP address is supplied in the DHCPLEASEQUERY message. The DHCP server will return any information that it has on the most recent client to have been assigned that IP address.

- MAC address

  Only a MAC address is supplied in the DHCPLEASEQUERY message. The DHCP server will return any information that it has on the IP address most recently accessed by a client with that MAC address. Also, the DHCP server may supply additional IP addresses that have been associated with that MAC address in different subnets.

- Client identifier option

  Only a Client identifier option is supplied in the DHCPLEASEQUERY message. The DHCP server will return any information that it has on the IP address most recently accessed by a client with that Client identifier. Also, the DHCP server may supply additional IP addresses that have been associated with Client identifier in different subnets.

An AlliedWare Plus DHCP server implementing DHCP Leasequery supports all three query regimes.

If the DHCP Leasequery feature is enabled, when a DHCP relay agent needs to know the location of an IP endpoint and sends a DHCPLEASEQUERY message, the DHCP server will reply with either a DHCPLEASEACTIVE, DHCPLEASEUNASSIGNED, or DHCPLEASEUNKNOWN message.

When the DHCP server replies to a DHCPLEASEQUERY message:

- a DHCPLEASEACTIVE message allows the DHCP relay agent to determine the IP endpoint location and the remaining duration of the IP address lease
- a DHCPLEASEUNASSIGNED message indicates that there is no current active lease for the IP address, but the DHCP server does manage that IP address
- a DHCPLEASEUNKNOWN message indicates that the DHCP server supports DHCP Leasequery but has no knowledge of the query information specified in the DHCPLEASEQUERY message (e.g., IP address, MAC address, or Client identifier option)

To enable the DHCP Leasequery feature, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp leasequery enable
```

To disable the DHCP Leasequery feature, use the commands:

```
awplus# configure terminal
awplus(config)# no ip dhcp leasequery enable
```

To display information about DHCP Leasequery messages, use either of the commands:

```
awplus# show counter dhcp-server
awplus# show ip dhcp server statistics
```

To display information about the current configuration of the DHCP server, including whether the DHCP server is configured to support DHCP Leasequery, use the command:

```
awplus# show ip dhcp server summary
```

Set the Options

DHCP allows clients to receive options from the DHCP server. Options describe the network configuration, and various services that are available on the network. Options are configured separately on each DHCP pool. You can configure both standard predefined options and user-defined options for a DHCP pool.

To create a user-defined option, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp option <1-254> [name <option-
name>] [<option-type>]
```

To add a user-defined option to a DHCP address pool, use the command sequence:

```
awplus(config)# ip dhcp pool <pool-name>
awplus(dhcp-config)# option [<1-254>|<option-name>]
<option-value>
```

It is possible to add a user-defined option with the same number as an existing pre-defined option. If this situation occurs, the user-defined option takes precedence—that is, it overrides but does not eliminate the standard option.

You can set some pre-defined options using the following commands:

To set a subnet mask (option 1) for the address pool, use the command:

```
awplus(dhcp-config)# subnet-mask <mask>
```

To add a domain name (option 15) for the address pool, use the command:

```
awplus(dhcp-config)# domain-name <domain-name>
```

To add a default router (option 3) for the address pool, use the command:

```
awplus(dhcp-config)# default-router <ip-address>
```

To add a DNS server (option 6) for the address pool, use the command:

```
awplus(dhcp-config)# dns-server <ip-address>
```

DHCP Lease Probing

Probing is used by the DHCP server to check whether an IP address it wants to lease to a client is already being used by another host. Probing is configured on a per-DHCP pool basis. You can specify probing either by ICMP Echo Request (ping) or by ARPing. ARP probing is useful in networks where ICMP may be blocked on some devices, whereas ARP is always supported. ARP and ping probing are mutually exclusive and cannot operate concurrently within a DHCP pool.

Probing is enabled by default when a DHCP pool is created.

To enable probing if probing has previously been disabled for a DHCP pool, enter the configuration mode for the pool with the ip dhcp pool command and then use the command:

```
awplus(dhcp-config)# probe enable
```

The default probe type is ping. To specify the probe type as ARP, enter the configuration mode for the pool and then use the command:

```
awplus(dhcp-config)# probe type arp
```

To set the timeout value in milliseconds to wait for a response after each probe packet is sent, use the command:

```
awplus(dhcp-config)# probe timeout <50-5000>
```

To specify the number of packets sent for each lease probe, use the command:

```
awplus(dhcp-config)# probe packets <0-10>
```

To disable probing for a DHCP pool, enter the configuration mode for the pool and then use the command:

```
awplus(dhcp-config)# no probe enable
```

To display the lease probe configuration settings for a specific DHCP pool or for all DHCP pools configured on the device, use the command:

```
awplus# show ip dhcp pool [<address-pool>]
```

DHCP Relay Agent Introduction

DHCP relay agents pass BOOTP messages between servers and clients. Networks where the DHCP or BOOTP server does not reside on the same IP subnet as its clients need the routers attached to the subnet to act as DHCP relay agents.

Note that both BOOTP and DHCP use BOOTP messages, allowing DHCP relay agents to relay all their packets.

Your device's DHCP Relay Agent relays these message types:

- BOOTREQUEST messages originating from any of the device's interfaces to a user-defined destination
- BOOTREPLY messages addressed to BOOTP clients on networks directly connected to the device

The relay agent ignores BOOTREPLY messages addressed to clients on networks not directly connected to the device. The device treats these as ordinary IP packets for forwarding.

A BOOTREQUEST message may be relayed via unicast, multicast or broadcast methods. In the last case, the message does not re-broadcast to the interface from which it was received. The relay destinations are configured independently of other broadcast forwarders' destinations (e.g. TFTP).

The hops field in a BOOTP message records the number of hops (routers) the message has been through. If the value of the hops field exceeds a predefined threshold, the relay agent discards the message.

Configuring the DHCP Relay Agent

To enable the DHCP relay agent on your device, use the commands:

```
awplus# configure terminal
awplus(config)# service dhcp-relay
```

You must define a relay destination on one of the device's interfaces before the relay agent can relay packets. This is the path to the DHCP server. To define a relay destination, use the commands:

```
awplus(config)# interface <interface-name>
awplus(config-if)# ip dhcp-relay server-address <ip-address>
```

You can define more than one relay destination on your device. The following table describes how the relay agent forwards the packets.

If an interface has...	Then the relay agent relays BOOTP packets it receives on that interface to...
one relay destination defined	the relay destination.
multiple relay destinations defined	each defined relay destination.

To delete a relay destination, use the command:

```
awplus(config-if)# no ip dhcp-relay server-address <ip-address>
```

See the ip dhcp-relay server-address command on page 86.20 and the service dhcp-relay command on page 86.33 for detailed command description and command examples. DHCP servers with IPv4 and IPv6 addresses can now be configured with ip dhcp-relay server-address.

When the 'hops' field in a BOOTP message exceeds a predefined threshold the BOOTP message is discarded. The default of the threshold is 10. To set the threshold, use the command:

```
awplus(config-if)# ip dhcp-relay maxhops <1-255>
```

To display the current configuration of the DHCP relay agent, use the command:

```
awplus# show ip dhcp-relay [interface <interface-name>]
```

DHCP Relay Agent Option 82

Enabling the DCHP Option 82 feature on the switch allows the switch to insert extra information into the DHCP packets that it is relaying. This information enables more accurate identification of a subscriber, as it states which switch port on which relay switch the subscriber is connected to. The information is stored in a specific optional field in the DHCP packet, namely, the agent-information field, which has option ID 82.

The DHCP relay agent inserts the Option 82 information into the DHCP packets that it is relaying to a DHCP server. DHCP servers that are configured to recognize Option 82 may use the information to implement IP addresses, or other parameter assignment policies, based on the network location of the client device. Alternatively, the server can simply log this information to create a detailed audit trail of the locations of the clients to which given addresses were allocated at given times.

If the DHCP Relay Agent Option 82 feature is enabled, the DHCP packet flow is as follows:

- The DHCP client generates a DHCP request and broadcasts it on the network.
- The DHCP relay agent intercepts the broadcast DHCP request packet and inserts the relay agent information option (Option 82) in the packet.
- The DHCP relay agent forwards the DHCP request that includes the Option 82 field to the DHCP server.
- The DHCP server receives the packet.
- If the DHCP server supports Option 82, then it echoes the Option 82 field in the DHCP reply. If the server does not support Option 82, it ignores the option and does not echo it in the reply.
- The DHCP server unicasts the reply to the relay agent.
- The relay agent removes the Option 82 field and forwards the packet to the switch port connected to the DHCP client that sent the DHCP request.

For more information about DHCP Relay Agent Option 82, see RFC 3046. Option 82 can be:

- added to packets relayed from the DHCP client to DHCP server
- removed from packets relayed from DHCP server to DHCP client
- checked from sources closer to the client

To enable the relay agent to insert its details into the Option 82 field in requests received from clients attached to a particular interface, use the command:

```
awplus(config)# interface <interface-name>
awplus(config-if)# ip dhcp-relay agent-option
```

This applies to requests received with no other agent relay information in the Option 82 field.

The Option 82 field contains sub-options. You can specify a value for the Remote ID sub-option, which contains information that identifies the host. To specify a value for the Remote ID, use the command:

```
awplus(config)# interface <interface-name>
awplus(config-if)# ip dhcp-relay agent-option remote-id
<remote-id>
```

If a Remote ID value is not specified, the Remote ID sub-option is set to the switch's MAC address.

Note that the Option 82 agent information added by DHCP Relay differs from the information inserted by the DHCP snooping (see "DHCP Option 82" on page 77.4).

Dealing with client-originated packets that already contain Option 82 information

The discussion above deals with the case where the DHCP requests arriving from the clients do not already contain Option 82 information. However, it is possible that the requests arriving from the clients to the relay agent could already contain Option 82 information. There are two main circumstances in which this can occur:

1. A client is maliciously inserting bogus information into the packet in an attempt to subvert the process of identifying the client's location

2. A Layer 2 DHCP snooping switch, that sits between the clients and the DCHP relay, is validly inserting the Option 82 information into the packets. The DHCP snooping switch is not acting as a relay agent, so it is not filling in the giaddr field (the relay IP address field) in the packet; it is only inserting the Option 82 information.

In case 1, you would want to drop the packets that contain the bogus information (or, at least remove the bogus information). In case 2, you would want to forward the valid information to the DHCP server.

To configure the switch to check for the presence of Option 82 information in incoming DHCP requests, configure DHCP-relay agent-option checking, with the command (in Interface Configuration mode):

```
awplus(config)# interface <interface-name>
awplus(config-if)# ip dhcp-relay agent-option checking
```

By default, this will cause the switch to act as follows:

- If the incoming DHCP request has a null IP address (0.0.0.0) in the giaddr field, and contains Option 82 information, drop the packet. This assumes that such a packet has been maliciously created by a client.

- If an incoming DHCP request has a non-null in the giaddr field, and contains Option 82 information, then replace the Option 82 field with the current switch's own information. This assumes that a non-null giaddr field indicates that the packet has already passed through a valid DHCP relay device, and so the presence of the Option 82 information is not an indication of malicious intent.

The action taken on packets that have a null giaddr field and an Option 82 field present cannot be altered once the agent-option check has been enabled. But the action taken on packets with a non-null giaddr field and an Option 82 field is configurable. The command to configure this action is shown below:

```
awplus(config)# interface <interface-name>
awplus(config-if)# ip dhcp-relay information policy
```

This command takes parameters that can configure the switch to:

- Leave the existing Option 82 field untouched
- Append its own Option 82 field after the existing field
- Drop the packet
- Replace the existing Option 82 information with its own (the default).

DHCP Relay Agent Option 82 maximum message length

Where a DHCP relay (that has Option 82 insertion enabled) receives a request packet from a DHCP client, it will append the Option 82 component data, and forward the packet to the DHCP server. The DHCP client will sometimes issue packets containing pad option fields that can be overwritten with Option 82 data. Where there are insufficient pad option fields to contain all the Option 82 data, the DHCP relay will increase the packet size to accommodate the Option 82 data. If the new (increased) packet size exceeds that defined by the maximum-message-length parameter, of the ip dhcp-relay max-message-length command then the DHCP relay will drop the packet.

```
awplus(config)# interface <interface-name>
awplus(config-if)# ip dhcp-relay max-message-length 1200
```

Configuring the DHCP Client

You can configure an interface on your device with a static IP address, or with a dynamic IP address assigned using your device's DHCP client. When you use the DHCP client, it obtains the IP address for the interface, and other IP configuration parameters, from a DHCP server. To configure an interface and gain its IP configuration using the DHCP client, use the command:

```
awplus(config)# interface <ifname>
awplus(config-if)# ip address dhcp [client-id <interface>]
[hostname <hostname>]
```

The DHCP client supports the following IP configuration options:

- Option 1—the subnet mask for your device.
- Option 3—a list of default routers.
- Option 6—a list of DNS servers. This list appends the DNS servers set on your device with the ip name-server command.
- Option 15—a domain name used to resolve host names. This option replaces the domain name set with the ip domain-name command. Your device ignores this domain name if it has a domain list set using the ip domain-list command.
- Option 51—lease expiration time.

If an IP interface is configured to get its IP address and subnet mask from DHCP, the interface does not take part in IP routing until the IP address and subnet mask have been set by DHCP.

For information on configuring a static IP address on an interface, see the ip address command on page 25.15.

Clearing Dynamically Allocated Lease Bindings

A lease binding is the mapping of an IP address to a physical address. To clear dynamically allocated lease bindings, use the command:

```
awplus# clear ip dhcp binding {ip <ip-address>|
        mac <mac-address>|all|pool <pool-name>|
        range <low-ip-address> <high-ip-address>}
```

You have the option to clear either a specific lease binding, specified by IP or MAC address, or to clear several lease bindings at once. The options for clearing multiple lease bindings are:

- all, to clear all DHCP bindings
- pool, to clear a specific DHCP server address pool
- range, to clear a range of DHCP clients

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Command List

This chapter provides an alphabetical reference for commands used to configure DHCP. For more information, see Chapter 85, Dynamic Host Configuration Protocol (DHCP) Introduction.

For information about modifying or redirecting the output from show commands to a file, see "Controlling "show" Command Output" on page 1.41.

bootfile

This command sets the boot filename for a DHCP server pool. This is the name of the boot file that the client should use in its bootstrap process. It may need to include a path.

The no variant of this command removes the boot filename from a DHCP server pool.

Syntax

```
bootfile <filename>
no bootfile
```

Parameter	Description
<filename>	The boot file name.

Mode DHCP Configuration

Example To configure the boot filename for a pool P2, use the command:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# bootfile boot/main_boot.bt
```

clear ip dhcp binding

This command clears either a specific lease binding or the lease bindings specified by the command. The command will only take effect on dynamically allocated bindings, not statically configured bindings.

Syntax

```
clear ip dhcp binding {ip <ip-address>|mac <mac-address>|all|pool
   <pool-name>|range <low-ip-address> <high-ip-address>}
```

Parameter	Description
`ip <ip-address>`	IPv4 address of the DHCP client, in dotted decimal notation in the format A.B.C.D.
`mac <mac-address>`	MAC address of the DHCP client, in hexadecimal notation in the format HHHH.HHHH.HHHH.
`all`	All DHCP bindings.
`pool <pool-name>`	Description used to identify DHCP server address pool. Valid characters are any printable character. If the name contains spaces then you must enclose these in “quotation marks”.
`range <low-ip-address> <high-ip-address>`	IPv4 address range for DHCP clients, in dotted decimal notation. The first IP address is the low end of the range, the second IP address is the high end of the range.

Mode Privileged Exec

Usage A specific binding may be deleted by ip address or mac address, or several bindings may be deleted at once using all, pool or range.

Note that if you specify to clear the ip or mac address of what is actually a static DHCP binding, an error message is displayed. If all, pool or range are specified and one or more static DHCP bindings exist within those addresses, any dynamic entries within those addresses are cleared but any static entries are not cleared.

Examples To clear the specific IP address binding `192.168.1.1`, use the command:

```
awplus# clear ip dhcp binding ip 192.168.1.1
```

To clear all dynamic DHCP entries, use the command:

```
awplus# clear ip dhcp binding all
```

Related Commands show ip dhcp binding

default-router

This command adds a default router to the DHCP address pool you are configuring. You can use this command multiple times to create a list of default routers on the client's subnet. This sets the router details using the pre-defined option 3. Note that if you add a user-defined option 3 using the option command, then you will override any settings created with this command.

The no variant of this command removes either the specified default router, or all default routers from the DHCP pool.

Syntax

```
default-router <ip-address>
no default-router [<ip-address>]
```

Parameter	Description
<ip-address>	IPv4 address of the default router, in dotted decimal notation.

Mode DHCP Configuration

Examples To add a router with an IP address 192.168.1.2 to the DHCP pool named P2, use the following commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# default-router 192.168.1.2
```

To remove a router with an IP address 192.168.1.2 to the DHCP pool named P2, use the following commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# no default-router 192.168.1.2
```

To remove all routers from the DHCP pool named P2, use the following commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# no default-router
```

dns-server

This command adds a Domain Name System (DNS) server to the DHCP address pool you are configuring. You can use this command multiple times to create a list of DNS name servers available to the client. This sets the DNS server details using the pre-defined option 6. Note that if you add a user-defined option 6 using the option command on page 86.26, then you will override any settings created with this command.

The no variant of this command removes either the specified DNS server, or all DNS servers from the DHCP pool.

Syntax

```
dns-server <ip-address>
no dns-server [<ip-address>]
```

Parameter	Description
<ip-address>	IPv4 address of the DNS server, in dotted decimal notation.

Mode DHCP Configuration

Examples To add the DNS server with the assigned IP address 192.168.1.1 to the DHCP pool named P1, use the following commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# dns-server 192.168.1.1
```

To remove the DNS server with the assigned IP address 192.168.1.1 from the DHCP pool named P1, use the following commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# no dns-server 192.168.1.1
```

To remove all DNS servers from the DHCP pool named P1, use the following commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# no dns-server
```

Related Commands

default-router
option
service dhcp-server
show ip dhcp pool
subnet-mask

domain-name

This command adds a domain name to the DHCP address pool you are configuring. Use this command to specify the domain name that a client should use when resolving host names using the Domain Name System. This sets the domain name details using the pre-defined option 15. Note that if you add a user-defined option 15 using the option command on page 86.26, then you will override any settings created with this command.

The no variant of this command removes the domain name from the address pool.

Syntax

```
domain-name <domain-name>
no domain-name
```

Parameter	Description
<domain-name>	The domain name you wish to assign the DHCP pool. Valid characters are any printable character. If the name contains spaces then you must enclose it in “quotation marks”.

Mode DHCP Configuration

Examples To add the domain name `Nerv_Office` to DHCP pool `P2`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# domain-name Nerv_Office
```

To remove the domain name `Nerv_Office` from DHCP pool `P2`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# no domain-name Nerv_Office
```

Related Commands

default-router
dns-server
option
service dhcp-server
show ip dhcp pool
subnet-mask

host

This command adds a static host address to the DHCP address pool you are configuring. The client with the matching MAC address is permanently assigned this IP address. No other clients can request it.

The no variant of this command removes the specified host address from the DHCP pool. Use the no host all command to remove all static host addresses from the DHCP pool.

Syntax

```
host <ip-address> <mac-address>
no host <ip-address>
no host all
```

Parameter	Description
<ip-address>	IPv4 address of the DHCP client, in dotted decimal notation in the format A.B.C.D
<mac-address>	MAC address of the DHCP client, in hexadecimal notation in the format HHHH.HHHH.HHHH

Mode DHCP Configuration

Usage Note that a network/mask must be configured using a network command before issuing a host command. Also note that a host address must match a network to add a static host address.

Examples To add the host at `192.168.1.5` with the MAC address `000a.451d.6e34` to DHCP pool `1`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool 1
awplus(dhcp-config)# network 192.168.1.0/24
awplus(dhcp-config)# host 192.168.1.5 000a.451d.6e34
```

To remove the host at `192.168.1.5` with the MAC address `000a.451d.6e34` from DHCP pool `1`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool 1
awplus(dhcp-config)# no host 192.168.1.5 000a.451d.6e34
```

Related Commands
lease
range
show ip dhcp pool

ip address dhcp

This command activates the DHCP client on the interface you are configuring. This allows the interface to use the DHCP client to obtain its IP configuration details from a DHCP server on its connected network.

The client-id and hostname parameters are identifiers that you may want to set in order to interoperate with your existing DHCP infrastructure. If neither option is needed, then the DHCP server uses the MAC address field of the request to identify the host.

The DHCP client supports the following IP configuration options:

- Option 1 - the subnet mask for your device.
- Option 3 - a list of default routers.
- Option 6 - a list of DNS servers. This list appends the DNS servers set on your device with the ip name-server command.
- Option 15 - a domain name used to resolve host names. This option replaces the domain name set with the ip domain-name command. Your device ignores this domain name if it has a domain list set using the ip domain-list command.
- Option 51 - lease expiration time.

The no variant of this command stops the interface from obtaining IP configuration details from a DHCP server.

Syntax

```
ip address dhcp [client-id <interface>] [hostname <hostname>]
no ip address dhcp
```

Parameter	Description
<interface>	The name of the interface you are activating the DHCP client on. If you specify this, then the MAC address associated with the specified interface is sent to the DHCP server in the optional identifier field. Default: no default
<hostname>	The hostname for the DHCP client on this interface. Typically this name is provided by the ISP. Default: no default

Mode Interface Configuration for a VLAN interface.

Examples To set the interface `vlan10` to use DHCP to obtain an IP address, use the command:

```
awplus# configure terminal
awplus(config)# interface vlan10
awplus(config-if)# ip address dhcp
```

To stop the interface `vlan10` from using DHCP to obtain its IP address, use the command:

```
awplus# configure terminal
awplus(config)# interface vlan10
awplus(config-if)# no ip address dhcp
```

Related Commands ip address

Validation Commands show running-config
show running-config access-list

ip dhcp bootp ignore

This command configures the DHCP server to ignore any BOOTP requests it receives. The DHCP server accepts BOOTP requests by default.

The no variant of this command configures the DHCP server to accept BOOTP requests. This is the default setting.

Syntax

```
ip dhcp bootp ignore
no ip dhcp bootp ignore
```

Mode Global Configuration

Examples To configure the DHCP server to ignore BOOTP requests, use the command:

```
awplus# configure terminal
awplus(config)# ip dhcp bootp ignore
```

To configure the DHCP server to respond to BOOTP requests, use the command:

```
awplus# configure terminal
awplus(config)# no ip dhcp bootp ignore
```

Related Commands show ip dhcp server summary

ip dhcp leasequery enable

Use this command to enable the DHCP server to respond to DHCPLEASEQUERY packets. Enabling the DHCP leasequery feature allows a DHCP relay agent to obtain IP address information directly from the DHCP server using DHCPLEASEQUERY messages.

Use the no variant of this command to disable the support of DHCPLEASEQUERY packets.

For more information, see "Enable DHCP Leasequery" on page 85.5.

Syntax

```
ip dhcp leasequery enable
no ip dhcp leasequery enable
```

Default DHCP leasequery support is disabled by default.

Mode Global Configuration

Examples To enable DHCP leasequery support, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp leasequery enable
```

To disable DHCP leasequery support, use the commands:

```
awplus# configure terminal
awplus(config)# no ip dhcp leasequery enable
```

Related Commands

show counter dhcp-server
show ip dhcp server statistics
show ip dhcp server summary

ip dhcp option

This command creates a user-defined DHCP option. You can then use this option when configuring a DHCP pool, by using the option command. Options with the same number as one of the pre-defined options override the standard option definition. The pre-defined options use the option numbers 1, 3, 6, 15, and 51.

The no variant of this command removes either the specified user-defined option, or removes all user-defined options. This also automatically removes the user-defined options from the associated DHCP address pools.

Syntax

```
ip dhcp option <1-254> [name <option-name>] [<option-type>]
no ip dhcp option [<1-254>|<option-name>]
```

Parameter	Description	
<1-254>	The option number of the option. Options with the same number as one of the standard options overrides the standard option definition.	
<option-name>	Option name used to identify the option. You cannot use a number as the option name. Valid characters are any printable character. If the name contains spaces then you must enclose it in “quotation marks”. Default: no default	
<option-type>	The option value. You must specify a value that is appropriate to the option type:	
	`asci`	An ASCII text string
	`hex`	A hexadecimal string. Valid characters are the numbers 0–9 and letters a–f. Embedded spaces are not valid. The string must be an even number of characters, from 2 and 256 characters long.
	`ip`	An IPv4 address or mask that has the dotted decimal A.B.C.D notation. To create a list of IP addresses, you must add each IP address individually by using the option command multiple times.
	`integer`	A number from 0 to 4294967295.
	`flag`	A value that either sets (to 1) or unsets (to 0) a flag: true, on, or enabled will set the flag false, off or disabled will unset the flag.

Mode Global Configuration

Examples To define a user-defined ASCII string option as option 66, without a name, use the command:

```
awplus# configure terminal
awplus(config)# ip dhcp option 66 ascii
```

To define a user-defined hexadecimal string option as option 46, with the name “tcpip-node-type”, use the command:

```
awplus# configure terminal
awplus(config)# ip dhcp option 46 name tcpip-node-type hex
```

To define a user-defined IP address option as option 175, with the name `special-address`, use the command:

```
awplus# configure terminal
awplus(config)# ip dhcp option 175 name special-address ip
```

To remove the specific user-defined option with the option number `12`, use the command:

```
awplus# configure terminal
awplus(config)# no ip dhcp option 12
```

To remove the specific user-defined option with the option name `perform-router-discovery`, use the command:

```
awplus# configure terminal
awplus(config)# no ip dhcp option perform-router-discovery
```

To remove all user-defined option definitions, use the command:

```
awplus# configure terminal
awplus(config)# no ip dhcp option
```

Related Commands

default-router
dns-server
domain-name
option
service dhcp-server
show ip dhcp server summary
subnet-mask

ip dhcp pool

This command will enter the configuration mode for the pool name specified. If the name specified is not associated with an existing pool, the switch will create a new pool with this name, then enter the configuration mode for the new pool.

Once you have entered the DHCP configuration mode, all commands executed before the next exit command will apply to this pool.

You can create multiple DHCP pools on devices with multiple interfaces. This allows the device to act as a DHCP server on multiple interfaces to distribute different information to clients on the different networks.

The no variant of this command deletes the specific DHCP pool.

Syntax

```
ip dhcp pool <pool-name>
no ip dhcp pool <pool-name>
```

Parameter	Description
<pool-name>	Description used to identify this DHCP pool. Valid characters are any printable character. If the name contains spaces then you must enclose it in “quotation marks”.

Mode Global Configuration

Example To create the DHCP pool called `P2`, use the command:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
```

Related Commands service dhcp-server

ip dhcp-relay agent-option

This command enables the DHCP relay agent to insert the relay agent information option (Option 82) into the client-request packets that it relays to its DHCP server. This allows the relay agent to pass on information to the server about the network location of the client device. The relay agent then strips the Option 82 field out of the server's response, so that the client never sees this field.

When the relay agent appends its Option 82 data into the packet, it first overwrites any pad options present; then if necessary, it increases the packet length to accommodate the option-82 data.

The no variant of this command stops the relay agent from appending the Option 82 field onto DHCP requests before forwarding it to the server.

Syntax

```
ip dhcp-relay agent-option

no ip dhcp-relay agent-option
```

Default The DHCP relay agent feature is disabled by default.

Mode Interface Configuration for a VLAN interface.

Usage Use this command to alter the relay agent's Option 82 setting when your device is the first hop for the DHCP client. To limit the maximum length of the packet, use the ip dhcp-relay max-message-length command.

This command cannot be enabled if DHCP snooping is enabled (service dhcp-snooping command on page 78.24), and vice versa.

Examples To make the relay agent listening on `vlan15` append the Option 82 field, use the commands:

```
awplus# configure terminal
awplus(config)# interface vlan15
awplus(config-if)# ip dhcp-relay agent-option
```

To stop the relay agent from appending the Option 82 field on `vlan15`, use the commands:

```
awplus# configure terminal
awplus(config)# interface vlan15
awplus(config-if)# no ip dhcp-relay agent-option
```

Related Commands

ip dhcp-relay agent-option remote-id
ip dhcp-relay information policy
ip dhcp-relay max-message-length
service dhcp-relay

ip dhcp-relay agent-option checking

This command controls the way that the DHCP-relay service deals with packets arriving from the client side that have:

- Option 82 information present in the packet
- a giaddr field (relay agent IP address field) of 0.0.0.0

By default such packets are accepted and passed through. This assumes that the Option 82 field has been inserted into the packet by a trusted device, such as a Layer 2 DHCP-snooping switch.

However, if you do not have such a trusted device between the relay switch and the clients, then packets arriving with no relay address but containing Option 82 information are treated with suspicion and dropped.

The command ip dhcp-relay agent-option checking will cause such packets to be dropped. Packets which contain Option 82 information, but have a non-zero address in the giaddr field will continue to be forwarded.

The no variant of this command returns this feature to the default state, whereby the DHCP-relay service does not check the state of the giaddr field in packets that contain Option 82 information.

Note The DHCP-relay service might also alter the content of the Option 82 field, if the commands ip dhcp-relay agent-option and ip dhcp-relay information policy have also been configured.

Syntax

```
ip dhcp-relay agent-option checking
no ip dhcp-relay agent-option checking
```

Mode Interface Configuration for a VLAN interface.

Examples To make the relay agent listening on `vlan10` check the Agent ID sub-option field, use the commands:

```
awplus# configure terminal
awplus(config)# interface vlan10
awplus(config-if)# ip dhcp-relay agent-option checking
```

To stop the relay agent on `vlan10` from checking the Agent ID sub-option field, use the commands:

```
awplus# configure terminal
awplus(config)# interface vlan10
awplus(config-if)# no ip dhcp-relay agent-option checking
```

Related Commands ip dhcp-relay agent-option remote-id
service dhcp-relay

ip dhcp-relay agent-option remote-id

Use this command to specify the Remote ID sub-option of the Option 82 field the DHCP relay agent inserts into clients' request packets. The Remote ID identifies the device that is inserting the Option 82 information. If a Remote ID is not specified, the Remote ID sub-option is set to the switch's MAC address.

Use the no variant of this command to return the Remote ID for an interface.

Syntax

```
ip dhcp-relay agent-option remote-id <remote-id>
no ip dhcp-relay agent-option remote-id
```

Parameter	Description
<remote-id>	An alphanumeric (ASCII) string, 1 to 63 characters in length. Additional characters allowed are hyphen (-), underscore (_) and hash (#). Spaces are not allowed.

Default The Remote ID is set to the switch's MAC address by default.

Mode Interface Configuration for a VLAN interface.

Usage The Remote ID sub-option is included in the DHCP Option 82 field of relayed client DHCP packets if:

- DHCP Option 82 is enabled (ip dhcp-relay agent-option), and
- DHCP relay agent is enabled on the switch (service dhcp-relay)

Examples To set the Remote ID to `myid` for client DHCP packets received on `vlan1`, use the commands:

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip dhcp-relay agent-option remote-id myid
```

To remove the Remote ID specified for `vlan1`, use the commands:

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# no ip dhcp-relay agent-option remote-id
```

Related Commands
ip dhcp-relay agent-option
ip dhcp-relay agent-option checking
show ip dhcp-relay

ip dhcp-relay information policy

This command sets the policy for how the DHCP relay deals with packets arriving from the client that contain Option 82 information.

If the command ip dhcp-relay agent-option has not been configured, then this command has no effect at all - no alteration is made to Option 82 information in packets arriving from the client side.

However, if the command ip dhcp-relay agent-option has been configured, this command modifies how the DHCP relay service deals with cases where the packet arriving from the client side already contains Option 82 information.

By default, the relay agent replaces any existing Option 82 field with its own relay agent field. This is equivalent to the functionality of the replace parameter.

The no variant of this command removes the policy, and returns it to the default behavior - i.e. replacing the existing Option 82 field.

Syntax

```
ip dhcp-relay information policy [append|drop|keep|replace]
no ip dhcp-relay information policy
```

Parameter	Description
`append`	The relay agent appends the Option 82 field of the packet with its own Option 82 details.
`drop`	The relay agent discards the packet.
`keep`	The relay agent forwards the packet without altering the Option 82 field.
`replace`	The relay agent replaces the existing relay agent details in the Option 82 field with its own details before forwarding the packet.

Mode Interface Configuration for a VLAN interface.

Examples To make the relay agent listening on `vlan15` drop any client requests that already contain Option 82 information, use the command:

```
awplus(config)# interface vlan15
awplus(config-if)# ip dhcp-relay information policy drop
```

To remove the DHCP relay information policy set with the ip dhcp information policy command, use the command:

```
awplus(config)# interface vlan15
awplus(config-if)# no ip dhcp-relay information policy
```

Related Commands ip dhcp-relay agent-option
service dhcp-server

ip dhcp-relay maxhops

This command sets the hop count threshold for discarding BOOTP messages. When the hops field in a BOOTP message exceeds the threshold, the relay agent discards the BOOTP message. The hop count threshold is set to 10 hops by default.

Use the no variant of this command negation command to reset the hop count to the default.

Syntax

```
ip dhcp-relay maxhops <1-255>
no ip dhcp-relay maxhops
```

Parameter	Description
<1-255>	The maximum hop count value.

Default The default hop count threshold is 10 hops.

Mode Interface Configuration for a VLAN interface.

Example To set the maximum number of hops to 5 for packets arriving in interface `vlan15`, use the command:

```
awplus(config)# interface vlan15
awplus(config-if)# ip dhcp-relay maxhops 5
```

Related Commands service dhcp-relay

ip dhcp-relay max-message-length

This command applies when the switch is acting as a DHCP relay and Option 82 insertion is enabled. It sets the maximum DHCP message length (in bytes) for the DHCP packet with its Option 82 data inserted. From this value it calculates the maximum packet size that it will accept at its input. Packets that arrive greater than this value will be dropped.

The no variant of this command sets the maximum message length to its default of 1400 bytes.

Syntax

```
ip dhcp-relay max-message-length <548-1472>
no ip dhcp-relay max-message-length
```

Parameter	Description
<548-1472>	The maximum DHCP message length (this is the message header plus the inserted DHCP option fields).

Default The default is 1400 bytes.

Mode Interface Configuration for a VLAN interface.

Usage Where a DHCP relay (that has Option 82 insertion enabled) receives a *request* packet from a DHCP client, it will append the Option 82 component data, and forward the packet to the DHCP server. The DHCP client will sometimes issue packets containing pad option fields that can be overwritten with Option 82 data. Where there are insufficient pad option fields to contain all the Option 82 data, the DHCP relay will increase the packet size to accommodate the Option 82 data. If the new (increased) packet size exceeds that defined by the maximum-message-length parameter, then the DHCP relay will drop the packet.

Note

Before setting this command, you must first run the ip dhcp-relay agent-option command on page 86.14. This will allow the Option 82 fields to be appended.

Example To set the maximum DHCP message length to 1200 for packets arriving in interface `vlan7`, use the command:

```
awplus# configure terminal
awplus(config)# interface vlan7
awplus(config-if)# ip dhcp-relay max-message-length 1200
```

To reset the maximum DHCP message length to the default of 1400 for packets arriving in interface `vlan7`, use the command:

```
awplus# configure terminal
awplus(config)# interface vlan7
awplus(config-if)# no ip dhcp-relay max-message-length
```

Related Commands service dhcp-relay

ip dhcp-relay server-address

This command adds a DHCP server for the DHCP relay agent to forward client DHCP packets to on a particular interface. You can add up to five DHCP servers on each device interface that the DHCP relay agent is listening on.

The no variant of this command deletes the specified DHCP server from the list of servers available to the DHCP relay agent.

For introduction and configuration information about DHCP relay agent see "DHCP Relay Agent Introduction" on page 85.8 and "Configuring the DHCP Relay Agent" on page 85.8.

Syntax

```
ip dhcp-relay server-address {<ipv4-address>|
    <ipv6-address> <server-interface>}

no ip dhcp-relay server-address {<ip-address>|
    <ipv6-address> <server-interface>}
```

Parameter	Description
<ipv4-address>	Specify the IPv4 address of the DHCP server for DHCP relay agent to forward client DHCP packets to, in dotted decimal notation. The IPv4 address uses the format A.B.C.D.
<ipv6-address>	Specify the IPv6 address of the DHCP server for DHCP relay agent to forward client DHCP packets to, in hexadecimal notation.
<server-interface>	Specify the interface name of the DHCP server itself, not the interface of the device as specified in Interface Configuration. The interface name of the DHCP server is only required for a DHCP server with an IPv6 address not with an IPv4 address.

Mode Interface Configuration for a VLAN interface.

Usage For a DHCP server with an IPv6 address you must specify the interface for the DHCP server. See examples below for configuration differences between IPv4 and IPv6 DHCP relay servers.

See also the service dhcp-relay command to enable the DHCP relay agent on your device. The ip dhcp-relay server-address command defines a relay destination on an interface on the device, needed before the DHCP relay agent relays DHCP client packets from a DHCP server.

Examples To enable the DHCP relay agent to relay DHCP packets on interface `vlan2` to the DHCP server with the IPv4 address `192.0.2.200`, use the following command sequence:

```
awplus# configure terminal
awplus(config)# service dhcp-relay
awplus(config)# interface vlan2
awplus(config-if)# ip dhcp-relay server-address 192.0.2.200
```

To remove the DHCP server with the IPv4 address `192.0.2.200` from the list of servers available to the DHCP relay agent on interface `vlan2`, use the following command sequence:

```
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip dhcp-relay server-address 192.0.2.200
```

To enable the DHCP relay agent on your device to relay DHCP packets on interface `vlan10` to the DHCP server with the IPv6 address `2001:0db8:010d::1` on interface `vlan20`, use the following command sequence:

```
awplus# configure terminal
awplus(config)# service dhcp-relay
awplus(config)# interface vlan10
awplus(config-if)# ip dhcp-relay server-address
2001:0db8:010d::1 vlan20
```

To remove the DHCP server with the IPv6 address `2001:0db8:010d::1` on interface `vlan20` from the list of servers available to the DHCP relay agent on interface `vlan10`, use the following command sequence:

```
awplus# configure terminal
awplus(config)# interface vlan10
awplus(config-if)# no ip dhcp-relay server-address
2001:0db8:010d::1 vlan20
```

Related Commands service dhcp-relay

lease

This command sets the expiration time for a leased address for the DHCP address pool you are configuring. The time set by the days, hours, minutes and seconds is cumulative. The minimum total lease time that can be configured is 20 seconds. The maximum total lease time that can be configured is 120 days.

Note that if you add a user-defined option 51 using the option command, then you will override any settings created with this command. Option 51 specifies a lease time of 1 day.

Use the infinite parameter to set the lease expiry time to infinite (leases never expire).

Use the no variant of this command to return the lease expiration time back to the default of one day.

Syntax

```
lease <days> <hours> <minutes> [<seconds>]
lease infinite
no lease
```

Parameter	Description
<days>	The number of days, from 0 to 120, that the lease expiry time is configured for. Default: 1
<hours>	The number of hours, from 0 to 24, that the lease expiry time is configured for. Default: 0
<minutes>	The number of minutes, from 0 to 60, the lease expiry time is configured for. Default: 0
<seconds>	The number of seconds, from 0 to 60, the lease expiry time is configured for.
`infinite`	The lease never expires.

Default The default lease time is 1 day.

Mode DHCP Configuration

Examples To set the lease expiration time for address pool `P2` to 35 minutes, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# lease 0 0 35
```

To set the lease expiration time for the address pool `Nerv_Office` to 1 day, 5 hours, and 30 minutes, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool Nerv_Office
awplus(dhcp-config)# lease 1 5 30
```

To set the lease expiration time for the address pool `P3` to 20 seconds, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P3
awplus(dhcp-config)# lease 0 0 0 20
```

To set the lease expiration time for the pool to never expire, use the command:

```
awplus(dhcp-config)# lease infinite
```

To return the lease expiration time to the default of one day, use the command:

```
awplus(dhcp-config)# no lease
```

Related Commands

option
service dhcp-server

network (DHCP)

This command sets the network (subnet) that the DHCP address pool applies to.

The no variant of this command removes the network (subnet) from the DHCP address pool.

Syntax

```
network {<ip-subnet-address/prefix-length>|<ip-subnet-address/mask>}
no network
```

Parameter	Description
<ip-subnet-address/prefix-length>	The IPv4 subnet address in dotted decimal notation followed by the prefix length in slash notation.
<ip-subnet-address/mask>	The IPv4 subnet address in dotted decimal notation followed by the subnet mask in dotted decimal notation.

Mode DHCP Configuration

Usage This command will fail if it would make existing ranges invalid. For example, if they do not lie within the new network you are configuring.

The no variant of this command will fail if ranges still exist in the pool. You must remove all ranges in the pool before issuing a no network command to remove a network from the pool.

Examples To configure a network for the address pool `P2`, where the subnet is `192.0.2.5` and the mask is `255.255.255.0`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# network 192.0.2.5/24
```

or you can use dotted decimal notation instead of slash notation for the subnet-mask:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# network 192.0.2.5 255.255.255.0
```

Related Commands service dhcp-server
subnet-mask

next-server

This command sets the next server address for a DHCP server pool. It is the address of the next server that the client should use in its bootstrap process.

The no variant of this command removes the next server address from the DHCP address pool.

Syntax

```
next-server <ip-address>
no next-server
```

Parameter	Description
<ip-address>	The server IP address, entered in dotted decimal notation.

Mode DHCP Configuration

Example To set the next-server address for the address pool `P2`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# next-server 192.0.2.2
```

option

This command adds a user-defined option to the DHCP address pool you are configuring. For the hex, integer, and flag option types, if the option already exists, the new option overwrites the existing option's value. Options with an ip type can hold a list of IP addresses or masks (i.e. entries that have the A.B.C.D address format), so if the option already exists in the pool, then the new IP address is added to the list of existing IP addresses.

Options with the same number as one of the pre-defined options override the standard option definition. The pre-defined options use the option numbers 1, 3, 6, 15, and 51.

The no variant of this command removes the specified user-defined option from the DHCP pool, or all user-defined options from the DHCP pool.

Syntax

```
option [<1-254>|<option-name>] <option-value>
no option [<1-254>|<option-value>]
```

Parameter	Description	
<1-254>	The option number of the option. Options with the same number as one of the standard options overrides the standard option definition.	
<option-name>	Option name associated with the option.	
<option-value>	The option value. You must specify a value that is appropriate to the option type:	
	`hex`	A hexadecimal string. Valid characters are the numbers 0–9 and letters a–f. Embedded spaces are not valid. The string must be an even number of characters, from 2 and 256 characters long.
	`ip`	An IPv4 address or mask that has the dotted decimal A.B.C.D notation. To create a list of IP addresses, you must add each IP address individually using the option command multiple times.
	`integer`	A number from 0 to 4294967295.
	`flag`	A value of either true, on, or enabled to set the flag, or false, off or disabled to unset the flag.

Mode DHCP Configuration

Examples To add the ASCII-type option named `tftp-server-name` to the pool `P2` and give the option the value `server1`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# option tftp-server-name server1
```

To add the hex-type option named `tcpip-node-type` to the pool `P2` and give the option the value `08af`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# option tcpip-node-type 08af
```

To add multiple IP addresses for the ip-type option `175`, use the command:

```
awplus(dhcp-config)# option 175 192.0.2.6
awplus(dhcp-config)# option 175 192.0.2.12
awplus(dhcp-config)# option 175 192.0.2.33
```

To add the option `179` to a pool, and give the option the value `123456`, use the command:

```
awplus(dhcp-config)# option 179 123456
```

To add a user-defined flag option with the name `perform-router-discovery`, use the command:

```
awplus(dhcp-config)# option perform-router-discovery yes
```

To clear all user-defined options from a DHCP address pool, use the command:

```
awplus(dhcp-config)# no option
```

To clear a user-defined option, named `tftp-server-name`, use the command:

```
awplus(dhcp-config)# no option tftp-server-name
```

Related Commands

ip dhcp option
lease
service dhcp-server
show ip dhcp pool

probe enable

Use this command to enable lease probing for a DHCP pool. Probing is used by the DHCP server to check if an IP address it wants to lease to a client is already being used by another host.

The no variant of this command disables probing for a DHCP pool.

Syntax

```
probe enable
no probe enable
```

Default Probing is enabled by default.

Mode DHCP Pool Configuration

Examples To enable probing for pool `P2`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(config-if)# probe enable
```

To disable probing for pool `P2`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# no probe enable
```

Related Commands

ip dhcp pool
probe packets
probe timeout
probe type
show ip dhcp pool

probe packets

Use this command to specify the number of packets sent for each lease probe. Lease probing is configured on a per-DHCP pool basis. When set to 0 probing is effectively disabled.

The no variant of this command sets the number of probe packets sent to the default of 5.

Syntax

```
probe packets <0-10>
no probe packets
```

Parameter	Description
<0-10>	The number of probe packets sent.

Default The default is 5.

Mode DHCP Pool Configuration

Examples To set the number of probe packets to 2 for pool `P2`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# probe packets 2
```

To set the number of probe packets to the default 5 for pool `P2`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# no probe packets
```

Related Commands

probe enable
probe timeout
probe type
show ip dhcp pool

probe timeout

Use this command to set the timeout value in milliseconds that the server waits for a response after each probe packet is sent. Lease probing is configured on a per-DHCP pool basis.

The no variant of this command sets the probe timeout value to the default setting, 200 milliseconds.

Syntax

```
probe timeout <50-5000>
no probe timeout
```

Parameter	Description
<50-5000>	Timeout interval in milliseconds.

Default The default timeout interval is 200 milliseconds.

Mode DHCP Pool Configuration

Examples To set the probe timeout value to 500 milliseconds for pool `P2`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# probe timeout 500
```

To set the probe timeout value for pool `P2` to the default, 200 milliseconds, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# no probe timeout
```

Related Commands

probe enable
probe packets
probe type
show ip dhcp pool

probe type

Use this command to set the probe type for a DHCP pool. The probe type specifies how the DHCP server checks whether an IP address is being used by other hosts, referred to as lease probing. If arp is specified, the server sends an ARP request to determine if an address is in use. If ping is specified, the server will send an ICMP Echo Request (ping).

The no variant of this command sets the probe type to the default setting, ping.

Syntax

```
probe type {arp|ping}
no probe type
```

Parameter	Description
arp	Probe using ARP.
ping	Probe using ping.

Default The default probe type is ping.

Mode DHCP Pool Configuration

Examples To set the probe type to `arp` for the pool `P2`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# probe type arp
```

To set the probe type for the pool `P2` to the default, `ping`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# no probe type
```

Related Commands

ip dhcp pooll
probe enable
probe packets
probe timeout
show ip dhcp pool

range

This command adds an address range to the DHCP address pool you are configuring. The DHCP server responds to client requests received from the pool's network. It assigns an IP addresses within the specified range. The IP address range must lie within the network. You can add multiple address ranges and individual IP addresses for a DHCP pool by using this command multiple times.

The no variant of this command removes an address range from the DHCP pool. Use the no range all command to remove all address ranges from the DHCP pool.

Syntax

```
range <ip-address> [<ip-address>]
no range <ip-address> [<ip-address>]
no range all
```

Parameter	Description
<ip-address>	IPv4 address range for DHCP clients, in dotted decimal notation. The first IP address is the low end of the range, the second IP address is the high end. Specify only one IP address to add an individual IP address to the address pool.

Mode DHCP Configuration

Examples To add an address range of `192.0.2.5` to `192.0.2.16` to the pool `Nerv_Office`, use the command:

```
awplus# configure terminal
awplus(config)# ip dhcp pool Nerv_Office
awplus(dhcp-config)# range 192.0.2.5 192.0.2.16
```

To add the individual IP address `192.0.2.2` to a pool, use the command:

```
awplus(dhcp-config)# range 192.0.2.2
```

To remove all address ranges from a pool, use the command:

```
awplus(dhcp-config)# no range all
```

Related Commands
ip dhcp pool
service dhcp-server
show ip dhcp pool

service dhcp-relay

This command enables the DHCP relay agent on the device. However, on a given IP interface, no DHCP forwarding takes place until at least one DHCP server is specified to forward/relay all clients' DHCP packets to.

The no variant of this command disables the DHCP relay agent on the device for all interfaces.

Syntax

```
service dhcp-relay
no service dhcp-relay
```

Mode Global Configuration

Usage A maximum number of 400 DHCP relay agents (one per interface) can be configured on the device. Once this limit has been reached, any further attempts to configure DHCP relay agents will not be successful.

Default The DHCP-relay service is enabled by default.

Examples To enable the DHCP relay global function, use the command:

```
awplus# configure terminal
awplus(config)# service dhcp-relay
```

To disable the DHCP relay global function, use the command:

```
awplus# configure terminal
awplus(config)# no service dhcp-relay
```

Related Commands

ip dhcp-relay agent-option
ip dhcp-relay agent-option checking
ip dhcp-relay information policy
ip dhcp-relay maxhops
ip dhcp-relay server-address

service dhcp-server

This command enables the DHCP server on your device. The server then listens for DHCP requests on all IP interfaces. It will not run if there are no IP interfaces configured.

The no variant of this command disables the DHCP server.

Syntax

```
service dhcp-server
no service dhcp-server
```

Mode Global Configuration

Example To enable the DHCP server, use the command:

```
awplus# configure terminal
awplus(config)# service dhcp-server
```

Related Commands

ip dhcp pool
show ip dhcp server summary
subnet-mask

show counter dhcp-client

This command shows counters for the DHCP client on your device.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show counter dhcp-client`

Mode User Exec and Privileged Exec

Example To display the message counters for the DHCP client on your device, use the command:

```
awplus# show counter dhcp-client
```

Output Figure 86-1: Example output from the **show counter dhcp-client** command

```
show counter dhcp-client

DHCPDISCOVER out      ......... 10
DHCPREQUEST out       ......... 34
DHCPDECLINE out       ......... 4
DHCPRELEASE out       ......... 0
DHCPOFFER in          ......... 22
DHCPACK in            ......... 18
DHCPNAK in            ......... 0
```

Table 86-1: Parameters in the output of the **show counter dhcp-client** command

Parameter	Description
`DHCPDISCOVER out`	The number of DHCP Discover messages sent by the client.
`DHCPREQUEST out`	The number of DHCP Request messages sent by the client.
`DHCPDECLINE out`	The number of DHCP Decline messages sent by the client.
`DHCPRELEASE out`	The number of DHCP Release messages sent by the client.
`DHCPOFFER in`	The number of DHCP Offer messages received by the client.
`DHCPACK in`	The number of DHCP Acknowledgement messages received by the client.
`DHCPNAK in`	The number of DHCP Negative Acknowledgement messages received by the client.

Related Commands ip address dhcp

show counter dhcp-relay

This command shows counters for the DHCP relay agent on your device.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show counter dhcp-relay`

Mode User Exec and Privileged Exec

Example To display counters for the DHCP relay agent on your device, use the command:

```
awplus# show counter dhcp-relay
```

Output Figure 86-2: Example output from the **show counter dhcp-relay** command

```
show counter dhcp-relay

Requests In            ......... 4
Replies In             ......... 4
Relayed To Server      ......... 4
Relayed To Client      ......... 4
Out To Server Failed   ......... 0
Out To Client Failed   ......... 0
Invalid hlen           ......... 0
Bogus giaddr           ......... 0
Corrupt Agent Option   ......... 0
Missing Agent Option   ......... 0
Bad Circuit ID         ......... 0
Missing Circuit ID     ......... 0
Option Insert Failed   ......... 0
```

Table 86-2: Parameters in the output of the **show counter dhcp-relay** command

Parameter	Description
`Requests In`	The number of DHCP Request messages received from clients.
`Replies In`	The number of DHCP Reply messages received from servers.
`Relayed To Server`	The number of DHCP Request messages relayed to servers.
`Relayed To Client`	The number of DHCP Reply messages relayed to clients.
`Out To Server Failed`	The number of failures when attempting to send request messages to servers. This is an internal debugging counter.
`Out To Client Failed`	The number of failures when attempting to send reply messages to clients. This is an internal debugging counter.
`Invalid hlen`	The number of incoming messages dropped due to an invalid hlen field.
`Bogus giaddr`	The number of incoming DHCP Reply messages dropped due to bogus giaddr field.
`Corrupt Agent Option`	The number of incoming DHCP Reply messages dropped due to corrupt agent option.
`Missing Agent Option`	The number of incoming DHCP Reply messages dropped due to missing agent option.

Table 86-2: Parameters in the output of the **show counter dhcp-relay** command(cont.)

Parameter	Description
`Bad Circuit ID`	The number of incoming DHCP Reply messages dropped due to bad circuit ID.
`Missing Circuit ID`	The number of incoming DHCP Reply messages dropped due to missing circuit ID.
`Option Insert Failed`	The number of incoming DHCP Request messages dropped due to an error adding the relay agent information (option-82). This counter increments when: the relay agent is set to drop packets with the Option 82 field already filled by another relay agent. This policy is set with the ip dhcp-relay information policy command. there is a packet error that stops the relay agent from being able to append the packet with its relay agent option information.

Related Commands

service dhcp-relay
show ip dhcp-relay

show counter dhcp-server

This command shows counters for the DHCP server on your device.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show counter dhcp-server`

Mode User Exec and Privileged Exec

Example To display counters for the DHCP server on your device, use the command:

```
awplus# show counter dhcp-server
```

Output Figure 86-3: Example output from the **show counter dhcp-server** command

```
DHCP server counters
DHCPDISCOVER in       ......... 20
DHCPREQUEST in        ......... 12
DHCPDECLINE in        ......... 1
DHCPRELEASE in        ......... 0
DHCPINFORM in         ......... 0
DHCPOFFER out         ......... 8
DHCPACK out           ......... 4
DHCPNAK out           ......... 0
BOOTREQUEST in        ......... 0
BOOTREPLY out         ......... 0
DHCPLEASEQUERY in       ....... 0
DHCPLEASEUNKNOWN out    ....... 0
DHCPLEASEACTIVE out     ....... 0
DHCPLEASEUNASSIGNED out ....... 0
```

Table 86-3: Parameters in the output of the **show counter dhcp-server** command

Parameter	Description
DHCPDISCOVER in	The number of Discover messages received by the DHCP server.
DHCPREQUEST in	The number of Request messages received by the DHCP server.
DHCPDECLINE in	The number of Decline messages received by the DHCP server.
DHCPRELEASE in	The number of Release messages received by the DHCP server.
DHCPINFORM in	The number of Inform messages received by the DHCP server.
DHCPOFFER out	The number of Offer messages sent by the DHCP server.
DHCPACK out	The number of Acknowledgement messages sent by the DHCP server.
DHCPNAK out	The number of Negative Acknowledgement messages sent by the DHCP server. The server sends these after receiving a request that it cannot fulfil because either there are no available IP addresses in the related address pool, or the request has come from a client that doesn't fit the network setting for an address pool.

Table 86-3: Parameters in the output of the **show counter dhcp-server** command(cont.)

Parameter	Description
BOOTREQUEST in	The number of bootp messages received by the DHCP server from bootp clients.
BOOTREPLY out	The number of bootp messages sent by the DHCP server to bootp clients.
DHCPLEASEQUERY in	The number of Lease Query messages received by the DHCP server from DHCP relay agents.
DHCPLEASEUNKNOWN out	The number of Lease Unknown messages sent by the DHCP server to DHCP relay agents.
DHCPLEASEACTIVE out	The number of Lease Active messages sent by the DHCP server to DHCP relay agents.
DHCPLEASEUNASSIGNED out	The number of Lease Unassigned messages sent by the DHCP server to DHCP relay agents.

Related Commands

service dhcp-server
show ip dhcp binding
show ip dhcp server statistics
show ip dhcp pool

show dhcp lease

This command shows details about the leases that the DHCP client has acquired from a DHCP server for interfaces on the device.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show dhcp lease [<interface>]`

Parameter	Description
<interface>	Interface name to display DHCP lease details for.

Mode User Exec and Privileged Exec

Example To show the current lease expiry times for all interfaces, use the command:

```
awplus# show dhcp lease
```

To show the current lease for vlan1, use the command:

```
awplus# show dhcp lease vlan1
```

Output Figure 86-4: Example output from the **show dhcp lease** command

```
Interface vlan1
-----------------------------------------------------------------
IP Address:                     192.168.22.4
Expires:                        13 Mar 2007 20:10:19
Renew:                          13 Mar 2007 18:37:06
Rebind:                         13 Mar 2007 19:49:29
Server:
Options:
  subnet-mask                   255.255.255.0
  routers                       19.18.2.100,12.16.2.17
  dhcp-lease-time               3600
  dhcp-message-type             5
  domain-name-servers           192.168.100.50,19.88.200.33
  dhcp-server-identifier        192.168.22.1
  domain-name                   alliedtelesis.com

Interface vlan2
-----------------------------------------------------------------
IP Address:                     100.8.16.4
Expires:                        13 Mar 2007 20:15:39
Renew:                          13 Mar 2007 18:42:25
Rebind:                         13 Mar 2007 19:54:46
Server:
Options:
  subnet-mask                   255.255.0.0
  routers                       10.58.1.51
  dhcp-lease-time               1000
  dhcp-message-type             5
  dhcp-server-identifier        100.8.16.1
```

Related Commands ip address dhcp

show ip dhcp binding

This command shows the lease bindings that the DHCP server has allocated clients.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax

```
show ip dhcp binding [<ip-address>|<address-pool>]
```

Parameter	Description
<ip-address>	IPv4 address of a leased IP address, in dotted decimal notation. This displays the lease information for the specified IP address.
<address-pool>	Name of an address pool. This displays the lease information for all clients within the address pool.

Mode User Exec and Privileged Exec

Examples To display all leases for every client in all address pools, use the command:

```
awplus# show ip dhcp binding
```

To display the details for the leased IP address `172.16.2.16`, use the command:

```
awplus# show ip dhcp binding 172.16.2.16
```

To display the leases from the address pool `MyPool`, use the command:

```
awplus# show ip dhcp binding MyPool
```

Output Figure 86-5: Example output from the **show ip dhcp binding** command

```
Pool 30_2_network Network 172.16.2.0/24
DHCP Client Entries
IP Address      ClientId                    Type           Expiry
-------------------------------------------------------------------------------
172.16.2.100    0050.fc82.9ede              Dynamic        21 Sep 2007 19:02:58
172.16.2.101    000e.a6ae.7c14              Static         Infinite
172.16.2.102    000e.a6ae.7c4c              Static         Infinite
172.16.2.103    000e.a69a.ac91              Static         Infinite
172.16.2.104    00e0.189d.5e41              Static         Infinite
172.16.2.150    00e0.2b04.5800              Static         Infinite
172.16.2.167    4444.4400.35c3              Dynamic        21 Sep 2007 14:58:41
```

Related Commands

clear ip dhcp binding
ip dhcp pool
lease
range
service dhcp-server
show ip dhcp pool

show ip dhcp pool

This command displays the configuration details and system usage of the DHCP address pools configured on the device.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip dhcp pool [<address-pool>]`

Parameter	Description
<address-pool>	Name of a specific address pool. This displays the configuration of the specified address pool only.

Mode User Exec and Privileged Exec

Example

```
awplus# show ip dhcp pool
```

Output Figure 86-6: Example output from the **show ip dhcp pool** command

```
Pool p1 :
  network: 192.168.1.0/24
  address ranges:
    addr: 192.168.1.10 to 192.168.1.18
  static host addresses:
    addr: 192.168.1.12     MAC addr: 1111.2222.3333
  lease <days:hours:minutes:seconds> <1:0:0:0>
  subnet mask: 255.255.255.0 (pool's network mask)
  Probe:                          Default Values
    Status:       Enabled         [Enabled]
    Type:         ARP             [Ping]
    Packets:      2               [5]
    Timeout:      200 msecs       [200]
  Dynamic addresses:
    Total:        8
    Leased:       2
    Utilization:  25.0 %
  Static host addresses:
    Total:        1
    Leased:       1
```

Output Figure 86-7: Example output from the **show ip dhcp pool** command with IP address 192.168.1.12 assigned to a VLAN interface on the device:

```
Pool p1 :
  network: 192.168.1.0/24
  address ranges:
    addr: 192.168.1.10 to 192.168.1.18
             (interface addr 192.168.1.12 excluded)
             (static host addr 192.168.1.12 excluded)
  static host addresses:
    addr: 192.168.1.12     MAC addr: 1111.2222.3333
             (= interface addr, so excluded)
  lease <days:hours:minutes:seconds> <1:0:0:0>
  subnet mask: 255.255.255.0 (pool's network mask)
  Probe:                        Default Values
    Status:       Enabled       [Enabled]
    Type:         ARP           [Ping]
    Packets:      2             [5]
    Timeout:      200 msecs     [200]
  Dynamic addresses:
    Total:        8
    Leased:       2
    Utilization:  25.0 %
  Static host addresses:
    Total:        1
    Leased:       1
```

Table 86-4: Parameters in the output of the **show ip dhcp pool** command

Parameter	Description
`Pool`	Name of the pool.
`network`	Subnet and mask length of the pool.
`address ranges`	Individual IP addresses and address ranges configured for the pool. The DHCP server can offer clients an IP address from within the specified ranges only. Any of these addresses that match an interface address on the device, or a static host address configured in the pool, will be automatically excluded from the range, and a message to this effect will appear beneath the range entry.
`static host addresses`	The static host addresses configured on the pool. Each IP address is permanently assigned to the client with the matching MAC address. Any of these addresses that match an interface address on the device will be automatically excluded, and a message to this effect will appear beneath the static host entry.
`lease <days:hours:minutes>`	The lease duration for address allocated by this pool.
`domain`	The domain name sent by the pool to clients. This is the domain name that the client should use when resolving host names using DNS.
`subnet mask`	The subnet mask sent by the pool to clients.
`Probe - Status`	Whether lease probing is enabled or disabled.
`Probe - Type`	The lease probe type configured. Either ping or ARP.

Table 86-4: Parameters in the output of the **show ip dhcp pool** command(cont.)

Parameter	Description
`Probe - Packets`	The number of packets sent for each lease probe in the range 0 to 10.
`Probe - Timeout`	The timeout value in milliseconds to wait for a response after each probe packet is sent. In the range 50 to 5000.
`dns servers`	The DNS server addresses sent to by the pool to clients.
`default-router(s)`	The default router addresses sent by the pool to clients.
`user-defined options`	The list of user-defined options sent by the pool to clients.
`Dynamic addresses - Total`	The total number of IP addresses that have been configured in the pool for dynamic allocation to DHCP clients.
`Dynamic addresses - Leased`	The number of IP addresses in the pool that have been dynamically allocated (leased) to DHCP clients.
`Dynamic addresses - Utilization`	The percentage of IP addresses in the pool that are currently dynamically allocated to clients.
`Static host addresses - Total`	The number of static IP addresses configured in the pool for specific DHCP client hosts.
`Static host addresses - Leased`	The number of static IP addresses assigned to specific DHCP client hosts.

Related Commands

ip dhcp pool
probe enable
probe packets
probe timeout
probe type
range
service dhcp-server
subnet-mask

show ip dhcp-relay

This command shows the configuration of the DHCP relay agent on each interface.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip dhcp-relay [interface <interface-name>]`

Parameter	Description
<interface-name>	Name of a specific interface. This displays the DHCP configuration for the specified interface only.

Mode User Exec and Privileged Exec

Example To display the DHCP relay agent's configuration on the interface `vlan100`, use the command:

```
awplus# show ip dhcp-relay interface vlan100
```

Output Figure 86-8: Example output from the **show ip dhcp-relay** command

```
DHCP Relay Service is enabled

vlan100 is up, line protocol is up
Maximum hop count is 10
Insertion of Relay Agent Option is disabled
Checking of Relay Agent Option is disabled
The Remote Id string for Relay Agent Option is 0000.cd28.074c
Relay information policy is to append new relay agent
information
List of servers :   192.168.1.200
```

Related Commands
ip dhcp-relay agent-option
ip dhcp-relay agent-option checking
ip dhcp-relay information policy
ip dhcp-relay maxhops
ip dhcp-relay server-address

show ip dhcp server statistics

This command shows statistics related to the DHCP server.

You can display the server counters using the show counter dhcp-server command as well as with this command.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip dhcp server statistics`

Mode User Exec and Privileged Exec

Example To display the server statistics, use the command:

```
awplus# show ip dhcp server statistics
```

Output Figure 86-9: Example output from the **show counter dhcp server statistics** command

```
DHCP server counters
DHCPDISCOVER in       ......... 20
DHCPREQUEST in        ......... 12
DHCPDECLINE in        ......... 1
DHCPRELEASE in        ......... 0
DHCPINFORM in         ......... 0
DHCPOFFER out         ......... 8
DHCPACK out           ......... 4
DHCPNAK out           ......... 0
BOOTREQUEST in        ......... 0
BOOTREPLY out         ......... 0
DHCPLEASEQUERY in       ....... 0
DHCPLEASEUNKNOWN out    ....... 0
DHCPLEASEACTIVE out     ....... 0
DHCPLEASEUNASSIGNED out ....... 0
```

Figure 86-10: Parameters in the output of the **show counter dhcp server statistics** command

Parameter	Description
DHCPDISCOVER in	The number of Discover messages received by the DHCP server.
DHCPREQUEST in	The number of Request messages received by the DHCP server.
DHCPDECLINE in	The number of Decline messages received by the DHCP server.
DHCPRELEASE in	The number of Release messages received by the DHCP server.
DHCPINFORM in	The number of Inform messages received by the DHCP server.
DHCPOFFER out	The number of Offer messages sent by the DHCP server.
DHCPACK out	The number of Acknowledgement messages sent by the DHCP server.

Figure 86-10: Parameters in the output of the **show counter dhcp server statistics** command(cont.)

`DHCPNAK out`	The number of Negative Acknowledgement messages sent by the DHCP server. The server sends these after receiving a request that it cannot fulfil because either there are no available IP addresses in the related address pool, or the request has come from a client that doesn't fit the network setting for an address pool.
`BOOTREQUEST in`	The number of bootp messages received by the DHCP server from bootp clients.
`BOOTREPLY out`	The number of bootp messages sent by the DHCP server to bootp clients.
`DHCPLEASEQUERY in`	The number of Lease Query messages received by the DHCP server from DHCP relay agents.
`DHCPLEASEUNKNOWN out`	The number of Lease Unknown messages sent by the DHCP server to DHCP relay agents.
`DHCPLEASEACTIVE out`	The number of Lease Active messages sent by the DHCP server to DHCP relay agents.
`DHCPLEASEUNASSIGNED out`	The number of Lease Unassigned messages sent by the DHCP server to DHCP relay agents.

Related Commands

show counter dhcp-server
service dhcp-server
show ip dhcp binding
show ip dhcp pool

show ip dhcp server summary

This command shows the current configuration of the DHCP server. This includes:

- whether the DHCP server is enabled
- whether the DHCP server is configured to ignore BOOTP requests
- whether the DHCP server is configured to support DHCP lease queries
- the details of any user-defined options
- a list of the names of all DHCP address pools currently configured

This show command does not include any configuration details of the address pools. You can display these using the show ip dhcp pool command.

For information on output options, see "Controlling "show" Command Output" on page 1.41.

Syntax `show ip dhcp server summary`

Mode User Exec and Privileged Exec

Example To display the current configuration of the DHCP server, use the command:

```
awplus# show ip dhcp server summary
```

Output Figure 86-11: Example output from the **show ip dhcp server summary** command

```
DHCP Server service is disabled
BOOTP ignore is disabled
DHCP leasequery support is disabled
Pool list: p2
```

Related Commands
ip dhcp leasequery enable
ip dhcp pool
service dhcp-server

subnet-mask

This command sets the subnet mask option for a DHCP address pool you are configuring. Use this command to specify the client's subnet mask as defined in RFC 950. This sets the subnet details using the pre-defined option 1. Note that if you create a user-defined option 1 using the option command, then you will override any settings created with this command. If you do not specify a subnet mask using this command, then the pool's network mask (specified using the next-server command) is applied.

The no variant of this command removes a subnet mask option from a DHCP pool. The pool reverts to using the pool's network mask.

Syntax

```
subnet-mask <mask>
no subnet-mask
```

Parameter	Description
<mask>	Valid IPv4 subnet mask, in dotted decimal notation.

Mode DHCP Configuration

Examples To set the subnet mask option to `255.255.255.0` for DHCP pool `P2`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# subnet-mask 255.255.255.0
```

To remove the subnet mask option from DHCP pool `P2`, use the commands:

```
awplus# configure terminal
awplus(config)# ip dhcp pool P2
awplus(dhcp-config)# no subnet-mask
```

Related Commands

default-router
dns-server
domain-name
next-server
option
service dhcp-server
show ip dhcp pool

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Introduction

The Simple Network Management Protocol (SNMP) is the network management protocol of choice for the Internet and IP-based internetworks.

This chapter describes the main features of SNMP Version 1 (SNMPv1), SNMP Version 2c (SNMPv2c) and Version 3 (SNMPv3). It also describes support for SNMP on the switch, and how to configure the switch's SNMP agent.

Unless a particular version of SNMP is named, "SNMP" in this chapter refers to versions SNMPv1, SNMPv2c and SNMPv3.

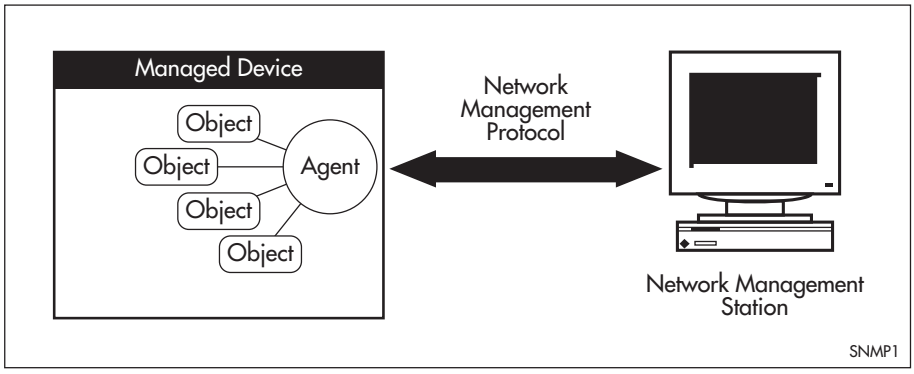
See also Chapter 88, SNMP Commands and Chapter 89, SNMP MIBs.

Network Management Framework

A network management system has the following components:

- One or more managed devices, each containing an agent that provides the management functions. A managed device may be any computing device with a network capability, for example, a host system, workstation, terminal server, printer, router, switch, bridge, hub or repeater.
- One or more Network Management Stations (NMS). An NMS is a host system running a network management protocol and network management applications, enabling the user to manage the network.
- A network management protocol used by the NMS and agents to exchange information.

Figure 87-1: Components of a network management system



The Internet-standard Network Management Framework is the framework used for network management in the Internet. The framework was originally defined by the following documents:

- RFC 1155, *Structure and identification of management information for TCP/IP based internets* (referred to as the SMI), details the mechanisms used to describe and name the objects to be managed.
- RFC 1213, *Management Information Base for network management of TCP/ IP-based internets: MIB-II* (referred to as MIB-II), defines the core set of managed objects for the Internet suite of protocols. The set of managed objects can be extended by adding other MIBs specific to particular protocols, interfaces or network devices.
- RFC 1157, *A Simple Network Management Protocol (SNMP)*, is the protocol used for communication between management stations and managed devices.

Subsequent documents that have defined SNMPv2c are:

- RFC 1901, *Introduction to Community-based SNMPv2*
- RFC 1902, *Structure of Management Information for Version 2 of the Simple Network Management Protocol (SNMPv2)*
- RFC 1903, *Textual Conventions for Version 2 of the Simple Network Management Protocol (SNMPv2)*
- RFC 1904, *Conformance Statements for Version 2 of the Simple Network Management Protocol*
- RFC 1905, *Protocol Operations for Version 2 of the Simple Network Management Protocol (SNMPv2)*
- RFC 1906, *Transport Mappings for Version 2 of the Simple Network Management Protocol (SNMPv2)*
- RFC 1907, *Management Information Base for Version 2 of the Simple Network Management Protocol (SNMPv2)*
- RFC 2576, *Coexistence between Version 1, Version 2, and Version 3 of the Internet-standard Network Management Framework*
- RFC 2578, *Structure of Management Information Version 2 (SMIv2)*
- RFC 2579, *Textual Conventions for SMIv2*
- RFC 2580, *Conformance Statements for SMIv2*

Subsequent documents that have defined SNMPv3 are:

- RFC 3410, *Introduction and Applicability Statements for Internet Standard Management Framework*
- RFC 3411, *An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks*
- RFC 3412, *Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)*
- RFC 3413, *Simple Network Management Protocol (SNMP) Applications*
- RFC 3414, *User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)*
- RFC 3415, *View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)*
- RFC 3416, *Version 2 of the Protocol Operations for the Simple Network Management Protocol (SNMP)*
- RFC 3417, *Transport Mappings for the Simple Network Management Protocol (SNMP)*
- RFC 3418, *Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)*

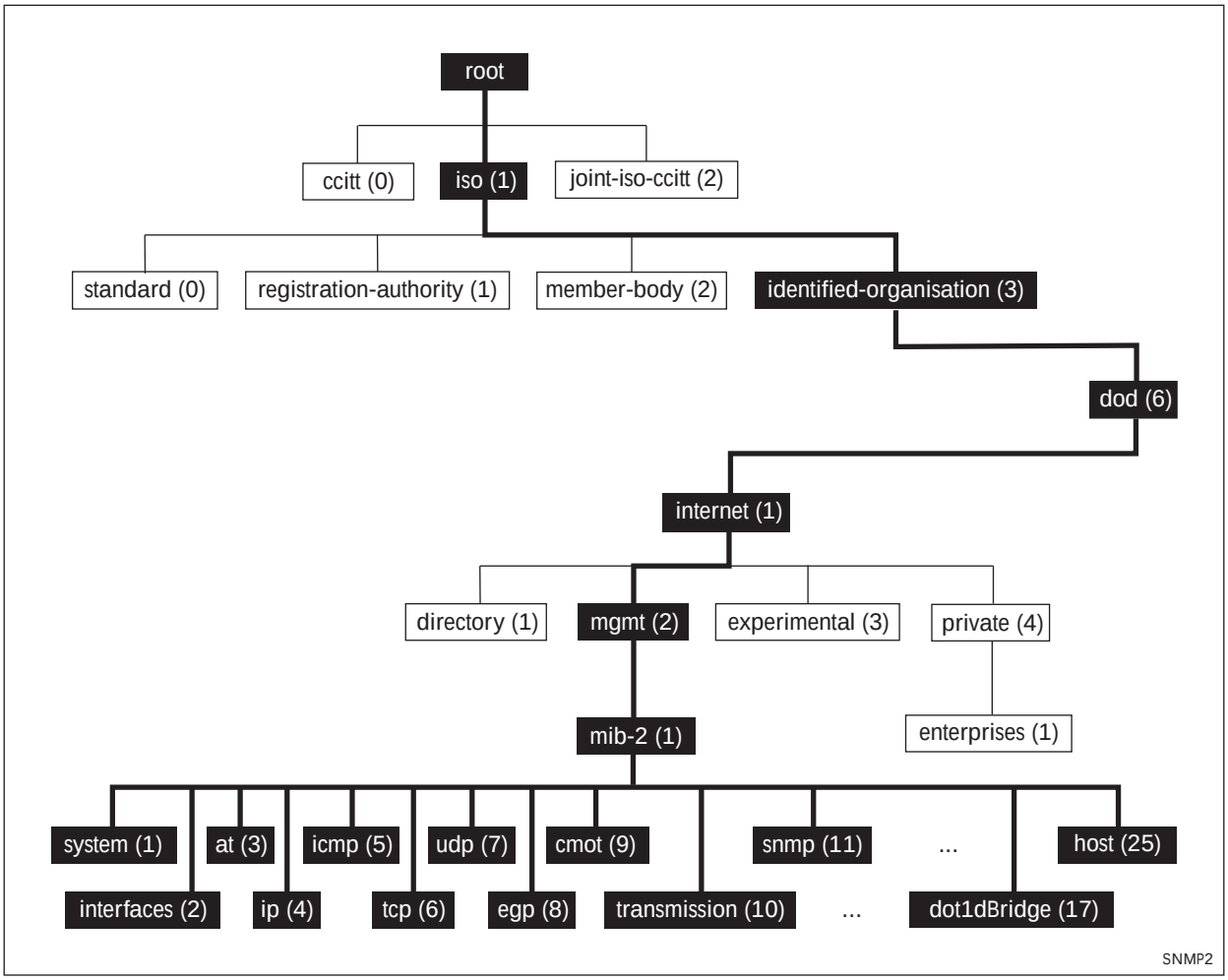
Structure of Management Information

The structure of management information (SMI) defines the schema for a collection of managed objects residing in a virtual store called the management information base (MIB). The information in a MIB includes administrative and operational configuration information, as well as counters of system events and activities.

The MIB is organized into a tree-like hierarchy in which nodes are each assigned an identifier consisting of a non-negative integer and an optional brief textual description.

Each managed object is represented by a leaf node and is defined by its name, syntax, access mode, status and description. It can also be specifically identified by its unique position within the tree. This position is expressed as a series of dot-delimited sub-identifiers that start at the root node and end in the sub-identifier at the particular object's leaf node. For example, in Figure 87-2 the object named interfaces would be uniquely identified by the string of individual sub-identifiers, 1.3.6.1.2.1.2.

Figure 87-2: Top levels of the Internet-standard Management Information Base (MIB)



Objects defined in the Internet-standard MIB (MIB-II) reside in the mib(1) sub-tree.

Names

Names are used to identify managed objects, and are hierarchical in nature. An object identifier is a globally unique, authoritatively assigned sequence of non-negative integers which traverse the MIB tree from the root to the node containing the object.

Object identifiers may be represented in one of the following forms:

- Dotted notation lists the integer values found by traversing the tree from the root to the node in question, separated by dots. For example, the following identifies the MIB-II sub-tree:

  ```
  1.3.6.1.2.1
  ```

  The following identifies the sysDescr object in the system group of MIB-II:

  ```
  1.3.6.1.2.1.1.1
  ```

- Textual notation lists the textual descriptions found by traversing the tree from the root to the node in question, separated by spaces and enclosed in braces. For following example identifies the internet sub-tree:

  ```
  { iso org dod 1}
  ```

  The name may be abbreviated to a relative form. The following example identifies the first (directory) node of the internet sub-tree:

  ```
  { internet 1}
  ```

- Combined notation lists both the integer values and textual descriptions found by traversing the tree from the root to the node in question. The integer value is placed in parentheses after the textual description. The labels are separated by spaces and enclosed in braces. For example, the following identifies the first (directory) node in the internet sub-tree:

  ```
  {iso(1) org(3) dod(6) internet(1) 1}
  ```

  The name may be abbreviated to the following:

  ```
  directory(1)
  ```

Since there is no effective limit to the magnitude of non-negative integers, and no effective limit to the depth of the tree, the MIB provides an unlimited name space.

An object is also usually assigned an object descriptor. The object descriptor is a unique, mnemonic, printable string intended for humans to use when discussing the MIB.

Instances

Objects are just templates for data types. An actual value that can be manipulated by an NMS is an instance of an object. An instance is named by appending an instance identifier to the end of the object's object identifier. The instance identifier depends on the object's data type:

- If the object is not a column in a table, the instance identifier is 0 (zero). For example, the instance of the sysDescr object is:

  ```
  sysDescr.0
  or 1.3.6.1.2.1.1.1.0
  ```

- If the object is a column in a table, the method used to assign an instance identifier varies. Typically, the value of the index column or columns is used.

The object ifTable in MIB-II contains information about interfaces and is indexed by the interface number, ifIndex. The instance of the ifDescr object for the first interface is:

```
ifDescr.1
or 1.3.6.1.2.1.2.2.1.2.1
```

If the index column is an IP address, the entire IP address is used as the instance identifier. The object ipRouteTable in MIB-II contains information about IP routes and is indexed by the destination address, ipRouteDest. The instance of the ipRouteNextHop object for the route 131.203.9.0 is:

```
ipRouteNextHop.131.203.9.0
or 1.3.6.1.2.1.4.21.1.7.131.203.9.0
```

If the table has more than one index, the values of all the index columns are combined to form the instance identifier. The object tcpConnTable in MIB-II contains information about existing TCP connections and is indexed by the local IP address (tcpConnLocalAddress), the local port number (tcpConnLocalPort), the remote IP address (tcpConnRemAddress) and the remote port number (tcpConnRemPort) of the TCP connection. The instance of the tcpConnState object for the connection between 131.203.8.36,23 and 131.203.9.197,1066 is:

tcpConnState.131.203.8.36.23.131.203.9.197.1066
or 1.3.6.1.2.1.6.13.1.1.131.203.8.36.23.131.203.9.197.1066

Syntax

The syntax of an object describes the abstract data structure corresponding to that object type. For example, INTEGER or OCTET STRING.

Access

The access mode of an object describes the level of access for the object.

Access modes for MIB objects:

Access	Description
Read-only	The object's value can be read but not set.
Read-write	The object's value can be read and set.
Write-only	The object's value can be set but not read.
Not-accessible	The object's value cannot be read or set.

Status

The status of an object describes the implementation requirements for the object.

Status values for MIB objects:

Status	Description
Mandatory	Managed devices must implement the object.
Optional	Managed devices may implement the object.
Obsolete	Managed devices need no longer implement the object.
Deprecated	Managed devices should implement the object. However, the object may be deleted from the next version of the MIB. A new object with equal or superior functionality is defined.

Description

The definition of an object may include an optional textual description of the meaning and use of the object. This description is often essential for successful understanding of the object.

The SNMP Protocol

The SNMP protocol provides a mechanism for management entities, or stations, to extract information from the Management Information Base (MIB) of a managed device.

The normal method of accessing information in a MIB is to use a Network Management Station (NMS), typically a PC or workstation, to send commands to the managed device (in this case the switch) using the SNMP protocol.

SNMP can use a number of different protocols as its underlying transport mechanism, but the most common transport protocol, and the only one supported by the switch, is UDP. Therefore the IP module must be enabled and properly configured in order to use SNMP. SNMP trap messages are sent to UDP port 162; all other SNMP messages are sent to UDP port 161. The switch's SNMP agent accepts SNMP messages up to the maximum UDP length the switch can receive.

Other transport mappings have been defined (e.g. OSI [RFC 1418], AppleTalk [RFC 1419] and IPX [RFC 1420]), but the standard transport mapping for the Internet (and the one the switch uses) is UDP. The IP module must be enabled and configured correctly. See Chapter 25, IP Addressing and Protocol Commands for detailed descriptions of the commands required to enable and configure IP.

SNMP Versions

The switch supports SNMP version 1 (SNMPv1), SNMP version 2c (SNMPv2c) and SNMP Version 3 (SNMPv3). The three versions operate similarly.

SNMPv2c updated the original protocol, and offered the following main enhancements:

- a new format for trap messages.
- the get-bulk-request PDU allows for the retrieval of large amounts of data, including tables, with one message.
- more error codes mean that error responses to set messages have more detail than is possible with SNMPv1.
- three new exceptions to errors can be returned for get, get-next and get-bulk-request messages. These are: noSuchObject, noSuchInstance, and endOfMibView.

SNMPv3 provides significant enhancements to address the security weaknesses existing in the earlier versions. This is achieved by implementing two new major features:

- Authentication - by using password hashing and time stamping.
- Privacy - by using message encryption.

Support for multiple versions of SNMP is achieved by responding to each SNMP request with a response of the same version. For example, if an SNMPv1 request is sent to the switch, an SNMPv1 response is returned. If an SNMPv2c request is sent, an SNMPv2c response is returned. Therefore, authentication and encryption functions are not invoked when messages are detected as having either an SNMPv1 or SNMPv2c protocol format.

SNMP Messages

The SNMP protocol is termed simple because it has only six operations, or messages—get, get-next, get-response, set, and trap, and SNMPv2c also has the get-bulk-request message. The replies from the managed device are processed by the NMS and generally used to provide a graphical representation of the state of the network. The two major SNMP operations available to a management station for interacting with a client are the get and set operations. The SNMP set operator can lead to security breaches, since SNMP is not inherently very secure. When forced to operate in either SNMPv1 or v2 mode, when operating with older management stations for example, care must be taken in the choice and safe-guarding of community names, which are effectively passwords for SNMP.

Polling versus Event Notification

SNMP employs a polling paradigm. A Network Management Station (NMS) polls the managed device for information as and when it is required, by sending get-request, get-next-request, and/or get-bulk-request PDUs to the managed device. The managed device responds by returning the requested information in a get-response PDU. The NMS may manipulate objects in the managed device by sending a set-request PDU to the managed device.

The only time that a managed device initiates an exchange of information is in the special case of a trap PDU. A managed device may generate a limited set of traps to notify the NMS of critical events that may affect the ability of the NMS to communicate with the managed device or other managed devices on the network, and therefore to “manage” the network. Such events include the restarting or re-initialization of a device, a change in the status of a network link (up or down), or an authentication failure.

Message Format for SNMPv1 and SNMPv2c

Table 87-1: Fields in an SNMP message

Field	Function
Version	The version of the SNMP protocol. The value is version-1 (0) for the SNMP protocol as defined in RFC 1157, or version-2c (1) for the SNMP protocol as defined in RFC 1902.
Community	The name of an SNMP community, for authentication purposes
SNMP PDU	An SNMP Protocol Data Unit (PDU).

Table 87-2: SNMP PDUs

PDU	Function
get-request	Sent by an NMS to an agent, to retrieve the value of an object.
get-next-request	Sent by an NMS to an agent, to retrieve the value of the next object in the sub-tree. A sub-tree is traversed by issuing a get-request PDU followed by successive get-next-request PDUs.
get-bulk-request	Sent by an NMS to an agent to request a large amount of data with a single message. This is for SNMPv2c messages.
set-request	Sent by an NMS to an agent, to manipulate the value of an object. SNMP PDU Version Community
get-response	Sent by an agent to an NMS in response to a get-request, get-next-request, get-bulk-response, or set-request PDU.
trap	Sent by an agent to an NMS to notify the NMS of a extraordinary event.
report	Although not explicitly defined in the RFCs, reports are used for specific purposes such as EngineID discovery and time synchronization.

Table 87-3: Generic SNMP traps

Value	Meaning
coldStart	The agent is re-initializing itself. Objects may be altered.
warmStart	The agent is re-initializing itself. Objects are not altered.
linkDown	An interface has changed state from up to down.
linkUp	An interface has changed state from down to up.
authenticationFailure	An SNMP message has been received with an invalid community name.
egpNeighborLoss	An EGP peer has transitioned to down state.

SNMP Communities (Version v1 and v2c)

A community is a relationship between an NMS and an agent. The community name is used like a password for a trivial authentication scheme. Both SNMPv1 and SNMPv2c provide security based on the community name only. The concept of communities does not exist for SNMPv3, which instead provides for a far more secure communications method using entities, users, and groups.

Caution

We strongly recommend removing community membership from all SNMPv3 configured devices to prevent access to them via SNMPv1 and SNMv2c, which could bypass the additional SNMPv3 security features.

SNMPv3 Entities

Entities comprise one of the basic components of the SNMPv3 enhanced architecture. They define the functionality and internal structure of the SNMP managers and agents. An in-depth description of entities can be found in RFC 3411, on which the following text is based. SNMPv3 defines two entity types, a manager and an agent. Both entity types contain two basic components: an SNMP engine and a set of applications.

SNMP Engine

The engine provides the basic services to support the agents component applications, in this respect it performs much of the functionality expected of the ISO Session and Presentation layers. These functions include message transmission and reception, authentication and encryption, and access control to its managed objects database (MIB). The SNMP engine comprises the following components:

- Dispatcher
- Message processing Subsystem
- Security Subsystem
- Access Control Subsystem

The only security subsystem presently supported is the user based security model (USM).

Each SNMP engine is identified by an snmpEngineID that must be unique within the management system. A one to one association exists between an engine and the entity that contains it.

Entity Applications

The following applications are defined within the agent applications:

- Command Generator
- Notification Receiver
- Proxy Forwarder
- Command Responder
- Notification Originator
- Other

SNMPv3 Message Protocol Format

Table 87-4: SNMPv3 PDUs

Value	Meaning
msgVersion	Identifies the message format to be SNMPv3.
msgID	An identifier used between SNMP entities to coordinate message requests and responses. Note that a message response takes the msgID value of the initiating message.
msgMaxSize	Conveys the maximum message size (in octets) an integer between 484 and 2^{31}-1, supported by the sender of the message. Specified as msgFlags. A single octet whose last three bits indicate the operational mode for privacy, authentication, and report.
msgSecurityModel	An identifier used to indicate the security mode (i.e. SNMPv1, SNMPv2c or SNMPv3 to be used when processing the message. Note that although only the SNMPv3 identifier is accepted by the switch, these earlier version message formats are detected by the msgVersion field and processed appropriately.
msgAuthoritativeEngineID	The ID of the authoritative engine that relates to a particular message, i.e. the source engine ID for Traps, Responses and Reports, and the destination engine for Gets, GetNexts, Sets, and Informs.
msgAuthoritativeEngineBoots	A value that represents the number of times the authoritative engine has rebooted since its installation. Its value has the range 1 to 2^{31}-1.
msgAuthoritativeEngineTime	The number of seconds since the authoritative engine snmpEngineBoots counter was last incremented.
msgUserName	The name of the user (principal) on whose behalf the message is being exchanged.
msgAuthenticationParameters	If the message has been authenticated, this field contains a serialized OCTET STRING representing the first 12 octets of the HMAC-MD5-96 output done over the whole message.
msgPrivacyParameters	For encrypted data, this field contains the "salt" used to create the DES encryption Initialization Vector (IV).
ContextEngineID	Within a particular administrative domain, this field uniquely identifies an SNMP entity that may realize an instance of a context with a particular contextName
ContextName	A unique name given to a context within a particular SNMP entity.

SNMPv1 and SNMPv2c

Although software levels 2.6.3 and higher support the specific facilities of SNMP v1 and v2, their documentation is available to provide backward compatibility with older network management systems. The far superior security features offered by implementing SNMPv3 should be used wherever possible.

The switch's implementation of SNMPv1 is based on RFC 1157, *A Simple Network Management Protocol (SNMP)*, and RFC 1812, *Requirements for IP Version 4 Routers*.

When the SNMP agent is disabled, the agent does not respond to SNMP request messages. The agent is disabled by default. The current state and configuration of the SNMP agent can be displayed.

SNMP MIB Views for SNMPv1 and SNMPv2c

An SNMP MIB view is a arbitrary subset of objects in the MIB. Objects in the view may be from any part of the object name space, and not necessarily the same sub-tree. An SNMP community profile is the pairing of an SNMP access mode (read-only or read-write) with the access mode defined by the MIB for each object in the view. For each object in the view, the community profile defines the operations that can be performed on the object.

Pairing an SNMP community with an SNMP community profile determines the level of access that the agent affords to an NMS that is a member of the specified community. When an agent receives an SNMP message, it checks the community name encoded in the message. If the agent knows the community name, the message is deemed to be authentic and the sending SNMP entity is accepted as a member of the community. The community profile associated with the community name then determines the sender's view of the MIB and the operations that can be performed on objects in the view.

SNMP Communities

SNMP communities were introduced into SNMPv1 and retained in version 2c. Although the switch's software still supports communities, this is to provide backward compatibility with legacy management systems. Communities should not be used where a secure network is required. Instead, use the secure network features offered by SNMPv3.

An SNMP community is a pairing of an SNMP agent with a set of SNMP application entities. Communities are the main configuration item in the switch's implementation of SNMPv1 and v2, and are defined in terms of a list of IP addresses which define the SNMP application entities (trap hosts and management stations) in the community.

Important community names act as passwords and provide minimal authentication. Any SNMP application entity that knows a community name can read the value of any instance of any object in the MIB implemented in the switch. Any SNMP application entity that knows the name of a community with write access can change the value of any instance of any object in the MIB implemented in the switch, possibly affecting the operation of the switch. For this reason, take care with the security of community names.

When a trap is generated by the SNMP agent it is forwarded to all trap hosts in all communities. The community name and manager addresses are used to provide trivial authentication. An incoming SNMP message is deemed authentic if it contains a valid community name and originated from an IP address defined as a management station for that community.

When a community is disabled, the SNMP agent behaves as if the community does not exist and generates authentication failure traps for messages directed to the disabled community.

The SNMP agent does not support a default community called “public” with read-only access, traps disabled and open access as mandated in RFC 1812, as this is a security hole open for users who wish to use the switch with minimal modification to the default configuration. The default configuration of the switch has no defined communities. Communities must be explicitly created.

SNMP authentication (for SNMPv1 and v2) is a mechanism whereby an SNMP message is declared to be authentic, that is from an SNMP application entity actually in the community to which the message purports to belong. The mechanism may be trivial or secure. The only form of SNMP authentication implemented by the switch’s SNMP agent is trivial authentication. The authentication failure trap may be generated as a result of the failure to authentication an SNMP message.

Switch interfaces can be enabled or disabled via SNMP by setting the ifAdminStatus object in the ifTable of MIB-II MIB to ‘Up(1)’ or ‘Down(2)’ for the corresponding ifIndex. If it is not possible to change the status of a particular interface the switch returns an SNMP error message.

The switch’s implementation of the ifOperStatus object in the ifTable of MIB-II MIB supports two additional values—”Unknown(4)” and “Dormant(5)” (e.g. an inactive dial-on-demand interface).

Caution

An unauthorized person with knowledge of the appropriate SNMP community name could bring an interface up or down. Community names act as passwords for the SNMP protocol. When creating an SNMP community with write access, take care to select a secure community name and to ensure that only authorized personnel know it.

An SNMP MIB view is a subset of objects in the MIB that pertain to a particular network element. For example, the MIB view of a hub would be the objects relevant to management of the hub, and would not include IP routing table objects, for example. The switch’s SNMP agent does not allow the construction of MIB views. The switch supports all relevant objects from all MIBs that it implements.

Note that the switch’s standard set and show commands can also be used to access objects in the MIBs supported by the switch.

Defining Management Stations within Communities

You can add management stations to a community either individually, by entering just its IP address, or you can enter a range of management stations by entering an IP address that ends with a ‘/’ character followed by a number between 1 and 32. The number that follows the ‘/’ character operates as an address mask to define a range of addresses for the management stations. The following example shows how to allocate a band of three binary addresses to a portion of the subnet 146.15.1.X

Example

In this example we make provision for up to 8 possible management stations within a community called “admin”.

Step 1:

Decide on the number of management stations that you want to assign to a particular subnet, then decide how many binary digits are required to define this number of addresses. In this case we need up to 8 management stations, so we will assign 3 binary digits (3 binary digits can provide 8 different values). To assign the last 3 binary digits for management stations, we assign a prefix that is a count of all binary digits in the address minus those to be assigned as management stations. In this case the prefix is 29; this being the number of binary digits in an IP address (32) minus the number of digits assigned to the management stations (3).

Step 2:

The method used in this step depends on whether or not the community already exists.

- If the community called “admin” does not exist, create a new community called “admin” and allocate a three binary digit block of addresses to the address subnet 146.15.1.X.
- If the community called “admin” already exists, allocate a three binary digit block of addresses to an existing community called “admin” with the address subnet 146.15.1.X.

For security reasons, the common management prefix should be larger than the IP subnet. This prevents stations on one subnet from being considered valid management stations on a different subnet.

Configuration Example (SNMPv1 and v2)

This example shows how to configure the switch’s SNMP agent. Two network management stations have been set up on a large network. The central NMS (IP address 192.168.11.5) monitors devices on the network and uses SNMP set messages to manage devices on the network. Trap messages are sent to this management station. The regional network management station (IP addresses 192.168.16.1) is used just to monitor devices on the network by using SNMP get messages. Link traps are enabled for all interfaces on this particular switch.

IP and VLANs must be correctly configured in order to access the SNMP agent in the switch. This is because the IP module handles both the TCP transport functions, and the UDP functions that enable datagrams to transport SNMP messages. See Chapter 25, IP Addressing and Protocol Commands for commands that enable and configure IP.

To configure SNMP

Step 1: Enable the SNMP agent.

Enable the SNMP agent and enable the generation of authenticate failure traps to monitor unauthorized SNMP access. SNMP is enabled by default in AlliedWare Plus.

```
awplus(config)# snmp-server enable trap auth
```

Step 2: Create a community with write access for the central NMS.

Create a write access community called “example1rw” for use by the central network management station at 192.168.11.5 Use an ACL to give the central NMS SNMP access to the switch using that community name.

```
awplus(config)# access-list 66 permit 192.168.11.5
awplus(config)# snmp-server community example1rw rw 66
```

Care must be taken with the security of community names. Do not use the names “private” or “public” in your network because they are too obvious. Community names act as passwords and provide only trivial authentication. Any SNMP application entity that knows a community name can read the value of any instance of any object in the MIB implemented in the switch. Any SNMP application entity that knows the name of a community with write access can change the value of any instance of any object in the MIB implemented in the switch, possibly affecting the operation of the switch.

SNMP V1 or V2c provide very minimal security. If security is a concern, you should use SNMPv3.

Step 3: Create a community with read-only access for the regional NMS.

Create a read-only access community called “example2ro” for use by the regional network management station at 192.168.16.1. Use an ACL to give the regional NMS SNMP access to the switch using that community name.

```
awplus(config)# access-list 67 permit 192.168.16.1
awplus(config)# snmp-server community example2ro ro 67
```

Step 4: Enable link traps.

Enable link traps for the desired interfaces. In this example, the NSMs are in VLAN 2 and VLAN 3 and other ports are in VLAN 1 for simplicity.

```
awplus(config)# interface vlan1-3
awplus(config-if)# snmp trap link-status
```

Note that link traps on VLANs are sent when the last port in the VLAN goes down. You will only see a trap for a VLAN if the trap host is in a different VLAN.

You can also enable link traps on channel groups and switch ports. For example, to enable traps on a range of switch ports:

```
awplus(config)# int port1.0.5-1.0.7
awplus(config-if)# snmp trap link-status
```

You can also enable link traps on channel groups and switch ports. For example, to enable traps on a range of switch ports:

Step 5: Configure trap hosts.

Specify the IP address or addresses that the traps will get sent to. In this example, traps will be sent to both NMSes.

```
awplus(config)# snmp-server host 192.168.11.5 version 2c
                example1rw
awplus(config)# snmp-server host 192.168.16.1 version 2c
                example2ro
```

Step 6: Check the configuration.

Check that the current configuration of the SNMP communities matches the desired configuration:

```
awplus# show snmp-server
awplus# show snmp-server community
awplus# show run snmp
```

This is the output of the show snmp-server community command for this example:

```
SNMP community information:
  Community Name ........... example1rw
    Access ................. Read-write
    View ................... none
  Community Name ........... example2ro
    Access ................. Read-only
    View ................... none
```

This is the output of the show run snmp command for this example:

```
no snmp-server ipv6
snmp-server enable trap auth
snmp-server community example1rw rw 66
snmp-server community example2ro 67
snmp-server host 192.168.1.2 version 2c example1rw
snmp-server host 192.168.2.2 version 2c example2ro
!
```

Check that the interface link up/down traps have been correctly configured:

```
awplus# show interface vlan1-3
```

This is the output of the show interface command for this example:

```
Interface vlan1
  Scope: both
  Link is UP, administrative state is UP
  Hardware is VLAN, address is 0009.41fd.c029
  index 201 metric 1 mtu 1500
  arp ageing timeout 300
  <UP,BROADCAST,RUNNING,MULTICAST>
  VRF Binding: Not bound
  SNMP link-status traps: Sending (suppressed after 20 traps in 60 sec)
  Bandwidth 1g
    input packets 4061, bytes 277043, dropped 0, multicast   packets 3690
    output packets 190, bytes 18123, multicast packets 0 broadcast packets 0
Interface vlan2
  Scope: both
  Link is DOWN, administrative state is UP
  Hardware is VLAN, address is 0009.41fd.c029
  IPv4 address 192.168.11.50/24 broadcast 192.168.11.255
  index 202 metric 1 mtu 1500
  arp ageing timeout 300
  <UP,BROADCAST,MULTICAST>
  VRF Binding: Not bound
  SNMP link-status traps: Sending (suppressed after 20 traps in 60 sec)
  Bandwidth 1g
    input packets 568, bytes 42309, dropped 0, multicast packets 0
    output packets 183, bytes 18078, multicast packets 0 broadcast packets 0
Interface vlan3
  Scope: both
  Link is DOWN, administrative state is UP
  Hardware is VLAN, address is 0009.41fd.c029
  IPv4 address 192.168.16.50/24 broadcast 192.168.16.255
  index 203 metric 1 mtu 1500
  arp ageing timeout 300
  <UP,BROADCAST,MULTICAST>
  VRF Binding: Not bound
  SNMP link-status traps: Sending (suppressed after 20 traps in 60 sec)
    input packets 0, bytes 0, dropped 0, multicast packets 0
    output packets 0, bytes 0, multicast packets 0 broadcast packets 0
```

SNMPv3

SNMPv3 is the third version of the Simple Network Management Protocol. The architecture comprises the following:

- entities that may be either managers, agents, or both
- a management information base (MIB)
- a transport protocol

At least one manager node runs the SNMP management software in every configuration. Managed devices such as routers, servers, and workstations are equipped with an agent software module. The agent provides access to local objects in the MIB that reflect activity and resources at the node. The agent also responds to manager commands to retrieve values from, and set values in the MIB.

SNMP MIB Views for SNMPv3

An SNMP MIB view is a arbitrary subset of objects in the MIB. Objects in the view may be from any part of the object name space, and not necessarily the same sub-tree.

SNMP Groups

Groups were introduced as part of SNMPv3. They are the means by which users are assigned their views and access control policy. Once a group has been created, users can be added to them. In practice a number of groups would be created, each with varying views and access security requirements. Users would then be added to their most appropriate groups. Each Group name and Security Level pair must be unique within a switch.

SNMP Users

Users were introduced as part of SNMPv3. From a system perspective a user is represented as an entity stored in a table that defines the access and authentication criteria to be applied to access or modify the SNMP MIB data.

SNMP Target Addresses

Target addresses were introduced as part of SNMPv3. They specify the destination and user that receives outgoing notifications such as trap messages. SNMP target address names must be unique within the managed device.

SNMP Target Params

Target params were introduced as part of SNMPv3. They specify an entry in the snmpTargetParamsTable. SNMP target params names must be unique within the managed device.

Configuration Example (SNMPv3)

This example shows how to configure the switch's SNMP agent. Two network management stations have been set up on a large network. The central NMS (IP address 192.168.11.5) monitors devices on the network and uses SNMP set messages to manage devices on the network. Trap messages are sent to this management station.

The IP module must be enabled and correctly configured in order to access the SNMP agent in the switch, since the IP module handles the UDP datagrams used to transport SNMP messages.

To configure SNMP

Step 1: Enable the SNMP agent.

Enable the SNMP agent and enable the generation of authenticate failure traps to monitor unauthorized SNMP access. SNMP is enabled by default in AlliedWare Plus.

Step 2: Add SNMP views.

You can specify views using their OID or the predefined MIB name.

```
awplus(config)# snmp-server view atmib 1.3.6.1.2.14
                included

awplus(config)# snmp-server view atmib alliedtelesis
                included
```

Step 3: Add SNMP group.

```
awplus(config)# snmp-server group ord-user noauth read
                atmib

awplus(config)# snmp-server group admin-user auth read
                atmib write atmib notify atmi
```

Step 4: Add SNMP users.

Add users to the groups by using commands such as:

```
awplus(config)# snmp-server user ken admin-user auth md5
                mercury
```

Step 5: Add SNMP target parameters.

Step 6: Add SNMP target address.

Using SNMP to Manage Files and Software

The Allied Telesis Enterprise MIB (Chapter 89, SNMP MIBs) includes objects for managing files and software on the switch. This section includes procedures for using MIB objects on the switch to perform some common tasks, via an SNMP management application:

- "Copy a File to or from a TFTP Server" on page 87.21
- "Upgrade Software and Configuration Files" on page 87.23

For more details about the Allied Telesis Enterprise MIB and public MIBs on the switch, see Chapter 89, SNMP MIBs.

Copy a File to or from a TFTP Server

Use this procedure to copy a file (for example, a software version file) to the switch from a TFTP server, or to copy a file (for example, a configuration file) from the switch to a TFTP server. The MIB objects in this procedure reside in the module atFilev2 { modules 600 }, with object ID 1.3.6.1.4.1.207.8.4.4.4.600. For detailed descriptions of the MIB objects used in this procedure, and other file management MIB objects, see "AT-FILEv2-MIB" on page 89.56. Other MIB objects can be used in a similar way for moving and deleting files on the switch.

Table 87-5: Procedure for copying a file to or from a device using a TFTP server

	Do this ...	By setting or reading this MIB object ...	Whose object ID is ...	To this value...
1.	If the source device is part of a stack, set the stack ID. For a standalone switch, keep the default value, 1.	atFilev2SourceStackId	{ atFilev2Operation 1 }	<*stack-id*>
2.	If the destination device is part of a stack, set the stack ID.	atFilev2DestinationStackId	{ atFilev2Operation 4 }	<*stack-id*>
3.	Set the source device.	atFilev2SourceDevice	{ atFilev2Operation 2 }	1 (TFTP) or 2 (Flash)
4.	Set the destination device.	atFilev2DestinationDevice	{ atFilev2Operation 5 }	1 (TFTP) or 2 (Flash)
5.	Set the source filename. Include the path (if any) but not the device.	atFilev2SourceFileName	{ atFilev2Operation 3 }	<*source-filename*> e.g. /awp/config/admin.cfg
6.	Set the destination filename. Include the path (if any) but not the device.	atFilev2DestinationFileName	{ atFilev2Operation 6 }	<*dest-filename*> e.g. /config/admin.cfg

Table 87-5: Procedure for copying a file to or from a device using a TFTP server

	Do this ...	By setting or reading this MIB object ...	Whose object ID is ...	To this value...
7.	Set the IP address of the TFTP server.	atFilev2TftpIPAddr	{ atFilev2Tftp_4 1 }	*<ip-addr>*
8.	Check that no other transfer is in progress, and that the required parameters have been set.	atFilev2CopyBegin	{ atFilev2Operation 7 }	Read: idle
9.	Start the file transfer.	atFilev2CopyBegin	{ atFilev2Operation 7 }	Set: 1
10.	Monitor file transfer progress.	atFilev2CopyBegin	{ atFilev2Operation 7 }	Read: In progress: copying *<src>* --> *<dst>* *or* Success: copy *<src>* --> *<dst>* success *or* Failure: copy *<src>* --> *<dst>* failure: *<err-msg>*

Upgrade Software and Configuration Files

Use this procedure to upgrade to a new software version and boot configuration file. For detailed descriptions of the MIB objects used in this procedure, and other MIB objects for managing software installation and configuration files, see "AT-SETUP-MIB" on page 89.37.

Table 87-6: Procedure for upgrading to a new software version and boot configuration

	Do this ...	By reading or setting this MIB object ...	Whose object ID is ...	To this value...
1.	Check that you have enough flash memory for the currently running software file, the new software version file, and any configuration scripts required.			
2.	Check the version and name of the software currently running.	currSoftVersion currSoftName	1.3.6.1.4.1.207.8.4.4.4.500.2.1.1 1.3.6.1.4.1.207.8.4.4.4.500.2.1.2	Read: <*software-name*> <*software-version*>
3.	If you do not already have the currently running software as a software version file in flash, save the currently running software with a file name to the flash root.	currSoftSaveAs	1.3.6.1.4.1.207.8.4.4.4.500.2.1.1	Set: <*backup-filename.rel*>
4.	Check that the file saved successfully. (The most common failures result from lack of flash memory space.)	currSoftSaveAs	1.3.6.1.4.1.207.8.4.4.4.500.2.1.3	Read: saving <*filename*> *or* <*filename*> success *or* <*filename*> failure: <*error-message*>
5.	Copy the new software version file to flash memory on the device	See Table 87-5.		
6.	Set the new release file to be the current release that the device will install and run the next time it restarts. Include the path.	nextBootPath	1.3.6.1.4.1.207.8.4.4.4.500.2.2.2	Set: <*next-filename*> e.g.: `flash:/release.rel`
7.	Check the version of release file set to install next.	nextBootVersion	1.3.6.1.4.1.207.8.4.4.4.500.2.2.1	Read: <*software-version*>
8.	Set the previous release file to be the backup release that the device will install and run if the device fails to boot successfully with the new release file. Include the path.	bckpPath	1.3.6.1.4.1.207.8.4.4.4.500.2.3.2	Set: <*backup-filename*> e.g.: `flash:/release.rel`

Table 87-6: Procedure for upgrading to a new software version and boot configuration(cont.)

	Do this ...	By reading or setting this MIB object ...	Whose object ID is ...	To this value...
9.	Check the version of backup release file.	bckpVersion	1.3.6.1.4.1.207.8.4.4.4.500.2.3.1	Read: *<software-version>*
10.	If necessary, copy a configuration file to the device (Table 87-5), or save the current running configuration to a file in the root directory of flash. To save the running configuration, specify the filename, but not a device or path.	See Table 87-5. or runCnfgSaveAs	1.3.6.1.4.1.207.8.4.4.4.500.3.1.1	Set: *<filename.cfg>* e.g.: myconfig.cfg
11.	Check and if necessary set the file the device will use for configuration when it restarts. Include the full path.	bootCnfgPath	1.3.6.1.4.1.207.8.4.4.4.500.3.2.1	Read/set: *<filename.cfg>* e.g.: flash:/myconfig.cfg
12.	Check that a boot configuration file matching the boot configuration path exists.	bootCnfgExists	1.3.6.1.4.1.207.8.4.4.4.500.3.2.2	Read: TRUE (1) or FALSE (2)
13.	Check that the default configuration file flash:/default.cfg exists.	dfltCnfgExists	1.3.6.1.4.1.207.8.4.4.4.500.3.3.2	Read: TRUE (1) or FALSE (2)
14.	Restart the device.	restartDevice	1.3.6.1.4.1.207.8.4.4.4.500.1	1

Chapter 88: SNMP Commands

Command List 88.2
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snmp-server host 88.23
snmp-server location 88.25
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undebug snmp 88.29

Command List

This chapter provides an alphabetical reference for commands used to configure SNMP. For more information, see Chapter 87, SNMP Introduction, and Chapter 89, SNMP MIBs.

For information about modifying or redirecting the output from show commands to a file, see "Controlling "show" Command Output" on page 1.41.

debug snmp

This command enables SNMP debugging.

The no variant of this command disables SNMP debugging.

Syntax

```
debug snmp [all|detail|error-string|process|receive|send|xdump]
no debug snmp [all|detail|error-string|process|receive|send|xdump]
```

Parameter	Description
`all`	Enable or disable the display of all SNMP debugging information.
`detail`	Enable or disable the display of detailed SNMP debugging information.
`error-string`	Enable or disable the display of debugging information for SNMP error strings.
`process`	Enable or disable the display of debugging information for processed SNMP packets.
`receive`	Enable or disable the display of debugging information for received SNMP packets.
`send`	Enable or disable the display of debugging information for sent SNMP packets.
`xdump`	Enable or disable the display of hexadecimal dump debugging information for SNMP packets.

Mode Privileged Exec and Global Configuration

Example To start SNMP debugging, use the command:

```
awplus# debug snmp
```

To start SNMP debugging, showing detailed SNMP debugging information, use the command:

```
awplus# debug snmp detail
```

To start SNMP debugging, showing all SNMP debugging information, use the command:

```
awplus# debug snmp all
```

Related Commands

show debugging snmp
terminal monitor
undebug snmp

show counter snmp-server

This command displays counters for SNMP messages received by the SNMP agent.

Syntax `show counter snmp-server`

Mode User Exec and Privileged Exec

Example To display the counters for the SNMP agent, use the command:

```
awplus# show counter snmp-server
```

Output Figure 88-1: Example output from the **show counter snmp-server** command

```
SNMP-SERVER counters
inPkts                  ......... 11
inBadVersions           ......... 0
inBadCommunityNames     ......... 0
inBadCommunityUses      ......... 0
inASNParseErrs          ......... 0
inTooBigs               ......... 0
inNoSuchNames           ......... 0
inBadValues             ......... 0
inReadOnlys             ......... 0
inGenErrs               ......... 0
inTotalReqVars          ......... 9
inTotalSetVars          ......... 0
inGetRequests           ......... 2
inGetNexts              ......... 9
inSetRequests           ......... 0
inGetResponses          ......... 0
inTraps                 ......... 0
outPkts                 ......... 11
outTooBigs              ......... 0
outNoSuchNames          ......... 2
outBadValues            ......... 0
outGenErrs              ......... 0
outGetRequests          ......... 0
outGetNexts             ......... 0
outSetRequests          ......... 0
outGetResponses         ......... 11
outTraps                ......... 0
UnSupportedSecLevels    ......... 0
NotInTimeWindows        ......... 0
UnknownUserNames        ......... 0
UnknownEngineIDs        ......... 0
WrongDigest             ......... 0
DecryptionErrors        ......... 0
UnknownSecModels        ......... 0
InvalidMsgs             ......... 0
UnknownPDUHandlers      ......... 0
```

Table 88-1: Parameters in the output of the **show counter snmp-server** command

Parameter	Meaning
`inPkts`	The total number of SNMP messages received by the SNMP agent.
`inBadVersions`	The number of messages received by the SNMP agent for an unsupported SNMP version. It drops these messages.The SNMP agent on your device supports versions 1, 2C, and 3.

Table 88-1: Parameters in the output of the **show counter snmp-server** command (cont.)

Parameter	Meaning
inBadCommunityNames	The number of messages received by the SNMP agent with an unrecognized SNMP community name. It drops these messages.
inBadCommunityUses	The number of messages received by the SNMP agent where the requested SNMP operation is not permitted from SNMP managers using the SNMP community named in the message.
inASNParseErrs	The number of ASN.1 or BER errors that the SNMP agent has encountered when decoding received SNMP Messages.
inTooBigs	The number of SNMP PDUs received by the SNMP agent where the value of the error-status field is 'tooBig'. This is sent by an SNMP manager to indicate that an exception occurred when processing a request from the agent.
inNoSuchNames	The number of SNMP PDUs received by the SNMP agent where the value of the error-status field is 'noSuchName'. This is sent by an SNMP manager to indicate that an exception occurred when processing a request from the agent.
inBadValues	The number of SNMP PDUs received by the SNMP agent where the value of the error-status field is 'badValue'. This is sent by an SNMP manager to indicate that an exception occurred when processing a request from the agent.
inReadOnlys	The number of valid SNMP PDUs received by the SNMP agent where the value of the error-status field is 'readOnly'. The SNMP manager should not generate a PDU which contains the value 'readOnly' in the error-status field. This indicates that there is an incorrect implementations of the SNMP.
inGenErrs	The number of SNMP PDUs received by the SNMP agent where the value of the error-status field is 'genErr'.
inTotalReqVars	The number of MIB objects that the SNMP agent has successfully retrieved after receiving valid SNMP Get-Request and Get-Next PDUs.
inTotalSetVars	The number of MIB objects that the SNMP agent has successfully altered after receiving valid SNMP Set-Request PDUs.
inGetRequests	The number of SNMP Get-Request PDUs that the SNMP agent has accepted and processed.
inGetNexts	The number of SNMP Get-Next PDUs that the SNMP agent has accepted and processed.
inSetRequests	The number of SNMP Set-Request PDUs that the SNMP agent has accepted and processed.
inGetResponses	The number of SNMP Get-Response PDUs that the SNMP agent has accepted and processed.
inTraps	The number of SNMP Trap PDUs that the SNMP agent has accepted and processed.
outPkts	The number of SNMP Messages that the SNMP agent has sent.

Table 88-1: Parameters in the output of the **show counter snmp-server** command (cont.)

Parameter	Meaning
outTooBigs	The number of SNMP PDUs that the SNMP agent has generated with the value ‘tooBig’ in the error-status field. This is sent to the SNMP manager to indicate that an exception occurred when processing a request from the manager.
outNoSuchNames	The number of SNMP PDUs that the SNMP agent has generated with the value `noSuchName' in the error-status field. This is sent to the SNMP manager to indicate that an exception occurred when processing a request from the manager.
outBadValues	The number of SNMP PDUs that the SNMP agent has generated with the value ‘badValue’ in the error-status field. This is sent to the SNMP manager to indicate that an exception occurred when processing a request from the manager.
outGenErrs	The number of SNMP PDUs that the SNMP agent has generated with the value ‘genErr' in the error-status field. This is sent to the SNMP manager to indicate that an exception occurred when processing a request from the manager.
outGetRequests	The number of SNMP Get-Request PDUs that the SNMP agent has generated.
outGetNexts	The number of SNMP Get-Next PDUs that the SNMP agent has generated.
outSetRequests	The number of SNMP Set-Request PDUs that the SNMP agent has generated.
outGetResponses	The number of SNMP Get-Response PDUs that the SNMP agent has generated.
outTraps	The number of SNMP Trap PDUs that the SNMP agent has generated.
UnSupportedSecLevels	The number of received packets that the SNMP agent has dropped because they requested a securityLevel unknown or not available to the SNMP agent.
NotInTimeWindows	The number of received packets that the SNMP agent has dropped because they appeared outside of the authoritative SNMP agent's window.
UnknownUserNames	The number of received packets that the SNMP agent has dropped because they referenced an unknown user.
UnknownEngineIDs	The number of received packets that the SNMP agent has dropped because they referenced an unknown snmpEngineID.
WrongDigest	The number of received packets that the SNMP agent has dropped because they didn't contain the expected digest value.
DecryptionErrors	The number of received packets that the SNMP agent has dropped because they could not be decrypted.
UnknownSecModels	The number of messages received that contain a security model that is not supported by the server. Valid for SNMPv3 messages only.

Table 88-1: Parameters in the output of the **show counter snmp-server** command (cont.)

Parameter	Meaning
InvalidMsgs	The number of messages received where the security model is supported but the authentication fails. Valid for SNMPv3 messages only.
UnknownPDUHandlers	The number of times the SNMP handler has failed to process a PDU. This is a system debugging counter.

Related Commands show snmp-server

show debugging snmp

This command displays whether SNMP debugging is enabled or disabled.

Syntax

```
show debugging snmp
```

Mode User Exec and Privileged Exec

Example To display the status of SNMP debugging, use the command:

```
awplus# show debugging snmp
```

Output Figure 88-2: Example output from the **show debugging snmp** command

```
Snmp (SMUX) debugging status:
  Snmp debugging is on
```

Related Commands debug snmp

show running-config snmp

This command displays the current configuration of SNMP on your device.

Syntax `show running-config snmp`

Mode Privileged Exec

Example To display the current configuration of SNMP on your device, use the command:

```
awplus# show running-config snmp
```

Output Figure 88-3: Example output from the **show running-config snmp** command

```
snmp-server contact AlliedTelesis
snmp-server location Philippines
snmp-server group grou1 auth read view1 write view1 notify view1
snmp-server view view1 1 included
snmp-server community public
snmp-server user user1 group1 auth md5 password priv des
password
```

Related Commands show snmp-server

show snmp-server

This command displays the status and current configuration of the SNMP server.

Syntax `show snmp-server`

Mode Privileged Exec

Example To display the status of the SNMP server, use the command:

```
awplus# show snmp-server
```

Output Figure 88-4: Example output from the **show snmp-server** command

```
SNMP Server ......................... Enabled
IP Protocol ......................... IPv4
SNMPv3 Engine ID (configured name) ... Not set
SNMPv3 Engine ID (actual) ............ 0x80001f888021338e4747b8e607
```

Related Commands
debug snmp
show counter snmp-server
snmp-server
snmp-server engineID local
snmp-server engineID local reset

show snmp-server community

This command displays the SNMP server communities configured on the device. SNMP communities are specific to v1 and v2c.

Syntax `show snmp-server community`

Mode Privileged Exec

Example To display the SNMP server communities, use the command:

```
awplus# show snmp-server community
```

Output Figure 88-5: Example output from the **show snmp-server community** command

```
SNMP community information:
  Community Name ........... public
    Access ................. Read-only
    View ................... none
```

Related Commands show snmp-server
snmp-server community

show snmp-server group

This command displays information about SNMP server groups. This command is used with SNMP version 3 only.

Syntax `show snmp-server group`

Mode Privileged Exec

Example To display the SNMP groups configured on the device, use the command:

```
awplus# show snmp-server group
```

Output Figure 88-6: Example output from the **show snmp-server group** command

```
SNMP group information:
  Group name ..... guireadgroup
    Security Level ..... priv
    Read View ..... guiview
    Write View ..... none
    Notify View ..... none

  Group name ..... guiwritegroup
    Security Level ..... priv
    Read View ..... none
    Write View ..... guiview
    Notify View ..... none
```

Related Commands show snmp-server
snmp-server group

show snmp-server user

This command displays the SNMP server users and is used with SNMP version 3 only.

Syntax `show snmp-server user`

Mode Privileged Exec

Example To display the SNMP server users configured on the device, use the command:

```
awplus# show snmp-server user
```

Output Figure 88-7: Example output from the **show snmp-server user** command

```
Name            Group name          Auth        Privacy
-------         -------------       -------     ----------
freddy          guireadgroup        none        none
```

Related Commands show snmp-server
snmp-server user

show snmp-server view

This command displays the SNMP server views and is used with SNMP version 3 only.

Syntax `show snmp-server view`

Mode Privileged Exec

Example To display the SNMP server views configured on the device, use the command:

```
awplus# show snmp-server view
```

Output Figure 88-8: Example output from the **show snmp-server view** command

```
SNMP view information:
  View Name ............... view1
    OID ..................... 1
    Type .................... included
```

Related Commands show snmp-server
snmp-server view

snmp trap link-status

Use this command to enable SNMP to send link status notifications (traps) for the interfaces when an interface goes up (linkUp) or down (linkDown).

Use the no variant of this command to disable the sending of link status notifications.

Syntax

```
snmp trap link-status
no snmp trap link-status
```

Default By default, link status notifications are disabled.

Mode Interface Configuration

Usage The link status notifications can be enabled for the following interface types:

- switch port (e.g. port 1.0.1)
- VLAN (e.g. vlan2)
- Ethernet (e.g. eth0)
- static and dynamic link aggregation (e.g. sa2, po3)

To specify where notifications are sent, use the snmp-server host command on page 88.23. To configure the switch globally to send other notifications, use the snmp-server enable trap command on page 88.17.

Examples To enable SNMP to send link status notifications for ports 1.0.2 to 1.0.12, use following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2-1.0.12
awplus(config-if)# snmp trap link-status
```

To disable the sending of link status notifications for port 1.0.2, use following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no snmp trap link-status
```

Related Commands

show interface
snmp trap link-status suppress
snmp-server enable trap
snmp-server host

snmp trap link-status suppress

Use this command to enable the suppression of link status notifications (traps) for the interfaces beyond the specified threshold, in the specified interval.

Use the no variant of this command to disable the suppression of link status notifications for the ports.

Syntax

```
snmp trap link-status suppress
   {time {<1-60>|default}|threshold {<1-20>|default}}

no snmp trap link-status suppress
```

Parameter	Description
`time`	Set the suppression timer for link status notifications.
<1-60>	The suppress time in seconds.
`default`	The default suppress time in seconds (60).
`threshold`	Set the suppression threshold for link status notifications. This is the number of link status notifications after which to suppress further notifications within the suppression timer interval.
<1-20>	The number of link status notifications.
`default`	The default number of link status notifications (20).

Default By default, if link status notifications are enabled (they are enabled by default), the suppression of link status notifications is enabled: notifications that exceed the notification threshold (default 20) within the notification timer interval (default 60 seconds) are not sent.

Mode Interface Configuration

Usage An unstable network can generate many link status notifications. When notification suppression is enabled, a suppression timer is started when the first link status notification of a particular type (linkUp or linkDown) is sent for an interface. If the threshold number of notifications of this type is sent before the timer reaches the suppress time, any further notifications of this type generated for the interface during the interval are not sent. At the end of the interval, the sending of link status notifications resumes, until the threshold is reached in the next interval.

Examples To enable the suppression of link status notifications for ports 1.0.2 to 1.0.12 after 10 notifications have been sent in 40 seconds, use following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2-1.0.12
awplus(config-if)# snmp trap link-status suppress time 40
                   threshold 10
```

To disable the suppression link status notifications for port 1.0.2, use following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no snmp trap link-status suppress
```

Related Commands
show interface
snmp trap link-status

snmp-server

Use this command to enable the SNMP agent (server) on the switch. The SNMP agent receives and processes SNMP packets sent to the switch, and generates notifications (traps) that have been enabled by the snmp-server enable trap command on page 88.17.

Use the no variant of this command to disable the SNMP agent on the switch. When SNMP is disabled, SNMP packets received by the switch are discarded, and no notifications are generated. This does not remove any existing SNMP configuration.

Syntax

```
snmp-server [ip|ipv6]
no snmp-server [ip|ipv6]
```

Parameter	Description
ip	Enable or disable the SNMP agent for IPv4.
ipv6	Enable or disable the SNMP agent for IPv6.

Default By default, the SNMP agent is enabled for both IPv4 and IPv6. If neither the ip parameter nor the ipv6 parameter is specified for this command, then SNMP is enabled or disabled for both IPv4 and IPv6.

Mode Global Configuration

Examples To enable SNMP on the switch for both IPv4 and IPv6, use the commands:

```
awplus# configure terminal
awplus(config)# snmp-server
```

To enable the SNMP agent for IPv4 on the device, use the commands:

```
awplus# configure terminal
awplus(config)# snmp-server ip
```

To disable the SNMP agent for both IPv4 and IPv6 on the switch, use the commands:

```
awplus# configure terminal
awplus(config)# no snmp-server
```

To disable the SNMP agent for IPv4, use the commands:

```
awplus(config)# no snmp-server ipv4
```

Related Commands
show snmp-server
show snmp-server community
show snmp-server user
snmp-server community

snmp-server contact
snmp-server enable trap
snmp-server engineID local
snmp-server group
snmp-server host
snmp-server location
snmp-server view

snmp-server community

This command creates an SNMP community, optionally setting the access mode for the community. The default access mode is read only. If view is not specified, the community allows access to all the MIB objects. The SNMP communities are only valid for SNMPv1 and v2c and provide very limited security. Communities should not be used when operating SNMPv3.

The no variant of this command removes an SNMP community. The specified community must already exist on the device.

Syntax

```
snmp-server community <community-name>
    {view <view-name>|ro|rw|<access-list>}

no snmp-server community <community-name> [{view <view-name>|<access-
    list>}]
```

Parameter	Description
`<community-name>`	Community name. The community name is a string up to 20 characters long and is case sensitive.
`view`	Configure SNMP view. If view is not specified, the community allows access to all the MIB objects.
`<view-name>`	View name. The view name is a string up to 20 characters long and is case sensitive.
`ro`	Read-only community.
`rw`	Read-write community.
`<access-list>`	*<1-99>* Access list number.

Mode Global Configuration

Example The following command creates an SNMP community called "public" with read only access to all MIB variables from any management station.

```
awplus# configure terminal
awplus(config)# snmp-server community public ro
```

The following command removes an SNMP community called "public"

```
awplus# configure terminal
awplus(config)# no snmp-server community public
```

Related Commands

show snmp-server
show snmp-server community
snmp-server view

snmp-server contact

This command sets the contact information for the system. The contact name is:

- displayed in the output of the show system command
- stored in the MIB object sysContact

The no variant of this command removes the contact information from the system.

Syntax

```
snmp-server contact <contact-info>
no snmp-server contact
```

Parameter	Description
<contact-info>	The contact information for the system, from 0 to 255 characters long. Valid characters are any printable character and spaces.

Mode Global Configuration

Example To set the system contact information to “support@alliedtelesis.co.nz”, use the command:

```
awplus# configure terminal
awplus(config)# snmp-server contact support@alliedtelesis.co.nz
```

Related Commands

show system
snmp-server location
snmp-server group

snmp-server enable trap

Use this command to enable the switch to send the specified notifications (traps).

Note that the Environmental Monitoring traps are enabled by default. So you do not need to issue this command for the Environmental Monitoring traps since these are enabled by default. SNMP environmental monitoring traps defined in AT-ENVMONv2-MIB are enabled by default.

Use the no variant of this command to disable the sending of the specified notifications.

Syntax

```
snmp-server enable trap {[auth] [bgp] [dhcpsnooping] [epsr] [lldp]
    [loopprot] [mstp] [nsm] [ospf] [pim] [rmon] [vcs] [vrrp]}

no snmp-server enable trap {[auth] [bgp] [dhcpsnooping] [epsr] [lldp]
    [loopprot] [mstp] [nsm] [ospf] [pim] [rmon] [vcs] [vrrp]}
```

Parameter	Description
`auth`	Authentication failure.
`bgp`	BGP traps.
`dhcpsnooping`	DHCP snooping and ARP security traps. These notifications must also be set using the ip dhcp snooping violation command on page 78.22, and/or the arp security violation command on page 78.3.
`epsr`	EPSR traps.
`lldp`	Link Layer Discovery Protocol (LLDP) traps. These notifications must also be enabled using the lldp notifications command on page 91.13, and/or the lldp med-notifications command on page 91.8.
`loopprot`	Loop Protection traps.
`mstp`	MSTP traps.
`nsm`	NSM traps.
`ospf`	OSPF traps.
`pim`	PIM traps.
`rmon`	RMON traps.
`vcs`	VCS traps.
`vrrp`	Virtual Router Redundancy (VRRP) traps.

Default By default, no notifications are generated.

Mode Global Configuration

Usage This command cannot be used to enable link status notifications globally. To enable link status notifications for particular interfaces, use the snmp trap link-status command.

To specify where notifications are sent, use the snmp-server host command.

Examples To enable the device to send OSPF and VRRP-related traps, use the following commands:

```
awplus# configure terminal
awplus(config)# snmp-server enable trap ospf vrrp
```

To disable OSPF traps being sent out by the switch, use the following commands:

```
awplus# configure terminal
awplus(config)# no snmp-server enable trap ospf
```

Related Commands
show snmp-server
show ip dhcp snooping
snmp trap link-status
snmp-server host

snmp-server engineID local

Use this command to configure the SNMPv3 engine ID. The SNMPv3 engine ID is used to uniquely identify the SNMPv3 agent on a switch when communicating with SNMP management clients. Once an SNMPv3 engine ID is assigned, this engine ID is permanently associated with the switch until you change it.

Use the no variant of this command to set the user defined SNMPv3 engine ID to a system generated pseudo-random value by resetting the SNMPv3 engine. The no snmp-server engineID local command has the same effect as the snmp-server engineID local default command. Note that the snmp-server engineID local reset command is used to force the system to generate a new engine ID when the current engine ID is also system generated.

Syntax

```
snmp-server engineID local {<engine-id>|default}
no snmp-server engineID local
```

Parameter	Description
<engine-id>	Specify SNMPv3 Engine ID value, a string of up to 27 characters.
`default`	Set SNMPv3 engine ID to a system generated value by resetting the SNMPv3 engine, provided the current engine ID is user defined. If the current engine ID is system generated, use the snmp-server engineID local reset command to force the system to generate a new engine ID.

Mode Global Configuration

Usage All switches must have a unique engine ID which is permanently set unless it is configured by the user.

In a stacked environment, if the same engine ID was automatically generated for all members of the stack, conflicts would occur if the stack was dismantled. Therefore, each member of the stack will generate its own engine ID and the stack master's ID is used when transmitting SNMPv3 packets. Should a master failover occur, a different engine ID is transmitted. You can modify this behavior by manually assigning all stack members the same engine ID using the snmp-server engineID local command. However, should you decide to separate the stack and use the switches individually, you must remember to change or remove this configuration to prevent conflicts.

Example To set the SNMPv3 engine ID to 800000cf030000cd123456, use the following commands:

```
awplus# configure terminal
awplus(config)# snmp-server engineID local
800000cf030000cd123456
```

To set a user defined SNMPv3 engine ID back to a system generated value, use the following commands:

```
awplus# configure terminal
awplus(config)# no snmp-server engineID local
```

Output The following example shows the engine ID values after configuration:

```
awplus(config)#snmp-server engineid local asdgdfh231234d
awplus(config)#exit
awplus#show snmp-server

SNMP Server ........................... Enabled
IP Protocol ........................... IPv4
SNMPv3 Engine ID (configured name) ... asdgdfh231234d
SNMPv3 Engine ID (actual) ............. 0x80001f888029af52e149198483

awplus(config)#no snmp-server engineid local
awplus(config)#exit
awplus#show snmp-server

SNMP Server ........................... Enabled
IP Protocol ........................... IPv4
SNMPv3 Engine ID (configured name) ... Not set
SNMPv3 Engine ID (actual) ............. 0x80001f888029af52e149198483
```

Validation Commands show snmp-server

Related Commands snmp-server engineID local reset
snmp-server group

snmp-server engineID local reset

Use this command to force the switch to generate a new pseudo-random SNMPv3 engine ID by resetting the SNMPv3 engine. If the current engine ID is user defined, use the snmp-server engineID local command to set SNMPv3 engine ID to a system generated value.

Syntax `snmp-server engineID local reset`

Mode Global Configuration

Example To force the SNMPv3 engine ID to be reset to a system generated value, use the commands:

```
awplus# configure terminal
awplus(config)# snmp-server engineID local reset
```

Validation Commands show snmp-server

Related Commands snmp-server engineID local

snmp-server group

This command is used with SNMP version 3 only, and adds an SNMP group, optionally setting the security level and view access modes for the group. The security and access views defined for the group represent the minimum required of its users in order to gain access.

The no variant of this command deletes an SNMP group, and is used with SNMPv3 only. The group with the specified authentication/encryption parameters must already exist.

Syntax

```
snmp-server group <groupname> {auth|noauth|priv}
   [read <readname>|write <writename>|notify <notifyname>]

no snmp-server group <groupname> {auth|noauth|priv}
```

Parameter	Description
<groupname>	Group name. The group name is a string up to 20 characters long and is case sensitive.
`auth`	Authentication.
`noauth`	No authentication and no encryption.
`priv`	Authentication and encryption.
`read`	Configure read view.
<readname>	Read view name.
`write`	Configure write view.
<writename>	Write view name. The view name is a string up to 20 characters long and is case sensitive.
`notify`	Configure notify view.
<notifyname>	Notify view name. The view name is a string up to 20 characters long and is case sensitive.

Mode Global Configuration

Examples To add SNMP group, for ordinary users, user the following commands:

```
awplus# configure terminal
awplus(config)# snmp-server group usergroup noauth read
                useraccess write useraccess
```

To delete SNMP group `usergroup`, use the following commands

```
awplus# configure terminal
awplus(config)# no snmp-server group usergroup noauth
```

Related Commands

snmp-server
show snmp-server
show snmp-server group
show snmp-server user

snmp-server host

This command specifies an SNMP trap host destination to which Trap or Inform messages generated by the device are sent.

For SNMP version 1 and 2c you must specify the community name parameter. For SNMP version 3, specify the authentication/encryption parameters and the user name. If the version is not specified, the default is SNMP version 1. Inform messages can be sent instead of traps for SNMP version 2c and 3.

Use the no variant of this command to remove an SNMP trap host. The trap host must already exist.

The trap host is uniquely identified by:

- host IP address (IPv4 or IPv6),
- inform or trap messages,
- community name (SNMPv1 or SNMP v2c) or the authentication/encryption parameters and user name (SNMP v3).

Syntax

```
snmp-server host {<ipv4-address>|<ipv6-address>} [traps] [version 1]
   <community-name>]

snmp-server host {<ipv4-address>|<ipv6-address>} [informs|traps]
   version 2c <community-name>

snmp-server host {<ipv4-address>|<ipv6-address>} [informs|traps]
   version 3 {auth|noauth|priv} <user-name>

no snmp-server host {<ipv4-address>|<ipv6-address>} [traps]
   [version 1] <community-name>

no snmp-server host {<ipv4-address>|<ipv6-address>} [informs|traps]
   version 2c <community-name>

no snmp-server host {<ipv4-address>|<ipv6-address>} [informs|traps]
   version 3 {auth|noauth|priv} <user-name>
```

Parameter	Description
<ipv4-address>	IPv4 trap host address in the format A.B.C.D, for example, 192.0.2.2.
<ipv6-address>	IPv6 trap host address in the format x:x::x:x for example, 2001:db8::8a2e:7334.
informs	Send Inform messages to this host.
traps	Send Trap messages to this host (default).
version	SNMP version to use for notification messages. Default: version 1.
1	Use SNMPv1(default).
2c	Use SNMPv2c.
3	Use SNMPv3.
auth	Authentication.
noauth	No authentication.

Parameter(cont.)	Description(cont.)
`priv`	Encryption.
`<community-name>`	The SNMPv1 or SNMPv2c community name.
`<user-name>`	SNMPv3 user name.

Mode Global Configuration

Examples To configure the device to send generated traps to the IPv4 host destination `192.0.2.5` with the SNMPv2c community name *public*, use the following command:

```
awplus# configure terminal
awplus(config)# snmp-server host 192.0.2.5 version 2c public
```

To configure the device to send generated traps to the IPv6 host destination `2001:db8::8a2e:7334` with the SNMPv2c community name *private*, use the following command:

```
awplus# configure terminal
awplus(config)# snmp-server host 2001:db8::8a2e:7334 version 2c
private
```

To remove a configured trap host of 192.0.2.5 with the SNMPv2c community name *public*, use the following command:

```
awplus# configure terminal
awplus(config)# no snmp-server host 192.0.2.5 version 2c public
```

Related Commands
snmp trap link-status
snmp-server enable trap
snmp-server view

snmp-server location

This command sets the location of the system. The location is:

- displayed in the output of the show system command
- stored in the MIB object sysLocation

The no variant of this command removes the configured location from the system.

Syntax

```
snmp-server location <location-name>
no snmp-server location
```

Parameter	Description
<location-name>	The location of the system, from 0 to 255 characters long. Valid characters are any printable character and spaces.

Mode Global Configuration

Example To set the location to “server room 523”, use the following commands:

```
awplus# configure terminal
awplus(config)# system location server room 523
```

Related Commands

show snmp-server
show system
snmp-server contact

snmp-server source-interface

Use this command to specify the interface that SNMP traps or informs originate from. You cannot specify an interface that does not already have an IP address assigned to the interface.

Use the no variant of this command to reset to the default source interface that SNMP traps or informs originate from (the Egress interface as sent from by default).

Syntax

```
snmp-server source-interface {traps|informs} <interface-name>
no snmp-server source-interface {traps|informs}
```

Parameter	Description
`traps`	SNMP traps.
`informs`	SNMP informs.
`<interface-name>`	Interface name (with an IP address already assigned).

Default By default the source interface is the Egress interface where traps or informs were sent from.

Mode Global Configuration

Usage An SNMP trap or inform sent from an SNMP server has the notification IP address of the interface where it was sent from. Use this command to monitor notifications from an interface.

Example To set the interface that SNMP informs originate from to port 1.0.2 for inform packets, use the following commands:

```
awplus# configure terminal
awplus(config)# snmp-server source-interface informs port1.0.2
```

To reset the interface to the default source interface (the Egress interface) that SNMP traps originate from for trap packets, use the following commands:

```
awplus# configure terminal
awplus(config)# no snmp-server source-interface traps
```

Validation Commands show running-config

snmp-server user

Use this command to create or move users as members of specified groups. This command is used with SNMPv3 only.

The no variant of this command removes an SNMPv3 user. The specified user must already exist.

Syntax

```
snmp-server user <username> <groupname> [encrypted]
   [auth {md5|sha} <auth-password>]
   [priv {des|aes} <privacy-password>]

no snmp-server user <username>
```

Parameter	Description
<username>	User name. The user name is a string up to 20 characters long and is case sensitive.
<groupname>	Group name. The group name is a string up to 20 characters long and is case sensitive.
encrypted	Use the encrypted parameter when you want to enter encrypted passwords.
auth	Authentication protocol.
md5	MD5 Message Digest Algorithms.
sha	SHA Secure Hash Algorithm.
<auth-password>	Authentication password. The password is a string of 8 to 20 characters long and is case sensitive.
priv	Privacy protocol.
des	DES Data Encryption Standard.
aes	AES Advanced Encryption Standards.
<privacy-password>	Privacy password. The password is a string of 8 to 20 characters long and is case sensitive.

Mode Global Configuration

Usage Additionally this command provides the option of selecting an authentication protocol and (where appropriate) an associated password. Similarly, options are offered for selecting a privacy protocol and password.

- Note that each SNMP user must be configured on both the manager and agent entities. Where passwords are used, these passwords must be the same for both entities.
- Use the encrypted parameter when you want to enter already encrypted passwords in encrypted form as displayed in the running and startup configs stored on the switch. For example, you may need to move a user from one group to another group and keep the same passwords for the user instead of removing the user to apply new passwords.
- User passwords are entered using plaintext without the encrypted parameter and are encrypted according to the authentication and privacy protocols selected.
- User passwords are viewed as encrypted passwords in running and startup configs shown

from show running-config and show startup-config commands respectively. Copy and paste encrypted passwords from running-configs or startup-configs to avoid entry errors.

Examples To add SNMP user `authuser` as a member of group `usergroup`, with authentication protocol `md5`, authentication password `Authpass`, privacy protocol `des` and privacy password `Privpass`, use the following commands

```
awplus# configure terminal
awplus(config)# snmp-server user authuser usergroup auth md5
Authpass priv des Privpass
```

Validate the user is assigned to the group using the following command:

```
awplus#show snmp-server user
Name                Group name          Auth         Privacy
-------             -------------       -------      ----------
authuser            usergroup           md5          des
```

To enter existing SNMP user `authuser` with existing passwords as a member of group `newusergroup` with authentication protocol `md5` plus the encrypted authentication password `0x1c74b9c22118291b0ce0cd883f8dab6b74`, privacy protocol `des` plus the encrypted privacy password `0x0e0133db5453ebd03822b004eeacb6608f`, use the following commands

```
awplus# configure terminal
awplus(config)# snmp-server user authuser newusergroup
encrypted auth md5
0x1c74b9c22118291b0ce0cd883f8dab6b74 priv des
0x0e0133db5453ebd03822b004eeacb6608f
```

Note Copy and paste the encrypted passwords from the running-config or the startup-config displayed, using the show running-config and show startup-config commands respectively, into the command line to avoid key stroke errors issuing this command.

Validate the user has been moved from the first group using the following command:

```
awplus#show snmp-server user
Name                Group name          Auth         Privacy
-------             -------------       -------      ----------
authuser            newusergroup        md5          des
```

To delete SNMP user `authuser`, use the following commands:

```
awplus# configure terminal
awplus(config)# no snmp-server user authuser
```

Related Commands show snmp-server user
snmp-server view

snmp-server view

Use this command to create an SNMP view that specifies a sub-tree of the MIB. Further sub-trees can then be added by specifying a new OID to an existing view. Views can be used in SNMP communities or groups to control the remote manager's access.

Note The object identifier must be specified in a sequence of integers separated by decimal points.

The no variant of this command removes the specified view on the device. The view must already exist.

Syntax

```
snmp-server view <view-name> <mib-name> {included|excluded}
no snmp-server view <view-name>
```

Parameter	Description
<view-name>	SNMP server view name. The view name is a string up to 20 characters long and is case sensitive.
<mib-name>	Object identifier of the MIB.
included	Include this OID in the view.
excluded	Exclude this OID in the view.

Mode Global Configuration

Examples The following command creates a view called "loc" that includes system location mib sub-tree.

```
awplus(config)# snmp-server view loc 1.3.6.1.2.1.1.6.0 included
```

To remove the view "loc" use the following command

```
awplus(config)# no snmp-server view loc
```

Related Commands show snmp-server view
snmp-server community

undebug snmp

This command applies the functionality of the no debug snmp command.

Chapter 89: SNMP MIBs

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Private MIBs 89.70

Introduction

This chapter describes the Management Information Bases (MIBs) and managed objects supported by the AlliedWare Plus™ Operating System. The following topics are covered:

- "Allied Telesis Enterprise MIB" on page 89.5 describes the objects implemented in the Allied Telesis Enterprise MIB
- "Public MIBs" on page 89.66 describes the public MIBs supported by the AlliedWare Plus™ Operating System, and any variations from the standard implementation.

About MIBs

A MIB is a collection of managed objects organized into a tree-like hierarchy of nodes in which the managed objects form the leaves. Within the tree, each node is identified by a non-negative integer identifier that is unique among the node's siblings. The address, or object identifier, of any node within the tree is expressed as a series of dot-delimited node identifiers that trace the path from the root of the tree to the node. For example, the object identifier for the sysDescr object is 1.3.6.1.2.1.1.1.

For more information about MIBs and the structure of management information, see Chapter 87, SNMP Introduction.

About SNMP

A network management station (NMS) uses a protocol known as Simple Network Management Protocol (SNMP) to query or change the values of objects in the MIB of managed devices.

A managed device uses SNMP to respond to queries from an NMS, and to send unsolicited alerts (traps) to an NMS in response to events.

For more information about the Simple Network Management Protocol (SNMP), see Chapter 87, SNMP Introduction.

For information about configuring SNMP, see Chapter 88, SNMP Commands.

Obtaining MIBs

You can download MIBs from the following locations:

Download this MIB...	From this location...
Allied Telesis Enterprise MIB	The MIB files are available with the software files from the Support area at http://www.alliedtelesis.com.
Public MIBs defined in RFCs	http://www.rfc-editor.org/rfc.html
IANAifType-MIB	http://www.iana.org/assignments/ianaiftype-mib

Loading MIBs

Individual MIBs define a portion of the total MIB for a device. For example, the MAU-MIB defines objects for managing IEEE 802.3 medium attachment units (MAUs), and forms a sub-tree under mib-2 with the object identifier snmpDot3MauMgt (1.3.6.1.2.1.26).

All the objects within a MIB are assigned object identifiers relative to a parent object. Most MIBs import the object identifier of the parent object, along with other object identifiers, textual conventions, macros and syntax types from the MIBs where they are defined. This creates dependencies between MIBs.

Some network management stations and MIB compilers will generate errors if you load a MIB that depends on another MIB that has not already been loaded. To avoid these errors, we recommend that you load MIBs in the following order:

1. RFC 1212
   RFC 1239
   RFC 2257
   RFC 3410

2. RFC1155-SMI (RFC 1155)
   SNMPv2-SMI (RFC 2578)
   SNMPv2-PDU (RFC 3416)

3. RFC1213-MIB (RFC 1213)
   RFC 1215
   SNMPv2-TC (RFC 2579)
   SNMPv2-CONF (RFC 2580)

4. IP-MIB (RFC 2011)
   TCP-MIB (RFC 2012)
   UDP-MIB (RFC 2013)
   IP-FORWARD-MIB (RFC 2096)
   SNMP-MPD-MIB (RFC 2572)
   RMON-MIB (RFC 2819)
   HCNUM-TC (RFC 2856)
   SNMP-FRAMEWORK-MIB (RFC 3411)
   SNMP-MPD-MIB (RFC 3412)
   SNMPv2-TM (RFC 3417)
   SNMPv2-MIB (RFC 3418)
   INET-ADDRESS-MIB (RFC 4001)
   IANAifType-MIB

5. IF-MIB (RFC 2863)
   SNMP-TARGET-MIB (RFC 3413)

6. SNMP-COMMUNITY-MIB (RFC 2576)
   EtherLike-MIB (RFC 3635)
   MAU-MIB (RFC 3636)
   BRIDGE-MIB (RFC 4188)
   DISMAN-PING-MIB (RFC 4560)
   SNMP-NOTIFICATION-MIB (RFC 3413)
   SNMP-PROXY-MIB (RFC 3413)

7. P-BRIDGE-MIB (RFC 2674)
   Q-BRIDGE-MIB (RFC 2674)
   RSTP-MIB (RFC 4318)

LLDP-MIB
LLDP-EXT-DOT1-MIB
LLDP-EXT-DOT3-MIB
LLDP-EXT-MED-MIB
VRRP-MIB

8. AT-SMI-MIB

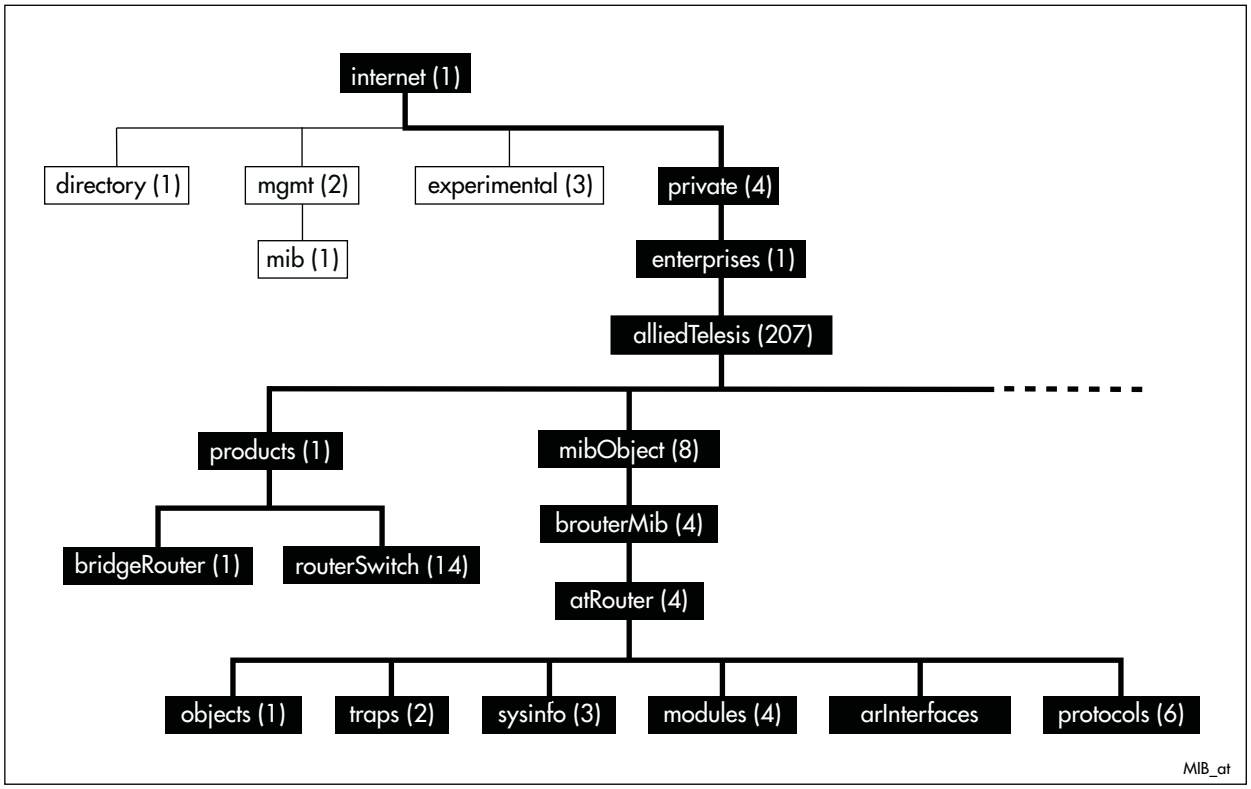
9. AT-BOARDS-MIB
AT-PRODUCT-MIB
AT-SETUP-MIB
AT-SYSINFO-MIB
AT-TRIGGER-MIB
AT-XEM-MIB
AT-VCSTACK-MIB
AT-USER-MIB
AT-RESOURCE-MIB
AT-LICENSE-MIB
AT-LOOPPROTECT-MIB
AT-DNS-CLIENT--MIB
AT-NTP-MIB
AT-EPSRv2-MIB
AT-FILEv2-MIB
AT-LOG-MIB
AT-IP-MIB
AT-ENVMONv2-MIB
AT-MIBVERSION-MIB
AT-DHCPSN-MIB

Allied Telesis Enterprise MIB

The *Allied Telesis Enterprise MIB* defines a portion of the Management Information Base (MIB) for managing Allied Telesis products and features that are not supported by public MIBs. Objects defined in this MIB reside in the private(4) subtree and have the object identifier alliedTelesis ({ enterprises 207 }).

This document describes only those portions of the Allied Telesis Enterprise MIB supported by the AlliedWare Plus™ Operating System. Figure 89-1 shows the structure of the Allied Telesis Enterprise MIB. Each component MIB is detailed in the following sections of this chapter.

Figure 89-1: The Allied Telesis Enterprise MIB sub-tree of the Internet-standard Management Information Base (MIB)



AT-SMI-MIB

AT-SMI-MIB defines the high-level structure and root objects of the Allied Telesis Enterprise MIB (Table 89-1). These objects are imported by other component MIBs of the Allied Telesis Enterprise MIB.

Table 89-1: AT Enterprise MIB - High Level Structure

Object	Object Identifier	Description
alliedTelesis	{ enterprises 207 } 1.3.6.1.4.1.207	Root of the Allied Telesis Enterprise MIB under the private(4) node defined in RFC1155-SMI.
products	{ alliedTelesis 1 } 1.3.6.1.4.1.207.1	Sub-tree of all product OIDs. Described in AT-PRODUCT-MIB.
bridgeRouter	{ products 1 } 1.3.6.1.4.1.207.1.1	Sub-tree of bridge product MIB objects (not applicable for AlliedWare Plus).
routerSwitch	{ products 14 } 1.3.6.1.4.1.207.1.2	Sub-tree for all router and switch product MIB objects.
mibObject	{ alliedTelesis 8 } 1.3.6.1.4.1.207.8	Sub-tree for all managed objects.
brouterMib	{ mibObject 4 } 1.3.6.1.4.1.207.8.4	Sub-tree of objects for managing bridges, routers, and switches.
atRouter	{ brouterMib 4 } 1.3.6.1.4.1.207.8.4.4	Sub-tree of objects for managing multiprotocol routers and switches.
objects	{ atRouter 1 } 1.3.6.1.4.1.207.8.4.4.1	Sub-tree of OIDs for boards, releases, interface types, and chips.
traps	{ atRouter 2 } 1.3.6.1.4.1.207.8.4.4.2	Sub-tree for generic traps (not applicable for AlliedWare Plus).
sysinfo	{ atRouter 3 } 1.3.6.1.4.1.207.8.4.4.3	Sub-tree of objects describing general system information.
modules	{ atRouter 4 } 1.3.6.1.4.1.207.8.4.4.4	Sub-tree of objects for monitoring and managing software features.
arInterfaces	{ atRouter 5 } 1.3.6.1.4.1.207.8.4.4.5	Sub-tree of objects describing boards, slots and physical interfaces.
protocols	{ atRouter 6 } 1.3.6.1.4.1.207.8.4.4.6	Sub-tree of OIDs for protocols.
atAgents	{ atRouter 7 } 1.3.6.1.4.1.207.8.4.4.7	Sub-tree of objects describing variations from standards.

Table 89-2 lists the major modules of the AT-SMI-MIB grouped by their object identifiers. Note that this is also the order in which they are described in this chapter.

Table 89-2: AT-SMI-MIBs Listed by Object Group

MIB Section	OID	Description
AT-SMI-MIB		This section describes the structure of management information for the Allied Telesis Enterprise object, alliedTelesis { 1.3.6.1.4.1.207 }.
AT-PRODUCT-MIB	1.3.6.1.4.1.207.1	Object identifiers for Allied Telesis products. See "AT-PRODUCT-MIB" on page 89.9.
AT-BOARDS-MIB	1.3.6.1.4.1.207.8.4.4.1.1	Object identifiers for boards, interface types, and chip sets. See "AT-BOARDS-MIB" on page 89.11.
AT-SYSINFO-MIB	1.3.6.1.4.1.207.8.4.4.3	Objects that describe generic system information and environmental monitoring. See "AT-SYSINFO-MIB" on page 89.14.
AT-XEM-MIB	1.3.6.1.4.1.207.8.4.4.3.11	Objects for managing XEMs (Expansion Modules). See "AT-XEM-MIB" on page 89.16.
AT-ENVMONv2-MIB	1.3.6.1.4.1.207.8.4.4.3.12	Objects and traps for monitoring fans, voltage rails, temperature sensors, and power supply bays. See "AT-ENVMONv2-MIB" on page 89.17.
AT-VCSTACK-MIB	1.3.6.1.4.1.207.8.4.4.3.13	Objects for managing Virtual Chassis Stacking (VCS). See "AT-VCSTACK-MIB" on page 89.22.
AT-MIBVERSION-MIB	1.3.6.1.4.1.207.8.4.4.3.15	Object to display the last software release that contained changes to the support AT Enterprise MIB definition files. See "AT-MIBVERSION-MIB" on page 89.26.
AT-USER-MIB	1.3.6.1.4.1.207.8.4.4.3.20	Objects for displaying information of users currently logged into a device, or configured in the Local User Data base of the device. See "AT-USER-MIB" on page 89.27.
AT-RESOURCE-MIB	1.3.6.1.4.1.207.8.4.4.3.21	Objects for displaying system hardware resource information. See "AT-RESOURCE-MIB" on page 89.29.
AT-LICENSE-MIB	1.3.6.1.4.1.207.8.4.4.3.22	Objects for managing software licenses on devices using AlliedWare Plus™ Operating System. See "AT-LICENSE-MIB" on page 89.30.
AT-TRIGGER-MIB	1.3.6.1.4.1.207.8.4.4.4.53	Objects for managing triggers. See "AT-TRIGGER-MIB" on page 89.33.
AT-LOOPPROTECT-MIB	1.3.6.1.4.1.207.8.4.4.4.54	Objects for managing Allied Telesis Loop Protection. See "AT-LOOPPROTECT-MIB" on page 89.35.
AT-SETUP-MIB	1.3.6.1.4.1.207.8.4.4.4.500	Objects for managing software installation and configuration files. See "AT-SETUP-MIB" on page 89.37.
AT-DNS-CLIENT-MIB	1.3.6.1.4.1.207.8.4.4.4.501	Objects for managing Allied Telesis DNS Client Configuration. See "AT-DNS-CLIENT-MIB" on page 89.47.
AT-NTP-MIB	1.3.6.1.4.1.207.8.4.4.4.502	Objects for managing Allied Telesis Network Time Protocol (NTP) configuration. See "AT-NTP-MIB" on page 89.48.
AT-EPSRv2-MIB	1.3.6.1.4.1.207.8.4.4.4.536	Objects for managing Allied Telesis EPSR. See "AT-EPSRv2-MIB" on page 89.51.
AT-DHCPSN-MIB	1.3.6.1.4.1.207.8.4.4.4.537	Objects for managing Allied Telesis DHCP Snooping. See "AT-DHCPSN-MIB" on page 89.53.
AT-FILEv2-MIB	1.3.6.1.4.1.207.8.4.4.4.600	Objects for displaying and managing file content on local, stacked and remote sources. See "AT-FILEv2-MIB" on page 89.56.

Table 89-2: AT-SMI-MIBs Listed by Object Group(cont.)

MIB Section	OID	Description
AT-LOG-MIB	1.3.6.1.4.1.207.8.4.4.4.601	Objects for listing log entries from the buffered and permanent logs. See "AT-LOG-MIB" on page 89.62.
AT-IP-MIB	1.3.6.1.4.1.207.8.4.4.4.602	Objects for Allied Telesis specific IP address management. See "AT-IP-MIB" on page 89.64.

AT-PRODUCT-MIB

AT-PRODUCT-MIB defines object identifiers for Allied Telesis products. Objects in this MIB have the object identifier products ({ alliedTelesis 1 }). Table 89-3 lists object identifiers for products supported by the AlliedWare Plus™ Operating System.

Table 89-3: Object identifiers for Allied Telesis products supported by the AlliedWare Plus™ Operating System

Object	Object Identifier	Description
at_SwitchBladex908	{ routerSwitch 69 }	Switchblade x908 8 Slot Layer 3 Switch Chassis
at_x900_12XTS	{ routerSwitch 70 }	AT-x900-12XT/S Advanced Gigabit Layer 3+ Expandable Switch, 12 x combo ports (10/100/1000BASE-T copper or SFP), 1 x 30Gbps expansion bay
at_x900_24XT	{ routerSwitch 75 }	x900-24XT Enhanced Gigabit Layer 3+ Expandable Switch, 24 x 10/100/1000BASE-T copper ports (RJ-45 connectors), 2 x 20 Gigabit expansion bays
at_x900_24XS	{ routerSwitch 76 }	x900-24XS Enhanced Gigabit Layer 3+ Expandable Switch, 24 x 10/100/1000BASE-T copper ports (RJ-45 connectors), 2 x 20 Gigabit expansion bays
at_x900_24XT_N	{ routerSwitch 77 }	x900-24XT-N Enhanced Gigabit Layer 3+ Expandable Switch, 24 x 10/100/1000BASE-T copper ports (RJ-45 connectors), 2 x 20 Gigabit expansion bays, NEBS compliant
at_x600_24Ts	{ routerSwitch 80 }	x600-24Ts Stackable Managed L2+/L3 Ethernet Switch, 24 x 1000BASE-T copper ports, 4 x SFP (combo) ports
at_x600_24TsXP	{ routerSwitch 81 }	x600-24Ts/XP Stackable Managed L2+/L3 Ethernet Switch, 24 x 1000BASE-T copper ports, 4 x SFP (combo) ports, 2 x XFP ports
at_x600_48Ts	{ routerSwitch 82 }	x600-48Ts Stackable Managed L2+/L3 Ethernet Switch, 48 x 1000BASE-T copper ports, 4 x SFP ports
at_x600_48TsXP	{ routerSwitch 83 }	x600-48Ts/XP Stackable Managed L2+/L3 Ethernet Switch, 48 x 1000BASE-T copper ports, 4 x SFP ports, 2 x XFP ports
at_x600-24TsPoE	{ routerSwitch 91}	x600-24Ts-POE Stackable Managed L2+/L3 Ethernet PoE Switch, 24 x 1000BASE-T PoE ports, 4 x SFP (combo) ports
at_x600_24TPoEPlus	{routerSwitch 92}	x600-24Ts-POE+ Stackable Managed L2+/L3 Ethernet PoE+ Switch, 24 x 1000BASE-T PoE+ ports, 4 x SFP (combo) ports
x610_48Ts_X_POEPlus	{routerSwitch 93}	x610-48Ts/X-POE+ Stackable Managed L2+/L3 Ethernet PoE+ Switch, 48 x 1000BASE-T PoE+ ports, 2 x SFP (combo) ports, 2 x SFP+ ports
x610_48Ts_POEPlus	{routerSwitch 94}	x610-48Ts-POE+ Stackable Managed L2+/L3 Ethernet PoE+ Switch, 48 x 1000BASE-T PoE+ ports, 4 x SFP (combo) ports
x610_24Ts_X_POEPlus	{routerSwitch 95}	x610-24Ts/X-POE+ Stackable Managed L2+/L3 Ethernet PoE+ Switch, 24 x 1000BASE-T PoE+ ports, 4 x SFP (combo) ports, 2 x SFP+ ports
x610_24Ts_POEPlus	{routerSwitch 96}	x610-24Ts-POE+ Stackable Managed L2+/L3 Ethernet PoE+ Switch, 24 x 1000BASE-T PoE+ ports, 4 x SFP (combo) ports

Table 89-3: Object identifiers for Allied Telesis products supported by the AlliedWare Plus™ Operating

Object	Object Identifier	Description
x610_48Ts_X	{routerSwitch 97}	x610-48Ts/X Stackable Managed L2+/L3 Ethernet Switch, 48 x 1000BASE-T copper ports, 2 x SFP (combo) ports, 2 x SFP+ ports
x610_48Ts	{routerSwitch 98}	x610-48Ts Stackable Managed L2+/L3 Ethernet Switch, 24 x 1000BASE-T copper ports, 4 x SFP (combo) ports
x610_24Ts_X	{routerSwitch 99}	x610-24Ts/X Stackable Managed L2+/L3 Ethernet Switch, 24 x 1000BASE-T copper ports, 4 x SFP (combo) ports, 2 x SFP+ ports
x610_24Ts	{routerSwitch 100}	x610-24Ts Stackable Managed L2+/L3 Ethernet Switch, 24 x 1000BASE-T copper ports, 4 x SFP (combo) ports
x610_24SP_X	{routerSwitch 101}	x610-24SP/X Stackable Managed L2+/L3 Ethernet Switch, 24 x SFP (combo) ports, 2 x SFP+ ports

AT-BOARDS-MIB

AT-BOARDS-MIB defines object identifiers for components of Allied Telesis products—base CPU and expansion boards, interface types, and chip sets. Objects in this MIB have the object identifier objects ({ atRouter 1 }), and are organized into the following groups:

- Base CPU and expansion boards (Table 89-4). These object identifiers are for use with the hrDeviceID object in the Host Resources MIB (see "Public MIBs" on page 89.66).
- Interface types (Table 89-5).
- Chip sets (Table 89-6).

Table 89-4: Object identifiers for base CPU and expansion boards

Object	Object Identifier	Description
boards	{ objects 1 }	
pprx90024XT	{ boards 271 }	x900-24XT Enhanced Gigabit Layer 3+ Expandable Switch, 24 x 10/100/1000BASE-T copper ports (RJ-45 connectors), 2 x 20 Gigabit expansion bays
pprx90024XS	{ boards 272 }	x900-24XS Enhanced Gigabit Layer 3+ Expandable Switch, 24 x 10/100/1000BASE-T copper ports (RJ-45 connectors), 2 x 20 Gigabit expansion bays
pprAtXum10Gi	{ boards 273 }	XEM-1XP Expansion Module, 1 x 10Gbe XFP port
pprAtXum12SFPi	{ boards 274 }	XEM-12S Expansion Module, 12 x SFP Gigabit ports
pprAtXum12Ti	{ boards 275 }	XEM-12T Expansion Module, 12 x 10/100/100BASE-T copper ports (RJ-45 connectors)
pprAtXum12TiN	{ boards 280 }	XEM-12T-N Expansion Module, 12 x 10/100/100BASE-T copper ports (RJ-45 connectors), NEBS compliant
pprx90024XTN	{ boards 281 }	x900-24XT Enhanced Gigabit Layer 3+ Expandable Switch, 24 x 10/100/1000BASE-T copper ports (RJ-45 connectors), 2 x 20 Gigabit expansion bays, NEBS compliant
pprSwitchBladex908	{ boards 282 }	Switchblade x908 8 Slot Layer 3 Switch Chassis
pprx90012XTS	{ boards 288 }	AT-x900-12XT/S Advanced Gigabit Layer 3+ Expandable Switch, 12 x combo ports (10/100/1000BASE-T copper or SFP), 1 x 30Gbps expansion bay
pprAt9524TS	{ boards 290 }	x600-24Ts/XP, 24 x 1000BASE-T ports (RJ45 connectors), 4 x SFP (combo) ports
pprAt9524TSXP	{ boards 291 }	x600-24Ts/XP, 24 x 1000BASE-T ports (RJ45 connectors), 4 x SFP (combo) ports, 2 x XFP ports
pprAt9548TS	{ boards 294 }	x600-44Ts, 44 x 1000BASE-T ports, 4 x SFP ports
pprAt9548TSXP	{ boards 295 }	x600-44Ts/XP, 44 x 1000BASE-T ports, 4 x SFP ports, 2 x XFP ports
pprXem2XP	{ boards 306 }	XEM-2XP Expansion Module, 2 x 10Gbe XFP port
pprATStackXG	{ boards 307 }	x600 Expansion Module, Stacking
pprATEMXP	{ boards 308 }	x600 Expansion Module, 2 x 10G XFP ports
pprATLBM	{ boards 309 }	x600 Expansion Module, loopback
pprAtPWR05DC	{ boards 323 }	AT-PWR05, DC power supply unit for SwitchBlade x908
pprXem2XT	{ boards 325 }	XEM-2XT Expansion Module, 2 x 10Gbe copper XEM port
pprx60024TSPOE	{ boards 326 }	x600-24Ts-POE, 24 x 1000BASE-T PoE ports (RJ45 connectors), 4 x SFP (combo) ports

Table 89-4: Object identifiers for base CPU and expansion boards**(cont.)**

Object	Object Identifier	Description
pprx60024TSPOEPLUS	{ boards 327 }	x600-24Ts-POE+, 24 x 1000BASE-T PoE+ ports (RJ45 connectors), 4 x SFP (combo) ports
pprx61048TsXPOEPlus	{ boards 331 }	x610-48Ts/X-POE+, 48 x 1000BASE-T PoE+ ports (RJ45 connectors), 2 x SFP (combo) ports, 2 x SFP+ ports
pprx61048TsPOEPlus	{ boards 332 }	x610-48Ts-POE+, 48 x 1000BASE-T PoE+ ports (RJ45 connectors), 4 x SFP (combo) ports
pprx61024TsXPOEPlus	{ boards 333 }	x610-24Ts/X-POE+, 24 x 1000BASE-T PoE+ ports (RJ45 connectors), 4 x SFP (combo) ports, 2 x SFP+ ports
pprx61024TsPOEPlus	{ boards 334 }	x610-24Ts-POE+, 24 x 1000BASE-T PoE+ ports (RJ45 connectors), 4 x SFP (combo) ports
pprPWR800	{ boards 336 }	AT-PWR800, 800W power supply unit
pprPWR1200	{ boards 337 }	AT-PWR1200, 1200W power supply unit
pprPWR250	{ boards 338 }	AT-PWR250, 250W power supply unit
pprx61048TsX	{ boards 339 }	x610-48Ts/X, 48 x 1000BASE-T ports (RJ45 connectors), 2 x SFP (combo) ports, 2 x SFP+ ports
pprx61048Ts	{ boards 340 }	x610-48Ts, 48 x 1000BASE-T ports (RJ45 connectors), 4 x SFP (combo) ports
pprx61024TsX	{ boards 341 }	x610-24Ts/X, 24 x 1000BASE-T ports (RJ45 connectors), 4 x SFP (combo) ports, 2 x SFP+ ports
pprx61024Ts	{ boards 342 }	x610-24Ts, 24 x 1000BASE-T ports (RJ45 connectors), 4 x SFP (combo) ports
pprPWR250DC	{ boards 351 }	AT-PWR250DC, 250W DC power supply unit

Table 89-5: Object identifiers for interface types

Object	Object Identifier	Description
iftypes	{ objects 3 }	
ifaceEth	{ iftypes 1 }	Ethernet
ifaceSyn	{ iftypes 2 }	Synchronous
ifaceAsyn	{ iftypes 3 }	Asynchronous
ifaceBri	{ iftypes 4 }	BRI ISDN
ifacePri	{ iftypes 5 }	PRI ISDN
ifacePots	{ iftypes 6 }	POTS (voice)
ifaceGBIC	{ iftypes 7 }	GBIC (Gigabit Interface Converter)

Table 89-6: Object identifiers for chip sets

Object	Object Identifier	Description
chips	{ objects 4 }	
chip68020Cpu	{ chips 1 }	MC68020 CPU
chip68340Cpu	{ chips 2 }	MC68340 CPU
chip68302Cpu	{ chips 3 }	MC68302 CPU
chip68360Cpu	{ chips 4 }	MC68360 CPU
chip860TCpu	{ chips 5 }	MPC860T CPU
chipRtc1	{ chips 21 }	Real Time Clock v1

Table 89-6: Object identifiers for chip sets**(cont.)**

Object	Object Identifier	Description
chipRtc2	{ chips 22 }	Real Time Clock v2
chipRtc3	{ chips 23 }	Real Time Clock v3
chipRtc4	{ chips 24 }	Real Time Clock v4
chipRam1mb	{ chips 31 }	1 MB RAM
chipRam2mb	{ chips 32 }	2 MB RAM
chipRam3mb	{ chips 33 }	3 MB RAM
chipRam4mb	{ chips 34 }	4 MB RAM
chipRam6mb	{ chips 36 }	6 MB RAM
chipRam8mb	{ chips 38 }	8 MB RAM
chipRam12mb	{ chips 42 }	12 MB RAM
chipRam16mb	{ chips 46 }	16 MB RAM
chipRam20mb	{ chips 50 }	20 MB RAM
chipRam32mb	{ chips 62 }	32 MB RAM
chipFlash1mb	{ chips 71 }	1 MB FLASH memory
chipFlash2mb	{ chips 72 }	2 MB FLASH memory
chipFlash3mb	{ chips 73 }	3 MB FLASH memory
chipFlash4mb	{ chips 74 }	4 MB FLASH memory
chipFlash6mb	{ chips 76 }	6 MB FLASH memory
chipFlash8mb	{ chips 78 }	8 MB FLASH memory
chipPem	{ chips 120 }	Processor Enhancement Module

AT-SYSINFO-MIB

AT-SYSINFO-MIB defines objects that describe generic system information and environmental monitoring. Objects in this group have the object identifier sysinfo ({ atRouter 3 }). Table 89-7 lists the objects supported by the AlliedWare Plus™ Operating System.

Table 89-7: Objects defined in AT-SYSINFO-MIB

Object	Object Identifier	Description
sysinfo	{ atRouter 3 }	Subtree containing generic system information.
cpu	{ sysinfo 3 }	A collection of objects containing information about the CPU utilization over different periods of time. All values are expressed as a percentage - integer in range 0 to 100.
cpuUtilisationMax	{ cpu 1 }	Maximum CPU utilization since the device was last restarted.
cpuUtilisationAvg	{ cpu 2 }	Average CPU utilization since the device was last restarted.
cpuUtilisationAvgLastMinute	{ cpu 3 }	Average CPU utilization over the past minute.
cpuUtilisationAvgLast10Seconds	{ cpu 4 }	Average CPU utilization over the past ten seconds.
cpuUtilisationAvgLastSecond	{ cpu 5 }	Average CPU utilization over the past second.
cpuUtilisationAvgMaxLast5Minutes	{ cpu 6 }	Maximum CPU utilization over the last 5 minutes.
cpuUtilisationAvgLast5Minutes	{ cpu 7 }	Average CPU utilization over the past 5 minutes.
atContactDetails	{ sysinfo 5 }	Contact details for Allied Telesis.
memory	{ sysinfo 7 }	A collection of objects and traps for monitoring memory usage and status.
freeMemory	{ memory 1 }	Percentage of free memory still available on device.
totalBuffers	{ memory 2 }	Total number of buffers available on device.
lowMemoryTrap	{ memory 11 }	Notification of low memory, generated when a device's memory is below a certain level. Will display the values in 'freeMemory' and 'totalBuffers'
xem	{ sysinfo 11 }	A collection of objects for monitoring XEMs installed in the device. See "AT-XEM-MIB" on page 89.16.
atEnvMonv2	{ sysinfo 12 }	AT Environment Monitoring v2 MIB for managing and reporting data relating to voltage rails, fan speeds, temperature sensors and power supply units. See "AT-ENVMONv2-MIB" on page 89.17.
vcstack	{ sysinfo 13 }	A collection of objects for managing Virtual Chassis Stacking in AlliedWare Plus™. See "AT-VCSTACK-MIB" on page 89.22.
atPortInfo	{ sysinfo 14 }	Objects containing information about the transceiver of an interface.

Table 89-7: Objects defined in AT-SYSINFO-MIB(cont.)

Object	Object Identifier	Description
atPortInfoTransceiverTable	{ atPortInfo 1 }	A table containing information about the transceiver of an interface. Indexed by: ■ atPortInfoTransceiverifIndex
atPortInfoTransceiverEntry	{ atPortInfoTransceiverTable 1 }	Description of a single transceiver.
atPortInfoTransceiverifIndex	{ atPortInfoTransceiverEntry 1 }	The interface index for the interface represented by this entry.
atPortInfoTransceiverType	{ atPortInfoTransceiverEntry 2 }	The type of transceiver on an interface. Can be one of the following: ■ rj45 (1) ■ sfp-px (2) ■ sfp-bx10 (3) ■ sfp-fx (4) ■ sfp-100base-lx (5) ■ sfp-t (6) ■ sfp-cx (7) ■ sfp-zx-cwdm (8) ■ sfp-lx (9) ■ sfp-sx (10) ■ sfp-oc3-lr (11) ■ sfp-oc3-ir (12) ■ sfp-oc3-mm (13) ■ xfp-srsw (14) ■ xfp-lrlw (15) ■ xfp-erew (16) ■ xfp-sr (17) ■ xfp-lr (18) ■ xfp-er (19) ■ xfp-lrm (20) ■ xfp-sw (21) ■ xfp-lw (22) ■ xfp-ew (23) ■ unknown (24) ■ empty (25)
atPortRenumberEvents	{ atPortInfo 2 }	The number of times that port number values (represented by the dot1dBasePort object in BRIDGE-MIB), have been re-assigned due to stack member leave/join events or XEM hot-swap events, since the system was initialized.

AT-XEM-MIB

AT-XEM-MIB defines objects for managing XEMs (Expansion Modules) installed in the device (Table 89-8). Objects in this group have the object identifier xem ({ sysinfo 11 }) and reside in the sysinfo Group of the Allied Telesis Enterprise MIB.

Table 89-8: Objects defined in AT-XEM-MIB

Object	Object Identifier	Description
xemTraps	{ xem 0 }	Collection of traps generated when a XEM is inserted or removed.
xemInserted	{ xemTraps 1 }	Trap generated when a XEM card is inserted to the device. It returns the objects xemInfoStackId and xemInfoBayId.
xemRemoved	{ xemTraps 2 }	Trap generated when a XEM card is removed from the device. It returns the objects xemInfoStackId and xemInfoBayId.
xemInsertedFail	{ xemTraps 3 }	Trap generated when the insertion of a XEM card into the device fails. It returns the objects xemInfoStackId and xemInfoBayId.
xemNumOfXem	{ xem 1 }	Total number of XEMs installed in the device.
xemInfoTable	{ xem 2 }	Table of information about the XEMs installed in the device, indexed by xemInfoMemberId and xemInfoBayId.
xemInfoEntry	{ xemInfoTable 1 }	Information about a single XEM.
xemInfoMemberId	{ xemInfoEntry 1 }	Stack Member ID in which the XEM is installed.
xemInfoBayId	{ xemInfoEntry 2 }	Number of the XEM bay in which the XEM is installed.
xemInfoXemId	{ xemInfoEntry 3 }	Numeric board identity of the XEM. This information is displayed in the ID column of the SHOW SYSTEM command.
xemInfoBoardType	{ xemInfoEntry 4 }	Board type. For XEMs this is always “Expansion”. This information is displayed in the Board column of the SHOW SYSTEM command.
xemInfoBoardName	{ xemInfoEntry 5 }	Name of the XEM. This information is displayed in the Board Name column of the SHOW SYSTEM command.
xemInfoRevision	{ xemInfoEntry 6 }	Board revision of the XEM. This information is displayed in the Rev column of the SHOW SYSTEM command.
xemInfoSerialNumber	{ xemInfoEntry 7 }	Serial number of the XEM. This information is displayed in the Serial Number column of the SHOW SYSTEM command.

AT-ENVMONv2-MIB

The AT Environment Monitoring v2 MIB (atEnvMonv2-MIB) contains objects for managing and reporting data relating to fans, voltage rails, temperature sensors and power supply units installed in the device (Table 89-9). Objects in this group have the object identifier EnvMonv2 ({ sysinfo 12 }).

Table 89-9: Objects defined in AT-ENVMONV2-MIB

Object / Object Identifier	Description
atEnvMonv2Notifications { atEnvMonv2 0 }	Collection of traps (notification) objects for monitoring fans, voltage rails, temperature sensors, and power supply bays.
atEnvMonv2FanAlarmSetNotify { atEnvMonv2Notifications 1 }	Notification generated when the monitored speed of a fan drops below its lower threshold. It returns the value of: ■ atEnvMonv2FanStackMemberId ■ atEnvMonv2FanBoardIndex ■ atEnvMonv2FanIndex ■ atEnvMonv2FanDescription ■ atEnvMonv2FanLowerThreshold ■ atEnvMonv2FanCurrentSpeed
atEnvMonv2FanAlarmClearedNotify { atEnvMonv2Notifications 2 }	Notification generated when the monitored speed of a fan returns to an acceptable value, the fan having previously been in an alarm condition. It returns the value of: ■ atEnvMonv2FanStackMemberId ■ atEnvMonv2FanBoardIndex ■ atEnvMonv2FanIndex ■ atEnvMonv2FanDescription ■ atEnvMonv2FanLowerThreshold ■ atEnvMonv2FanCurrentSpeed
atEnvMonv2VoltAlarmSetNotify { atEnvMonv2Notifications 3 }	Notification generated when the voltage of a monitored voltage rail, goes out of tolerance by either dropping below its lower threshold, or exceeding its upper threshold. It returns the value of: ■ atEnvMonv2VoltageStackMemberId ■ atEnvMonv2VoltageBoardIndex ■ atEnvMonv2VoltageIndex ■ atEnvMonv2VoltageDescription ■ atEnvMonv2VoltageUpperThreshold ■ atEnvMonv2VoltageLowerThreshold ■ atEnvMonv2VoltageCurrent
atEnvMonv2VoltAlarmClearedNotify { atEnvMonv2Notifications 4 }	Notification generated when the voltage of a monitored voltage rail returns to an acceptable value, having previously been in an alarm condition. It returns the value of: ■ atEnvMonv2VoltageStackMemberId ■ atEnvMonv2VoltageBoardIndex ■ atEnvMonv2VoltageIndex ■ atEnvMonv2VoltageDescription ■ atEnvMonv2VoltageUpperThreshold ■ atEnvMonv2VoltageLowerThreshold ■ atEnvMonv2VoltageCurrent

Table 89-9: Objects defined in AT-ENVMONV2-MIB(cont.)

Object / Object Identifier	Description
atEnvMonv2TempAlarmSetNotify { atEnvMonv2Notifications 5 }	Notification generated when a monitored temperature exceeds its upper threshold. It returns the value of: ■ atEnvMonv2TemperatureStackMemberId ■ atEnvMonv2TemperatureBoardIndex ■ atEnvMonv2TemperatureIndex ■ atEnvMonv2TemperatureDescription ■ atEnvMonv2TemperatureUpperThreshold ■ atEnvMonv2TemperatureCurrent
atEnvMonv2TempAlarmClearedNotify { atEnvMonv2Notifications 6 }	Notification generated when a monitored temperature returns to an acceptable value, having previously been in an alarm condition. It returns the value of: ■ atEnvMonv2TemperatureStackMemberId ■ atEnvMonv2TemperatureBoardIndex ■ atEnvMonv2TemperatureIndex ■ atEnvMonv2TemperatureDescription ■ atEnvMonv2TemperatureUpperThreshold
atEnvMonv2PsbAlarmSetNotify { atEnvMonv2Notifications 7 }	Notification generated when a monitored parameter of a power supply bay device goes out of tolerance. It returns the value of: ■ atEnvMonv2PsbSensorStackMemberId ■ atEnvMonv2PsbSensorBoardIndex ■ atEnvMonv2PsbSensorIndex ■ atEnvMonv2PsbSensorType ■ atEnvMonv2PsbSensorDescription
atEnvMonv2PsbAlarmClearedNotify { atEnvMonv2Notifications 8 }	Notification generated when a monitored parameter of a power supply bay device returns to an acceptable value, having previously been in an alarm condition. It returns the value of: ■ atEnvMonv2PsbSensorStackMemberId ■ atEnvMonv2PsbSensorBoardIndex ■ atEnvMonv2PsbSensorIndex ■ atEnvMonv2PsbSensorType ■ atEnvMonv2PsbSensorDescription
atEnvMonv2FanTable { EnvMonv2 1 }	Table of information about fans installed in the device that have their fan speeds monitored by environment monitoring hardware, indexed by: ■ atEnvMonv2FanStackMemberId ■ atEnvMonv2FanBoardIndex ■ atEnvMonv2FanIndex
atEnvMonv2FanEntry { atEnvMonv2FanTable 1 }	Description, current speed, lower threshold speed and current status of a single fan.
atEnvMonv2FanStackMemberId { atEnvMonv2FanEntry 1 }	Index of the stack member hosting this fan.
atEnvMonv2FanBoardIndex { atEnvMonv2FanEntry 2 }	Index of the board hosting this fan in the board table.
atEnvMonv2FanIndex { atEnvMonv2FanEntry 3 }	Numeric identifier of this fan on its host board.
atEnvMonv2FanDescription { atEnvMonv2FanEntry 4 }	Description of this fan.
atEnvMonv2FanCurrentSpeed { atEnvMonv2FanEntry 5 }	Current speed of this fan in revolutions per minute.

Table 89-9: Objects defined in AT-ENVMONV2-MIB(cont.)

Object / Object Identifier	Description
atEnvMonv2FanLowerThreshold { atEnvMonv2FanEntry 6 }	Minimum acceptable speed of the fan in revolutions per minute.
atEnvMonv2FanStatus { atEnvMonv2FanEntry 7 }	Whether this fan is currently in an alarm condition. The values can be: ■ Failed (1) means that the current speed is too low. ■ Good (2) means that the current speed is acceptable.
atEnvMonv2VoltageTable { atEnvMonv2 2 }	Table of information about voltage rails in the device that are monitored by environment monitoring hardware, indexed by: ■ atEnvMonv2VoltageStackMemberId ■ atEnvMonv2VoltageBoardIndex ■ atEnvMonv2VoltageIndex
atEnvMonv2VoltageEntry { atEnvMonv2VoltageTable 1 }	Description, current value, upper & lower threshold settings and current status of a single voltage rail.
atEnvMonv2VoltageStackMemberId { atEnvMonv2VoltageEntry 1 }	Index of the stack member hosting this voltage sensor.
atEnvMonv2VoltageBoardIndex { atEnvMonv2VoltageEntry 2 }	Index of the board hosting this voltage sensor in the board table.
atEnvMonv2VoltageIndex { atEnvMonv2VoltageEntry 3 }	Numeric identifier of this voltage rail on its host board.
atEnvMonv2VoltageDescription { atEnvMonv2VoltageEntry 4 }	Description of this voltage rail.
atEnvMonv2VoltageCurrent { atEnvMonv2VoltageEntry 5 }	Current reading of this voltage rail in millivolts.
atEnvMonv2VoltageUpperThreshold { atEnvMonv2VoltageEntry 6 }	Maximum acceptable reading of this voltage rail in millivolts.
atEnvMonv2VoltageLowerThreshold { atEnvMonv2VoltageEntry 7 }	Minimum acceptable reading of this voltage rail in millivolts.
atEnvMonv2VoltageStatus { atEnvMonv2VoltageEntry 8 }	Whether this voltage rail is currently in an alarm condition. Possible values are: ■ outOfRange (1) - means that the current reading is outside the threshold range. ■ inRange (2) - means that the current reading is acceptable.
atEnvMonv2TemperatureTable { atEnvMonv2 3 }	Table of information about temperature sensors in the device that are monitored by environment monitoring hardware, indexed by: ■ atEnvMonv2TemperatureStackMemberId ■ atEnvMonv2TemperatureBoardIndex ■ atEnvMonv2TemperatureIndex
atEnvMonv2TemperatureEntry { atEnvMonv2TemperatureTable 1 }	Description, current value, upper threshold setting and current status of a single temperature sensor.
atEnvMonv2TemperatureStackMemberId { atEnvMonv2TemperatureEntry 1 }	Index of the stack member hosting this temperature sensor.
atEnvMonv2TemperatureBoardIndex { atEnvMonv2TemperatureEntry 2 }	Index of the board hosting this temperature sensor in the board table.
atEnvMonv2TemperatureIndex { atEnvMonv2TemperatureEntry 3 }	Numeric identifier of this temperature sensor on its host board.
atEnvMonv2TemperatureDescription { atEnvMonv2TemperatureEntry 4 }	Description of this temperature sensor.
atEnvMonv2TemperatureCurrent { atEnvMonv2TemperatureEntry 5 }	Current reading of this temperature sensor in degrees Celsius.

Table 89-9: Objects defined in AT-ENVMONV2-MIB(cont.)

Object / Object Identifier	Description
atEnvMonv2TemperatureUpperThreshold { atEnvMonv2TemperatureEntry 6 }	Maximum acceptable reading for this temperature sensor in degrees Celsius.
atEnvMonv2TemperatureStatus { atEnvMonv2TemperatureEntry 7 }	Whether this temperature sensor is currently in an alarm condition. Can be: ■ outOfRange (1) - means that the current reading is outside the threshold range. ■ inRange (2) - means that the current reading is acceptable.
atEnvMonv2PsbObjects { atEnvMonv2 4 }	Collection of objects for monitoring power supply bays in the system and any devices that are installed. It contains the following objects: ■ atEnvMonv2PsbTable ■ atEnvMonv2PsbSensorTable
atEnvMonv2PsbTable { atEnvMonv2PsbObjects 1 }	Table of information about power supply bays in the system, indexed by: ■ atEnvMonv2PsbHostStackMemberId ■ atEnvMonv2PsbHostBoardIndex ■ atEnvMonv2PsbHostSlotIndex
atEnvMonv2PsbEntry { atEnvMonv2PsbTable 1 }	Description and current status of a single power supply bay device.
atEnvMonv2PsbHostStackMemberId { atEnvMonv2PsbEntry 1 }	Index of the stack member hosting this power supply bay.
atEnvMonv2PsbHostBoardIndex { atEnvMonv2PsbEntry 2 }	Index of the board hosting this power supply bay in the board table.
atEnvMonv2PsbHostSlotIndex { atEnvMonv2PsbEntry 3 }	Index of this power supply bay slot on its host board. This index is fixed for each slot, on each type of board.
atEnvMonv2PsbHeldBoardIndex { atEnvMonv2PsbEntry 4 }	Index of a board installed in this power supply bay. This value corresponds to atEnvMonv2PsbSensorBoardIndex for each sensor on this board. A value of 0 indicates that a board is either not present or not supported.
atEnvMonv2PsbHeldBoardId { atEnvMonv2PsbEntry 5 }	Type of board installed in this power supply bay. The values of this object are taken from the pprXxx object IDs under the boards sub-tree in the parent MIB. A value of 0 indicates that a board is either not present or not supported.
atEnvMonv2PsbDescription { atEnvMonv2PsbEntry 6 }	Description of this power supply bay.
atEnvMonv2PsbSensorTable { atEnvMonv2PsbObjects 2 }	Table of information about environment monitoring sensors on devices installed in power supply bays, indexed by: ■ atEnvMonv2PsbSensorStackMemberId ■ atEnvMonv2PsbSensorBoardIndex ■ atEnvMonv2PsbSensorIndex
atEnvMonv2PsbSensorEntry { atEnvMonv2PsbSensorTable 1 }	Description and current status of the sensor on a device installed in a power supply bay.
atEnvMonv2PsbSensorStackMemberId { atEnvMonv2PsbSensorEntry 1 }	Index of the stack member hosting this sensor.
atEnvMonv2PsbSensorBoardIndex { atEnvMonv2PsbSensorEntry 2 }	Index of the board hosting this sensor in the board table.
atEnvMonv2PsbSensorIndex { atEnvMonv2PsbSensorEntry 3 }	Index of this power supply bay environmental sensor on its host board.

Table 89-9: Objects defined in AT-ENVMONV2-MIB(cont.)

Object / Object Identifier	Description
atEnvMonv2PsbSensorType { atEnvMonv2PsbSensorEntry 4 }	Type of environmental variable this sensor detects. One of: ■ psbSensorTypeInvalid(0) ■ fanSpeedDiscrete(1) ■ temperatureDiscrete(2) ■ voltageDiscrete(3)
atEnvMonv2PsbSensorDescription { atEnvMonv2PsbSensorEntry 5 }	Description of this power supply bay environmental sensor.
atEnvMonv2PsbSensorStatus { atEnvMonv2PsbSensorEntry 6 }	Whether this environmental sensor is currently in an alarm condition. One of: ■ failed (1) - means that the device is in a failure condition ■ good(2) - means that the device is functioning normally. ■ notPowered (3) - a PSU is installed, but not powered up
atEnvMonv2FaultLedTable { atEnvMonv2 6 }	Table detailing any LED fault indications on the device, indexed by: ■ atEnvMonv2FaultLedStackMemberId
atEnvMonv2FaultLedEntry { atEnvMonv2FaultLedTable 1 }	Information pertaining to a given fault LED.
atEnvMonv2FaultLedStackMemberId { atEnvMonv2FaultLedEntry 1 }	Index of the stack member hosting this fault LED.
atEnvMonv2FaultLed1Flash { atEnvMonv2FaultLedEntry 2 }	Indicates whether a fault LED is currently showing a system failure by flashing once. Values can be: ■ heatsinkFanFailure (1) - indicates that one or more heatsink fans have failed, or are operating below the recommended speed ■ noFault (2)
atEnvMonv2FaultLed2Flashes { atEnvMonv2FaultLedEntry 3 }	Indicates whether a fault LED is currently showing a system failure by flashing twice. Values can be: ■ chassisFanFailure (1) - indicates that one or both of the chassis fans are not installed, or the fans are operating below the recommended speed ■ noFault (2)
atEnvMonv2FaultLed3Flashes { atEnvMonv2FaultLedEntry 4 }	Indicates whether a fault LED is currently showing a system failure by flashing three times. Values can be: ■ sensorFailure (1) - indicates that the ability to monitor temperature or fans has failed ■ noFault (2)
atEnvMonv2FaultLed4Flashes { atEnvMonv2FaultLedEntry 5 }	Indicates whether a fault LED is currently showing a system failure by flashing four times. Values can be: ■ xemInitialisationFailure (1) - indicates that a XEM failed to initialise or is incompatible ■ noFault (2)
atEnvMonv2FaultLed5Flashes { atEnvMonv2FaultLedEntry 6 }	Indicates whether a fault LED is currently showing a system failure by flashing five times. This flashing sequence is not currently in use. Value is: ■ noFault (2)
atEnvMonv2FaultLed6Flashes { atEnvMonv2FaultLedEntry 7 }	Indicates whether a fault LED is currently showing a system failure by flashing six times. Values can be: ■ temperatureFailure (1) - indicates that the device's temperature has exceeded the recommended threshold ■ noFault (2)

AT-VCSTACK-MIB

AT-VCSTACK-MIB defines objects for managing Virtual Chassis Stacking (Table 89-10). Objects in this group have the object identifier vcstack ({ sysinfo 13 }).

Figure 89-2 on page 89.22 shows the tree structure of the AT-VCSTACK objects.

Figure 89-2: The AT-VCSTACK MIB sub-tree

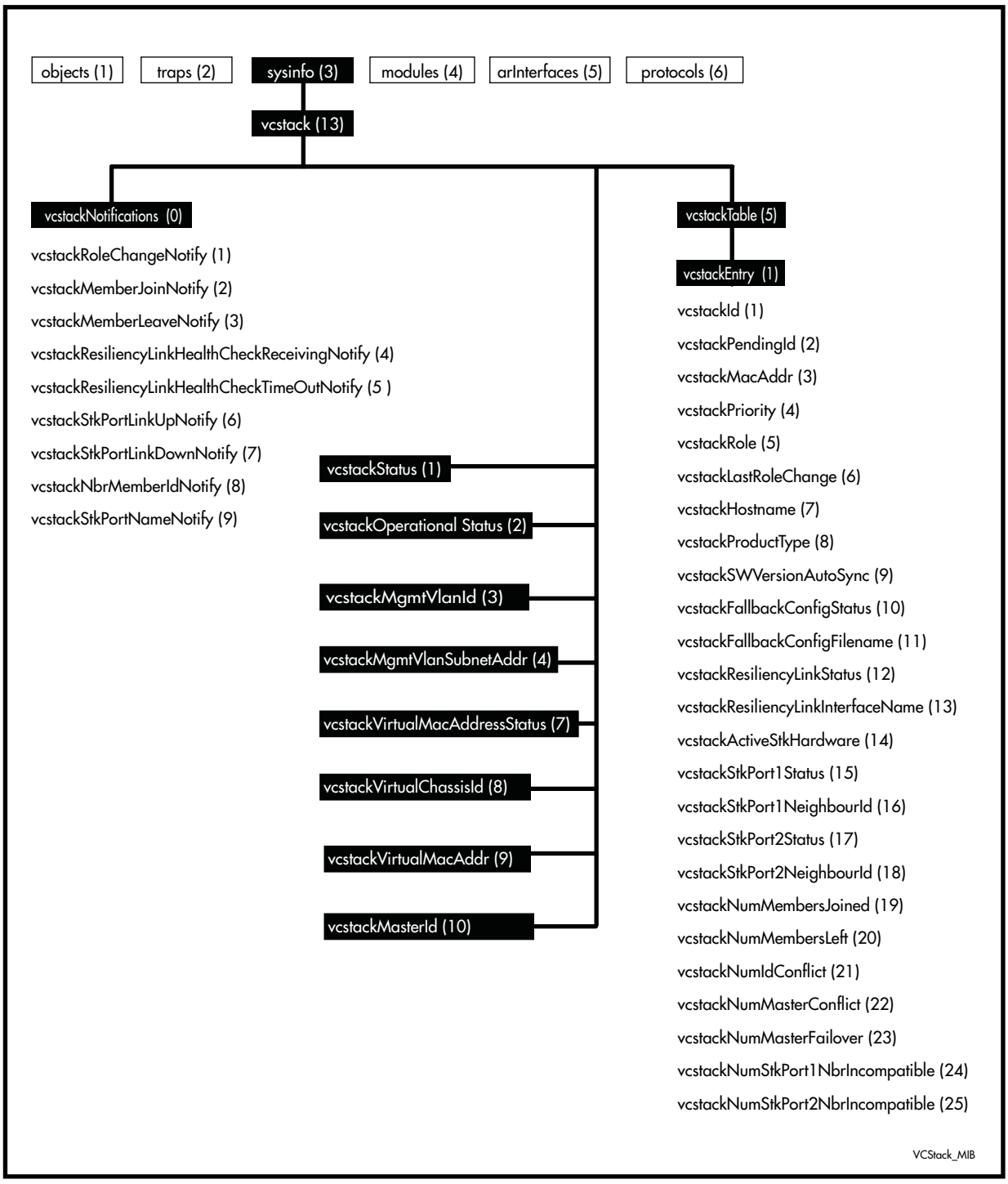


Table 89-10: Objects defined in AT-VCSTACK-MIB

Object	Object Identifier	Description
vcstack	{ sysinfo (13) }	Overall stack status.
vcstackNotifications	{ vcstack 0 }	List of traps (notifications) generated for the stack:
vcstackRoleChangeNotify	{ vcstackNotifications 1 }	The stack status can take one of the following states: ■ normalOperation (1) ■ operatingInFailoverState (2) ■ standaloneUnit (3) ■ ringTopologyBroken (4)
vcstackMemberJoinNotify	{ vcstackNotifications 2 }	Notification generated when a member joins the stack. Displays the objects: ■ vcstackId ■ vcstackNbrMemberId
vcstackMemberLeaveNotify	{ vcstackNotifications 3 }	Notification generated when a member leaves the stack. Displays the objects: ■ vcstackId ■ vcstackNbrMemberId
vcstackResiliencyLinkHealthCheckReceivingNotify	{ vcstackNotifications 4 }	Notification generated when the resiliency link is activated. Displays the objects: ■ vcstackId ■ vcstackResiliencyLinkInterface Name
vcstackResiliencyLinkHealthCheckTimeOutNotify	{ vcstackNotifications 5 }	Notification generated when the slave's receive timer has timed-out, indicating that the Slave has lost contact with the Master via the resiliency link. Displays the objects: ■ vcstackId ■ vcstackResiliencyLinkInterface Name
vcstackStkPortLinkUpNotify	{ vcstackNotifications 6 }	Notification generated when the stack port link is up. Displays the objects: ■ vcstackId ■ vcstackStkPortName
vcstackStkPortLinkDownNotify	{ vcstackNotifications 7 }	Notification generated when the stack port link is down. Displays the objects: ■ vcstackId ■ vcstackStkPortName
vvcstackNbrMemberIdNotify	{ vcstackNotifications 8 }	The stack member id related to this trap
vcstackStkPortNameNotify	{ vcstackNotifications 9 }	The stack port name related to this trap

Table 89-10: Objects defined in AT-VCSTACK-MIB(cont.)

Object	Object Identifier	Description
vcstackOperationalStatus	{ vcstack 2 }	The operational status of the stack can be either: ■ enabled (1) ■ disabled (2)
vcstackMgmtVlanId	{ vcstack 3 }	The current stacking management VLAN ID
vcstackMgmtVlanSubnetAddr	{ vcstack 4 }	The current stacking management VLAN subnet address
vcstackTable	{ vcstack 5 }	Table of information about stack members, indexed by vcstackId.
vcstackEntry	{ vcstackTable 1 }	Information about a single stack member, indexed by vcstackId.
vcstackId	{ vcstackEntry 1 }	Stack member ID.
vcstackPendingId	{ vcstackEntry 2 }	Pending stack member ID.
vcstackMacAddr	{ vcstackEntry 3 }	Stack member's hardware MAC address.
vcstackPriority	{ vcstackEntry 4 }	Priority for election of the stack master. The lowest number has the highest priority.
vcstackRole	{ vcstackEntry 5 }	Stack member's role in the stack. Can be one of the following: ■ leaving (1) ■ discovering (2) ■ synchronizing (3) ■ backupMember (4) ■ pendingMaster (5) ■ disabledMaster (6) ■ fallbackMaster (7) ■ activeMaster (8)
vcstackLastRoleChange	{ vcstackEntry 6 }	Time and date when the stack member last changed its role in the stack.
vcstackHostname	{ vcstackEntry 7 }	Stack member's hostname.
vcstackProductType	{ vcstackEntry 8 }	Stack members product type.
vcstackSWVersionAutoSync	{ vcstackEntry 9 }	Whether or not the stack member's software is automatically upgraded.
vcstackFallbackConfigStatus	{ vcstackEntry 10 }	Status of the fallback configuration file. Can be one of: ■ fileExists (1) ■ fileNotFound (2) ■ notConfigured (3)

Table 89-10: Objects defined in AT-VCSTACK-MIB(cont.)

Object	Object Identifier	Description
vcstackFallbackConfigFilename	{ vcstackEntry 11 }	Filename of the fallback configuration file.
vcstackResiliencyLinkStatus	{ vcstackEntry 12 }	Status of the stack members resiliency link. Can be one of: ■ configured (1) ■ successful (2) ■ failed (3) ■ notConfigured (4)
vcstackResiliencyLinkInterfaceName	{ vcstackEntry 13 }	Name of the interface the resiliency link is configured on.
vcstackActiveStkHardware	{ vcstackEntry 14 }	Stack ports hardware type. Can be one of: ■ value (0) is now obsolete ■ xemStk (1) ■ builtinStackingPorts (2) ■ none (3) is now obsolete ■ stackXG (4)
vcstackStkPort1Status	{ vcstackEntry 15 }	Status of stack-port 1. Can be one of the following: ■ down (1) ■ neighbourIncompatible (2) ■ discoveringNeighbour (3) ■ learntNeighbour (4)
vcstackStkPort1NeighbourId	{ vcstackEntry 16 }	ID of the neighbor on stack-port 1. Zero indicates no learned neighbor.
vcstackStkPort2Status	{ vcstackEntry 17 }	Status of stack-port 2. Can be one of: ■ down (1) ■ neighbourIncompatible (2) ■ discoveringNeighbour (3) ■ learntNeighbour (4)
vcstackStkPort2NeighbourId	{ vcstackEntry 18 }	ID of the neighbor on stack-port 2. Zero indicates no learned neighbor.
vcstackNumMembersJoined	{ vcstackEntry 19 }	Number of times the stack has acquired a member.
vcstackNumMembersLeft	{ vcstackEntry 20 }	Number of times the stack has lost a member.
vcstackNumIdConflict	{ vcstackEntry 21 }	Number of times that a stack member ID conflict has occurred.
vcstackNumMasterConflict	{ vcstackEntry 22 }	Number of times that a stack master conflict has occurred.
vcstackNumMasterFailover	{ vcstackEntry 23 }	Number of times that the stack master has failed.

Table 89-10: Objects defined in AT-VCSTACK-MIB(cont.)

Object	Object Identifier	Description
vcstackNumStkPort1NbrIncompatible	{ vcstackEntry 24 }	Number of times that the neighbor on stack port 1 was incompatible.
vcstackNumStkPort2NbrIncompatible	{ vcstackEntry 25 }	Number of times that the neighbor on stack port 2 was incompatible.
vcstackVirtualMacAddressStatus	{vcstack 7}	Indicates whether the virtual MAC address is enabled or disabled. Read-only object.
vcstackVirtualChassisId	{vcstack 8}	Displays the current virtual chassis ID. Read-only object.
vcstackVirtualMacAddr	{vcstack 9}	Displays the virtual MAC address used by the stack. Read-only object.
vcstackMasterId	{vcstack 10}	Displays the stack ID of the master unit, or the stack ID of the standalone unit. Read-only object

AT-MIBVERSION-MIB

The AT-MIBVERSION-MIB contains an object to display the last software release that contained changes to the supported AT Enterprise MIB definition files (Table 89-11). Objects in this group have the object identifier atMibsetVersion ({ sysinfo 15 }).

Table 89-11: Object defined in AT-MIBVERSION-MIB

Object	Object Identifier	Description
atMibsetVersion	{ sysinfo 15 }	This object returns a five digit integer which indicates the last software release that contained changes to the supported AT Enterprise MIB definition files. For example, If the currently loaded software release on the device is 5.3.1-0.3 but the Enterprise MIBs have not changed since 5.3.1-0.1, then the value returned will be 53101.

AT-USER-MIB

The AT-USER-MIB contains objects for displaying information about users currently logged into a device, or configured in the Local User Database of the device (Table 89-12). Objects in this group have the object identifier user ({ sysinfo 20 }).

Table 89-12: Objects defined in AT-USER-MIB

Object	Object Identifier	Description
userInfoTable	{ user 1 }	Table containing information about users. Each entry in the table represents a user currently logged into the device. Indexed by: rscBoardType and rscBoardIndex.
userInfoEntry	{ userInfoTable 1 }	Information about a single user logged into the device.
userInfoType	{ userInfoEntry 1 }	The type of connection through which the user logged into the device. Can be: ■ console (1) ■ aux (2) ■ telnet (3) ■ script (4) ■ stack (5)
userInfoIndex	{ userInfoEntry 2 }	Index of the line upon which the user logged into the device. Can be a value in range 1 to 16.
userInfoName	{ userInfoEntry 3 }	User name of the user logged into the device.
userInfoPrivilegeLevel	{ userInfoEntry 4 }	The user's privilege level. Can be a value in range 1 to 15.
userInfoIdleTime	{ userInfoEntry 5 }	The amount of time since the user was last active, in the form hh:mm:ss.
userInfoLocation	{ userInfoEntry 6 }	The user location or login method. It can be an IP Address used by the user to telnet into the device, or an asyn port, etc.
userInfoPasswordLifetime	{ userInfoEntry 7 }	The number of days remaining until the user's password expires. Depending on the current user setting it will display one of the following: ■ No Expiry - the password will never expire (default setting) ■ x days - where x is the remaining lifetime of the current password (maximum lifetime value is 1000 days) ■ -x days (expired) - indicating that the current password expired x days ago
userInfoPasswordLastChange	{ userInfoEntry 8 }	The number of days since the password was last altered.

Table 89-12: Objects defined in AT-USER-MIB(cont.)

Object	Object Identifier	Description
userConfigTable	{ user 2 }	Table containing user configuration information. Each entry in the table relates to a user configured in the Local User Database of the device. Indexed by userConfigIndex.
userConfigEntry	{ userConfigTable 1 }	Information about a single user configured in the Local User Database of the device.
userConfigIndex	{ userConfigEntry 1 }	Unique number used to identify entries in the userConfigTable.
userConfigName	{ userConfigEntry 2 }	The user's name.
userConfigPrivilegeLevel	{ userConfigEntry 3 }	The privilege level granted to the user. Can be a value in range 1 to 15.
userSecurityPasswordRules	{ user 3 }	Information about user password security rules.
userSecurityPasswordHistory	{ userSecurityPasswordRules 1 }	The number of previous passwords that are retained for comparison when a user password is created. A new password must be unique when compared against the previous history. A value of 0 represents no restriction. The maximum number of retained passwords is 15.
userSecurityPasswordLifetime	{ userSecurityPasswordRules 2 }	The maximum number of days that the password may persist before a change is required. A value of 0 represents no expiry. The maximum value is 1000.
userSecurityPasswordWarning	{ userSecurityPasswordRules 3 }	The number of days before the password expires that a warning message is displayed when the user logs in. A value of 0 indicates no warning. The maximum value is 1000 but must always be less than the password lifetime.
userSecurityPasswordMinLength	{ userSecurityPasswordRules 4 }	The minimum allowable password length.
userSecurityPasswordMinCategory	{ userSecurityPasswordRules 5 }	The minimum number of different categories that the password must satisfy to be considered valid. Categories are split into four groups: ■ upper-case letters ■ lower-case letters ■ digits ■ special symbols. ASCII characters not included in the previous three categories.
userSecurityPasswordForced	{ userSecurityPasswordRules 6 }	Whether or not a user with an expired password is forced to change their password at the next login. At login a user with an expired password is prompted to change their password. If the new password meets the current security password rules the user is allowed to login, otherwise they are rejected.
userSecurityPasswordReject	{ userSecurityPasswordRules 7 }	Whether or not a user login attempt with an expired password is rejected. If the user is not rejected then they can login.

AT-RESOURCE-MIB

The AT-RESOURCE-MIB contains objects for displaying system hardware resource and host information (Table 89-13). Objects in this group have the object identifier rsc ({ sysinfo 21 }).

Table 89-13: Objects defined in AT-RESOURCE-MIB

Object	Object Identifier	Description
resource	{ sysinfo 21 }	Contains objects for displaying system hardware resource and host information.
rscBoardTable	{ resource 1 }	Table containing information about boards installed in a device. Indexed by: ■ rscStkId ■ rscResourceId
rscBoardEntry	{ rscBoardTable 1 }	Information about a single board installed in the device.
rscStkId	{ rscBoardEntry 1 }	The ID of the stack member. It is a number from 1 to 8, assigned to a stackable unit by the operating system when it is stacked. A default of 1 is given to a stand-alone unit.
rscResourceId	{ rscBoardEntry 2 }	The resource ID number of the board. It is a number assigned to a hardware resource when the operating system detects its existence. Can be a value in range 1 to 4294967294.
rscBoardType	{ rscBoardEntry 3 }	The type of board. Can be one of the following: ■ Base ■ Expansion ■ Fan module ■ PSU, etc.
rscBoardName	{ rscBoardEntry 4 }	The name of the board. Can be one of the following: ■ SwitchBlade x908 ■ XEM-12S ■ AT-PWR05-AC, etc
rscBoardId	{ rscBoardEntry 5 }	The ID number of the board. Its value is an Allied Telesis assigned number, such as 274 for the XEM-12S, or 255 for the AT-9924Ts.
rscBoardBay	{ rscBoardEntry 6 }	The board installation location. Its value can be Bay1, Bay2, PSU1, etc. For a base board, it has a value of a single character space.
rscBoardRevision	{ rscBoardEntry 7 }	The revision number of the board.
rscBoardSerialNumber	{ rscBoardEntry 8 }	The serial number of the board.
hostInfoTable	{ resource 2 }	Table containing general system information. Indexed by rscStkId.
hostInfoEntry	{ hostInfoTable 1 }	Information about a single system parameter
hostInfoDRAM	{ hostInfoEntry 1 }	The host DRAM information.
hostInfoFlash	{ hostInfoEntry 2 }	The host Flash information.
hostInfoUptime	{ hostInfoEntry 3 }	The host up-time.
hostInfoBootloaderVersion	{ hostInfoEntry 4 }	The host boot loader version.

AT-LICENSE-MIB

The AT-LICENSE-MIB contains objects for managing the AlliedWare Plus™ Operating System software licenses: listing applied software licenses, adding new licenses and deleting existing licenses (Table 89-14). The objects reside in the module license { sysinfo 22 }, organized in the following groups:

- Base Software License Table - a table containing the installed base software licenses on the device
- Installed Software License Table - a list of installed software licenses; used also to remove software license from the device
- Available Software Features Table
- LicenseNew - Objects used to install a new license
- LicenseStackRemove - Objects used to remove a license across a stack of devices

Table 89-14: Objects defined in AT-LICENSE-MIB

Object	Object Identifier	Description
license	{ sysinfo 22 }	MIB containing objects for listing applied software licenses, adding new licenses, and deleting existing licenses.
baseLicenseTable	{ license 1 }	Table containing information about base software licenses installed on a device. Indexed by: ■ baseLicenseStkId
baseLicenseEntry	{ baseLicenseTable 1 }	Information about a single license installed on the device.
baseLicenseStkId	{ baseLicenseEntry 1 }	The stack member ID of the device hosting the license.
baseLicenseName	{ baseLicenseEntry 2 }	The name of the base license.
baseLicenseQuantity	{ baseLicenseEntry 3 }	The number of licenses issued for this entry.
baseLicenseType	{ baseLicenseEntry 4 }	The type of base license issued.
baseLicenseIssueDate	{ baseLicenseEntry 5 }	The date of issue of the base license.
baseLicenseExpiryDate	{ baseLicenseEntry 6 }	The expiry date of the base license.
baseLicenseFeatures	{ baseLicenseEntry 7 }	The feature set that this license enables, in the format of an octet string. Each bit in the returned octet string represents a particular feature that can be license-enabled. The bit position within the string maps to the feature entry with the same index, in licenseFeatureTable. A binary '1' indicates that the feature is included in the license; a binary '0' indicates that the feature is not included in the license.
licenseTable	{ license 2 }	Table containing information about software licenses installed on the device. Indexed by: ■ licenseStackId ■ licenseIndex
licenseEntry	{ licenseTable 1 }	Information about a single installed software license on the device.
llicenseStackId	{ licenseEntry 1 }	The stack member ID of the device hosting the license.
licenseIndex	{ licenseEntry 2 }	The index number of the license entry.
licenseName	{ licenseEntry 3 }	The name of the license.
licenseCustomer	{ licenseEntry 4 }	The name of the customer of the license.
licenseQuantity	{ licenseEntry 5 }	The number of licenses issued for this entry.
licenseType	{ licenseEntry 6 }	The type of license issued.
licenseIssueDate	{ licenseEntry 7 }	The date of issue of the license.

Table 89-14: Objects defined in AT-LICENSE-MIB(cont.)

Object	Object Identifier	Description
licenseExpiryDate	{ licenseEntry 8 }	The expiry date of the license.
licenseFeatures	{ licenseEntry 9 }	The feature set that this license enables, in the format of octet string. Each bit in the returned octet string represents a particular feature that can be license-enabled. The bit position within the string maps to the feature entry with the same index, in licenseFeatureTable. A binary '1' indicates that the feature is included in the license; a binary '0' indicates that the feature is not included in the license.
licenseRowStatus	{ licenseEntry 10 }	The current status of the license. The following values may be returned when reading this object: ■ active (1) - the license is currently installed and valid ■ notInService (2) - the license has expired or is invalid The following value may be written to this object: ■ destroy (6) - the license will be removed from the device; this may result in some features being disabled. Note that a stacked device that has a license deleted may not be able to rejoin the stack after reboot, unless the license is also deleted on all other devices in the stack.
licenseFeatureTable	{ license 3 }	Table containing all available Software Features. A feature must be license-enabled to be utilized on the device.
licenseFeatureEntry	{ licenseFeatureTable 1 }	Information about a single feature that must be license-enabled in order to be utilized on the device.
licenseFeatureIndex	{ licenseFeatureEntry 1 }	The index number of the feature which must be license-enabled.
licenseFeatureName	{ licenseFeatureEntry 2 }	The name of the feature under licensing control.
licenseFeatureStkMembers	{ licenseFeatureEntry 3 }	The set of stack members on which the feature is enabled, in the format of an octet string. Each bit in the string maps to an individual stacking member, e.g. bit one represents stacking member one, bit two represents stacking member two, etc. A bit value of '1' indicates that the applicable feature is enabled on the matching device; a bit value of '0' indicates that the feature is disabled.
licenseNew	{ license 4 }	Group of objects available for updates, used when installing a new software license on the device.
licenseNewStackId	{ licenseNew 1 }	The ID of the stacking member upon which the new license is to be installed. The value zero (0) indicates that the license should be applied to all stack members.
licenseNewName	{ licenseNew 2 }	The name of the new license to be installed.
licenseNewKey	{ licenseNew 3 }	The key for the new license to be installed.

Table 89-14: Objects defined in AT-LICENSE-MIB(cont.)

Object	Object Identifier	Description
licenseNewInstall	{ licenseNew 4 }	Used to install new licenses. Values can be: ■ true (1) ■ false (2) To commence installation, a valid license name and key must first have been set via the licenseNewName and licenseNewKey respectively. This object should then be set to the value true (1). If either the license name or key is invalid, the write operation will fail. Once installed, the software modules affected by any newly enabled features will automatically be restarted. Note that a stacked device that has a new license installed on it may not be able to rejoin the stack after reboot, unless the license is also added to all other devices in the stack. When read, the object will always return the value false (2).
licenseNewInstallStatus	{ licenseNew 5 }	The current status of the last license installation request. One of the following values is returned when reading this object: ■ idle (1) ■ processing (2) ■ success (3) ■ failed (4) When a stack license installation operation is complete the first read of this object will return either a success (3) or a failure (4) indication. Subsequent reads of this object will then return an idle (1) indication.
licenseStackRemove	{ license 5 }	Group of objects used when removing a software license across a stack of devices.
licenseStackRemoveName	{ licenseStackRemove 1 }	The name of the license to be removed from all devices across the stack, on which the license currently exists.
licenseStackRemoveExecute	{ licenseStackRemove 2 }	When set to the value true (1), the system will attempt to remove the named license from all devices across the stack on which the license currently exists. All devices in a stack must be from the same product family and the named license must activate the same feature set on all devices.
licenseStackRemoveStatus	{ licenseStackRemove 3 }	The current status of the last requested stack license removal request. One of the following values is returned when reading this object: ■ idle (1) ■ processing (2) ■ success (3) ■ failed (4) When a stack license removal operation is complete the first read of this object will return either a success (3) or failure (4) indication. Subsequent reads of this object will then return an idle (1) indication.

AT-TRIGGER-MIB

AT-TRIGGER-MIB defines objects for managing triggers (Table 89-15). Objects in this group have the object identifier trigger ({ modules 53 }). All objects in this group have read only access.

Table 89-15: Objects defined in AT-TRIGGER-MIB

Object Identifier	Description
triggerTraps { trigger 0 }	Sub-tree for all trigger traps.
triggerTrap { triggerTraps 1 }	Notification generated when a trigger is activated. It returns the value of triggerLastTriggerActivated.
triggerLastTriggerActivated { trigger 1 }	Trigger number of the most recent trigger activated on the switch.
triggerConfigInfoTable { trigger 9 }	Table of information about each trigger that has been configured, indexed by triggerNumber.
triggerConfigInfoEntry { triggerConfigInfoTable 1 }	Information about the configuration of a single trigger.
triggerNumber { triggerConfigInfoEntry 1 }	ID number of the trigger. Values are in range 1- 250.
triggerName { triggerConfigInfoEntry 2 }	Name and description of the trigger.
triggerTypeDetail { triggerConfigInfoEntry 3 }	Trigger type and its activation conditions.
triggerActiveDaysOrDate { triggerConfigInfoEntry 4 }	The days of a week or the date on which the trigger can be activated.
triggerActivateAfter { triggerConfigInfoEntry 5 }	Time after which the trigger can be activated.
triggerActivateBefore { triggerConfigInfoEntry 6 }	Time before which the trigger can be activated.
triggerActiveStatus { triggerConfigInfoEntry 7 }	Whether or not the trigger can be activated.
triggerTestMode { triggerConfigInfoEntry 8 }	Whether or not the trigger is operating in diagnostic (test) mode.
triggerSnmpTrap { triggerConfigInfoEntry 9 }	Whether or a not an SNMP trap will be generated when the trigger is activated.
triggerRepeatTimes { triggerConfigInfoEntry 10 }	Whether the trigger can repeat an unlimited number of times (continuous) or a specified number of times. If the trigger can repeat only a specified number of times, then the number of times the trigger has already been activated is displayed in brackets.
triggerLasttimeModified { triggerConfigInfoEntry 11 }	Date and time that the trigger configuration was last modified.
triggerNumberOfActivation { triggerConfigInfoEntry 12 }	Number of times the trigger has been activated since the last restart of the device.
triggerLasttimeActivation { triggerConfigInfoEntry 13 }	Date and time that the trigger was last activated.
triggerNumberOfScripts { triggerConfigInfoEntry 14 }	Number of scripts that this trigger will execute. Values are in range 0-5.

Table 89-15: Objects defined in AT-TRIGGER-MIB(cont.)

Object Identifier	Description
triggerScript1 { triggerConfigInfoEntry 15 }	Name of the first script that this trigger will execute if the trigger is activated.
triggerScript2 { triggerConfigInfoEntry 16 }	Name of the second script that this trigger will execute if the trigger is activated.
triggerScript3 { triggerConfigInfoEntry 17 }	Name of the third script that this trigger will execute if the trigger is activated.
triggerScript4 { triggerConfigInfoEntry 18 }	Name of the fourth script that this trigger will execute if the trigger is activated.
triggerScript5 { triggerConfigInfoEntry 19 }	Name of the fifth script that this trigger will execute if the trigger is activated.
triggerCounters { trigger 10 }	Collection of counters for trigger activations.
triggerNumOfActivation { triggerCounters 1 }	Number of times a trigger has been activated.
triggerNumOfActivationToday { triggerCounters 2 }	Number of times a trigger has been activated today.
triggerNumOfPerodicActivationToday { triggerCounters 3 }	Number of times a periodic trigger has been activated today.
triggerNumOfInterfaceActivationToday { triggerCounters 4 }	Number of times an interface trigger has been activated today.
triggerNumOfResourceActivationToday { triggerCounters 5 }	Number of times a CPU or memory trigger has been activated today.
triggerNumOfRebootActivationToday { triggerCounters 6 }	Number of times a reboot trigger has been activated today.
triggerNumOfPingPollActivationToday { triggerCounters 7 }	Number of times a ping-poll trigger has been activated today.
triggerNumOfStackMasterFailActivationToday { triggerCounters 8 }	Number of times a stack master fail trigger has been activated today.
triggerNumOfStackMemberActivationToday { triggerCounters 9 }	Number of times a stack member trigger has been activated today.
triggerNumOfStackXemStkActivationToday { triggerCounters 10 }	Number of times a stack XEM trigger has been activated today.

AT-LOOPPROTECT-MIB

The atLoopProtect-MIB (Figure 89-3, Table 89-16) defines objects for managing Loop Protection objects and triggers. Objects in this group have the object identifier atLoopProtect ({ modules 4 }).

Figure 89-3: The ATLoopProtect MIB Sub-tree

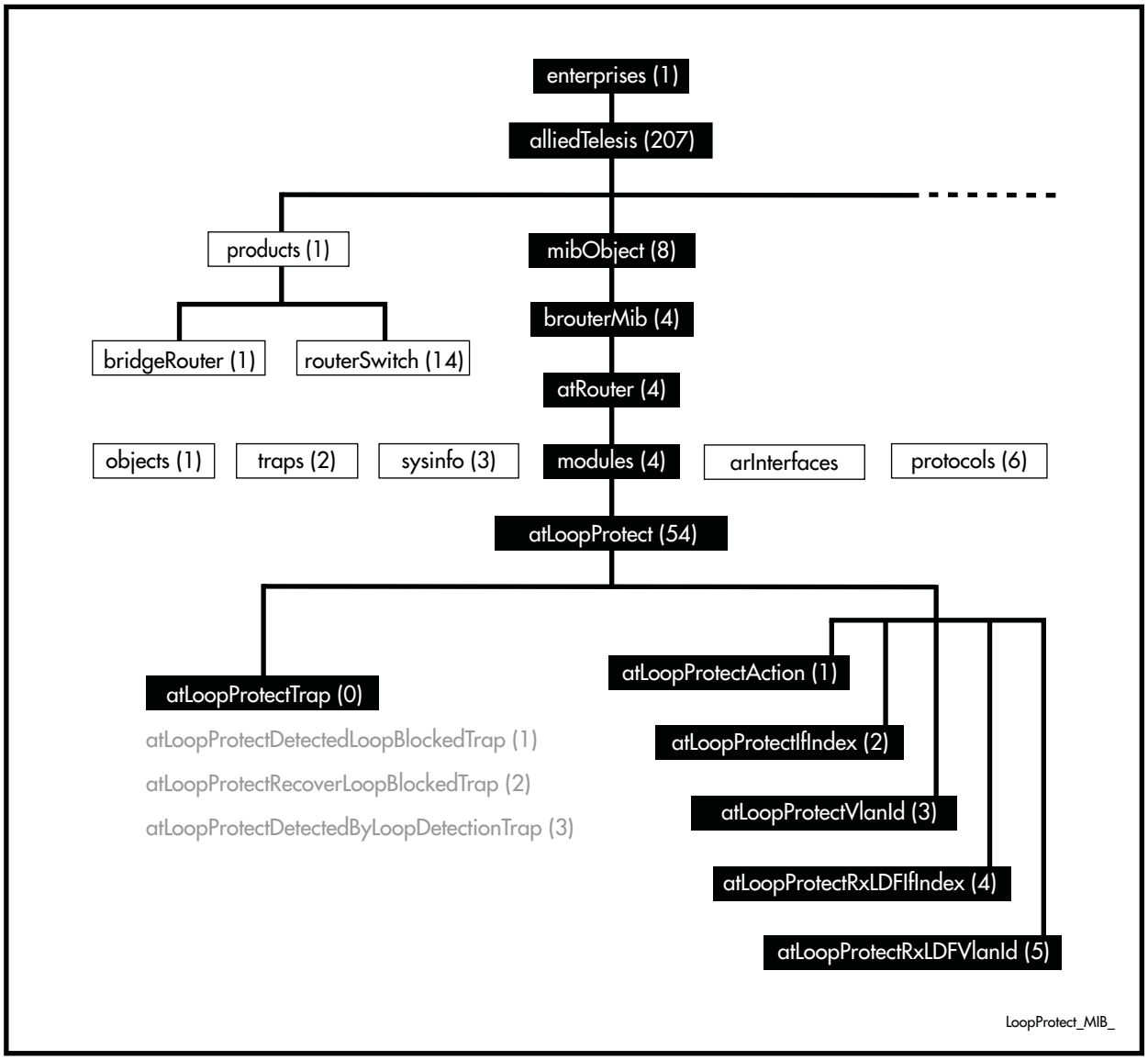


Table 89-16: Objects Defined in the AT-Loop Protect MIB

Object	Object Identifier	Description
{ atLoopProtect }	{ modules 54 }	The root of the Loop Protect object sub tree.
{ atLoopProtectTrap }	{ atLoopProtect0 }	The Loop Protection node state transition trap. List of traps (notifications) generated for Loop Protection.
{ atLoopProtectDetected LoopBlockedTrap }	{ atLoopProtectTrap1 }	Notification generated when the Loop Protection feature blocks an interface with a loop. The following bindings are associated with this trap: ■ atLoopProtectIfIndex ■ atLoopProtectVlanId ■ atLoopProtectAction
{ atLoopProtectRecover LoopBlockedTrap }	{ atLoopProtectTrap2 }	Notification generated when the Loop Protection feature restores a blocked interface back to normal operation. The following bindings are associated with this trap: ■ atLoopProtectIfIndex ■ atLoopProtectVlanId ■ atLoopProtectAction
{ atLoopProtectDetected ByLoopDetectionTrap }	{ atLoopProtectTrap3 }	Notification generated when the Loop Protection feature detects a loop by Loop Detection method. The following bindings are associated with this trap: ■ atLoopProtectIfIndex ■ atLoopProtectVlanId ■ atLoopProtectRxLDFIfIndex ■ atLoopProtectRxLDFVlanId
{ atLoopProtectAction }	{ atLoopProtect1 }	The Action for the Loop Protection feature. The following values are defined: ■ atLoopProtectAction-LearnDisable (0) ■ atLoopProtectAction-LearnEnable (1) ■ atLoopProtectAction-PortDisable (2) ■ atLoopProtectAction-PortEnable (3) ■ atLoopProtectAction-LinkDown (4) ■ atLoopProtectAction-LinkUp (5) ■ atLoopProtectAction-VlanDisable (6) ■ atLoopProtectAction-VlanEnable (7)
{ atLoopProtectIfIndex }	{ atLoopProtect2 }	The interface on which the loop was detected.
{ atLoopProtectVlanId }	{ atLoopProtect3 }	The VLAN ID on which the loop was detected.
{ atLoopProtectRxLDFIfIndex }	{ atLoopProtect4 }	The interface on which the loop detection frame was received.
{ atLoopProtectRxLDFVlanId }	{ atLoopProtect5 }	The VLAN ID on which the loop detection frame was received.

AT-SETUP-MIB

AT-SETUP-MIB defines objects for managing software installation and configuration files (Figure 89-4, Table 89-17). Objects in this group have the object identifier setup ({ modules 500 }). The procedure in Table 87-6 on page 87.23 shows how to use these MIB objects to upgrade to a new software version and boot configuration file. For objects used for file copying, see “AT-FILEv2-MIB” on page 89.56.

Figure 89-4: The AT-SETUP-MIB sub-tree

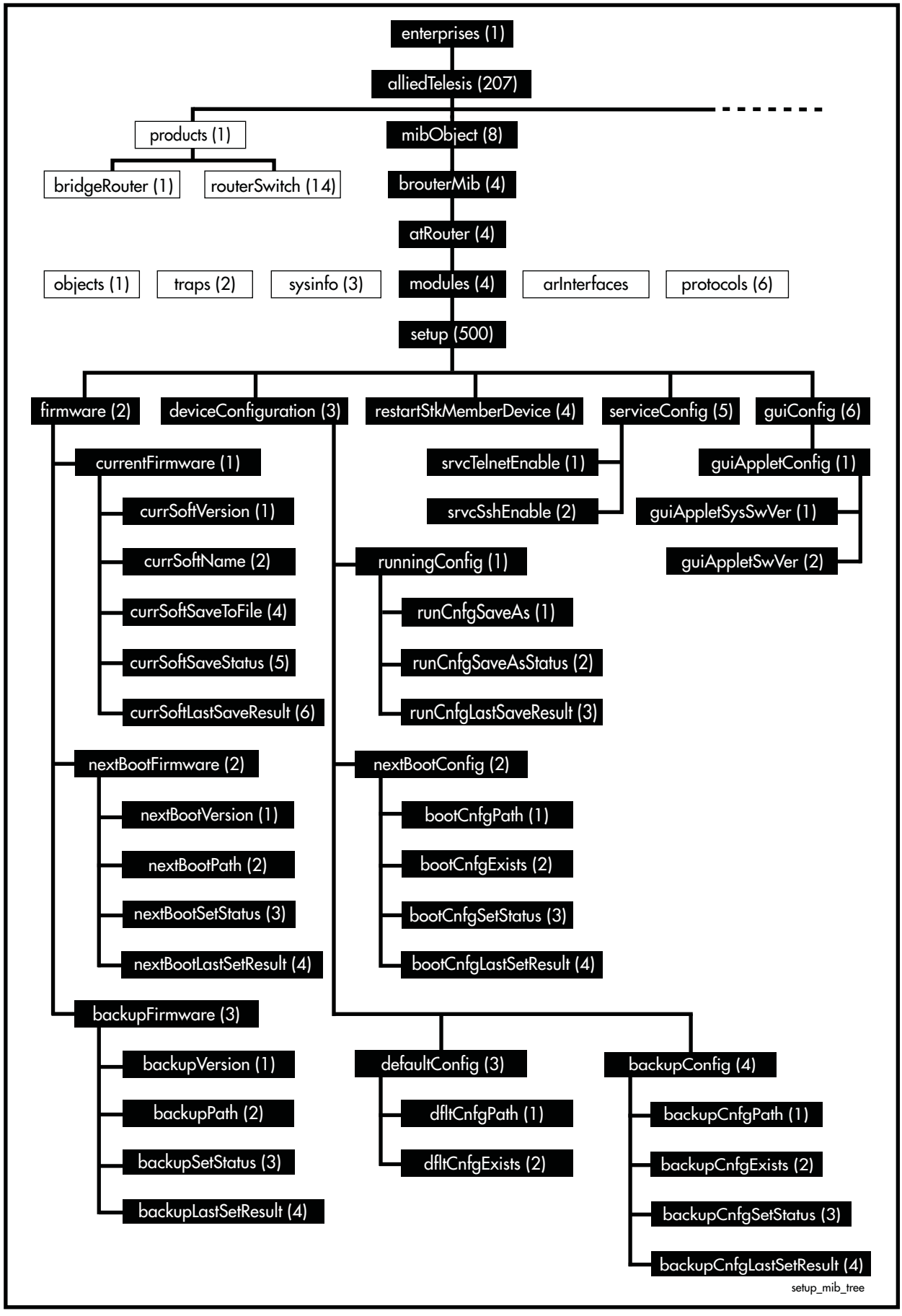


Table 89-17: Objects defined in AT-SETUP-MIB

Object	Object Identifier	Description
firmware	{ setup 2 }	Objects for managing the software version files that the device will install and run.
currentFirmware	{ firmware 1 }	Information about the current software version installed on the device.
currSoftVersion	{ currentFirmware 1 }	Current software version.
currSoftName	{ currentFirmware 2 }	Current software name.
currSoftSaveToFile	{ currentFirmware 4 }	Set with a URL to save the currently running software to the root of Flash or SD card (e.g. 'flash:/filename.rel' or 'card:/filename.rel'). The URL must not contain whitespace characters. Only one save operation can be executed at a time across all SNMP users and an operation may not be started unless the current value of currSoftSaveStatus is 'idle'. Immediately upon executing the set action, the actual firmware save operation is started and will continue on the device until it has completed or a failure occurs. When read, this object will return the URL of the last firmware save operation that was attempted.
currSoftSaveStatus	{ currentFirmware 5 }	This object will return the status of any current operation to store the running software to a release file. The following values may be returned: ■ 1 (idle) - there is no release file save operation in progress ■ 2 (success) - the last release file save operation completed successfully ■ 3 (failure) - the last release file save operation failed ■ 4 (saving) - a release file save operation is currently in progress When a read of this object returns a value of 'success' or 'failure', it will immediately be reset to 'idle' and a new operation may be initiated if desired. A detailed description of the last completed operation may be determined by reading currSoftLastSaveResult.
currSoftLastSaveResult	{ currentFirmware 6 }	Gives an indication of the result of the last completed SNMP operation to save the running firmware to a release file.

Table 89-17: Objects defined in AT-SETUP-MIB(cont.)

Object	Object Identifier	Description
nextBootFirmware	{ firmware 2 }	Information about the software version to be installed on the device when booting.
nextBootVersion	{ nextBootFirmware 1 }	Provides information on the software version (major.minor.interim, for example version 5.4.1) that the device will boot from. A zero will be returned if the version cannot be determined.
nextBootPath	{ nextBootFirmware 2 }	The full path to the release file that will be used the next time the device is rebooted. The URL must not contain whitespace characters. Only one set operation can be executed at a time across all SNMP users and an operation may not be started unless the current value of nextBootSetStatus is 'idle'. Immediately upon executing the set action, the system will attempt to set the new configuration path, and the process will continue on the device until it has completed or a failure occurs. This object can be set with an empty string in order to clear the current boot firmware. Otherwise, the path should be of the form 'flash:/filename.cfg' or 'card:/filename.cfg'. In order to set this object, the file must meet the following conditions: ■ it must exist ■ it must be located in the root of Flash (on the active master in a stacked environment) or SD card ■ it must not be the same as the backup release file ■ it must have a .rel suffix ■ it must pass several internal checks to ensure that it is a genuine release file ■ in a stacked environment, there must be enough disk space available to store the release file on each stack member
nextBootSetStatus	{ nextBootFirmware 3 }	Returns the status of any current operation to set the next boot release file. The following values may be returned: ■ 1 (idle) - there is no boot release setting operation in progress ■ 2 (success) - the last boot release setting operation completed successfully ■ 3 (failure) - the last boot release setting operation failed ■ 5 (syncing) - a boot release setting operation is currently in progress and the file is being synchronized across the stack When a read of this object returns a value of 'success' or 'failure', it will immediately be reset to 'idle' and a new operation may be initiated if desired. A detailed description of the last completed operation may be determined by reading nextBootLastSetResult.
nextBootLastSetResult	{ nextBootFirmware 4 }	Gives an indication of the result of the last completed SNMP operation to set the boot release filename.

Table 89-17: Objects defined in AT-SETUP-MIB(cont.)

Object	Object Identifier	Description
backupFirmware	{ firmware 3 }	Information about the backup software version and path.
backupVersion	{ backupFirmware 1 }	Provides information on the backup software version (major.minor.interim, for example version 5.4.1) that the device will boot from. A zero will be returned if the version cannot be determined.
backupPath	{ backupFirmware 2 }	The full path to the backup release file that will be used the next time the device is rebooted. The URL must not contain whitespace characters. Only one set operation can be executed at a time across all SNMP users and an operation may not be started unless the current value of backupSetStatus is 'idle'. Immediately upon executing the set action, the system will attempt to set the new configuration path, and the process will continue on the device until it has completed or a failure occurs. This object can be set with an empty string in order to clear the current backup firmware. Otherwise, the path should be of the form 'flash:/filename.cfg' or 'card:/filename.cfg'. In order to set this object, the file must meet the following conditions: ■ it must exist ■ it must be located in the root of Flash (on the active master in a stacked environment) or SD card ■ it must not be the same as the configured main release file ■ it must have a .rel suffix ■ it must pass several internal checks to ensure that it is a genuine release file ■ in a stacked environment, there must be enough disk space available to store the release file on each stack member
backupSetStatus	{ backupFirmware 3 }	Returns the status of any current operation to set the backup boot release file. The following values may be returned: ■ 1 (idle) - there is no backup boot release setting operation in progress ■ 2 (success) - the last backup boot release setting operation completed successfully ■ 3 (failure) - the last backup boot release setting operation failed ■ 5 (syncing) - a backup boot release setting operation is currently in progress and the file is being synchronized across the stack When a read of this object returns a value of 'success' or 'failure', it will immediately be reset to 'idle' and a new operation may be initiated if desired. A detailed description of the last completed operation may be determined by reading backupLastSetResult.
backupLastSetResult	{ backupFirmware 4 }	Gives an indication of the result of the last completed SNMP operation to set the backup boot release filename.

Table 89-17: Objects defined in AT-SETUP-MIB(cont.)

Object	Object Identifier	Description
deviceConfiguration	{ setup 3	Objects for managing device configuration.
runningConfig	{ deviceConfiguration 1 }	
runCnfgSaveAs	{ runningConfig 1 }	Set with a URL to save the currently running software to the root of Flash or SD card (e.g. 'flash:/filename.rel' or 'card:/filename.rel'). The URL must not contain whitespace characters. Only one set operation can be executed at a time across all SNMP users and an operation may not be started unless the current value of runCnfgSaveAsStatus is 'idle'. Immediately upon executing the set action, the system will attempt to save the running configuration and the process will continue on the device until it has completed or a failure occurs. When read, this object will return the URL of the last firmware save operation that was attempted.
runCnfgSaveAsStatus	{ runningConfig 2 }	Returns the status of any current operation to save the running configuration. The following values may be returned: ■ 1 (idle) - there is no config file save operation in progress ■ 2 (success) - the last config file save operation completed successfully ■ 3 (failure) - the last config file save operation failed ■ 4 (saving) - a config file save operation is currently in progress When a read of this object returns a value of 'success' or 'failure', it will immediately be reset to 'idle' and a new operation may be initiated if desired. A detailed description of the last completed operation may be determined by reading runCnfgLastSaveResult.
runCnfgLastSaveResult	{ runningConfig 3 }	Gives an indication of the result of the last completed SNMP operation to save the running configuration.

Table 89-17: Objects defined in AT-SETUP-MIB(cont.)

Object	Object Identifier	Description
nextBootConfig	{ deviceConfiguration 2 }	
bootCnfgPath	{ nextBootConfig 1 }	The full path to the configuration file that will be used the next time the device is rebooted. The URL must not contain whitespace characters. Only one set operation can be executed at a time across all SNMP users and an operation may not be started unless the current value of bootCnfgSetStatus is 'idle'. Immediately upon executing the set action, the system will attempt to set the new configuration path, and the process will continue on the device until it has completed or a failure occurs. This object can be set with an empty string in order to clear the current boot configuration. Otherwise, the path should be of the form 'flash:/myconfig.cfg' or 'card:/filename.cfg'. In order to set this object, the file must meet the following conditions: ■ it must exist ■ it must be located in the root of Flash (on the active master in a stacked environment) or SD card ■ it must have a .cfg suffix ■ in a stacked environment, there must be enough disk space available to store the configuration file on each stack member
bootCnfgExists	{ nextBootConfig 2 }	This object will return the value TRUE if the currently defined boot configuration file exists, or FALSE if it does not.
bootCnfgSetStatus	{ nextBootConfig 3 }	Returns the status of any current operation to set the next boot configuration file. The following values may be returned: ■ 1 (idle) - there is no boot configuration setting operation in progress ■ 2 (success) - the last boot configuration setting operation completed successfully ■ 3 (failure) - the last boot configuration setting operation failed ■ 5 (syncing) - a boot configuration setting operation is currently in progress and the file is being synchronized across the stack When a read of this object returns a value of 'success' or 'failure', it will immediately be reset to 'idle' and a new operation may be initiated if desired. A detailed description of the last completed operation may be determined by reading bootCnfgLastSetResult.
bootCnfgLastSetResult	{ nextBootConfig 4 }	Gives an indication of the result of the last completed SNMP operation to set the boot configuration filename.

Table 89-17: Objects defined in AT-SETUP-MIB(cont.)

Object	Object Identifier	Description
defaultConfig	{ deviceConfiguration 3 }	
dfltCnfgPath	{ defaultConfig 1 }	The full path of the configuration file to use as backup when the device is rebooted. This object is not settable. The default configuration file is always 'flash:/default.cfg'.
dfltCnfgExists	{ defaultConfig 2 }	This object will return the value TRUE if the currently defined default configuration file exists, or FALSE if it does not.

Table 89-17: Objects defined in AT-SETUP-MIB(cont.)

Object	Object Identifier	Description
backupConfig	{ deviceConfiguration 4 }	
backupCnfgPath	{ backupConfig 1 }	The full path to the backup configuration file that will be used the next time the device is rebooted. The URL must not contain whitespace characters. Only one set operation can be executed at a time across all SNMP users and an operation may not be started unless the current value of backupCnfgSetStatus is 'idle'. Immediately upon executing the set action, the system will attempt to set the new backup configuration path, and the process will continue on the device until it has completed or a failure occurs. This object can be set with an empty string in order to clear the current boot configuration. Otherwise, the path should be of the form 'flash:/myconfig.cfg' or 'card:/filename.cfg'. In order to set this object, the file must meet the following conditions: ■ it must exist ■ it must be located in the root of Flash (on the active master in a stacked environment) or SD card ■ it must have a .cfg suffix ■ in a stacked environment, there must be enough disk space available to store the configuration file on each stack member
backupCnfgExists	{ backupConfig 2 }	This object will return the value TRUE if the currently defined backup configuration file exists, or FALSE if it does not.
backupCnfgSetStatus	{ backupConfig 3 }	Returns the status of any current operation to set the next backup boot configuration file. The following values may be returned: ■ 1 (idle) - there is no backup boot configuration setting operation in progress ■ 2 (success) - the last backup boot configuration setting operation completed successfully ■ 3 (failure) - the last backup boot configuration setting operation failed ■ 5 (syncing) - a backup boot configuration setting operation is currently in progress and the file is being synchronized across the stack When a read of this object returns a value of 'success' or 'failure', it will immediately be reset to 'idle' and a new operation may be initiated if desired. A detailed description of the last completed operation may be determined by reading backupCnfgLastSetResult.
backupCnfgLastSetResult	{ backupConfig 4 }	Gives an indication of the result of the last completed SNMP operation to set the backup boot configuration filename.

Table 89-17: Objects defined in AT-SETUP-MIB(cont.)

Object	Object Identifier	Description
restartStkMemberDevice	{ setup 4 }	This object causes a specified device to restart immediately. The restart is initiated by setting its value to the device's stack member ID. Setting its value to zero will cause all devices in the stack, or a standalone device, to restart. Reading the object will always return zero.
serviceConfig	{ setup 5 }	
srvcTelnetEnable	{ serviceConfig 1 }	This object is used to either read or set the state of the telnet server on a device. Telnet can be enabled by setting the value of this object to 'enable(1)' or can be disabled by setting the value 'disable(2)'.
srvcSshEnable	{ serviceConfig 2 }	This object is used to either read or set the state of the SSH server on a device. SSH can be enabled by setting the value of this object to 'enable(1)' or can be disabled by setting the value 'disable(2)'.
guiConfig	{ setup 6 }	
guiAppletConfig	{ guiConfig 1 }	
guiAppletSysSwVer	{ guiAppletConfig 1 }	This object represents the system software release that the currently selected GUI applet was designed to run on. The system automatically searches for GUI applet files that reside in the root directory of the Flash memory, and selects the latest available file that is applicable to the currently running system software. This is the applet that will be uploaded to a user's web browser when they initiate the GUI.
	{ guiAppletConfig 2 }	This object represents the software version of the currently selected GUI applet. The system automatically searches for GUI applet files residing in the root directory of the Flash memory, and selects the latest available one that is applicable to the currently running system software. This is the applet that will be uploaded to a user's web browser when they initiate the GUI.

AT-DNS-CLIENT-MIB

AT-DNS-CLIENT-MIB contains definitions of managed objects for the Allied Telesis DNS Client Configuration.

Objects in this group have the object identifier atDns ({ Modules 501 }). Table 89-18 lists the objects supported by the AlliedWare Plus™ Operating System.

Table 89-18: Objects defined in AT-DNS-CLIENT-MIB

Object	Object Identifier	Description
atDnsClient	{ atDns 1 }	MIB File for DNS Client Configuration.
atDNSServerIndexNext	{ atDnsClient 1 }	The next available value for the object 'atDNSServerIndex'. The value is used by a management application to create an entry in the 'atDNSServerTable'.
atDNSServerTable	{ atDnsClient 2 }	Table of information about the Domain Name System (DNS) Server configurations in the system, indexed by 'atDNSServerIndex'.
atDNSServerEntry	{ atDNSServerTable 1 }	Information about a single DNS Server Configuration.
atDNSServerIndex	{ atDNSServerEntry 1 }	The index corresponding to the particular DNS Server Configuration. When creating a new entry in the table, the value of this object must be equal to the value in the 'atDNSServerIndexNext'.
atDNSServerAddrType	{ atDNSServerEntry 2 }	The Internet Address Type of the 'atDNSServerAddr' object. Can be one of the following: ■ unknown (0) ■ ipv4 (1) - default ■ ipv6 (2) - not supported ■ ipv4z (3) - not supported ■ ipv6z (4) - not supported ■ dns (16) - not supported
atDNSServerAddr	{ atDNSServerEntry 3 }	The IP Address of the DNS Server. When a new entry is created, this object is set to the default of '0.0.0.0' { '00000000'h }. The management application will change this to the desired value using a SET operation.
atDNSServerStatus	{ atDNSServerEntry 4 }	The status of the current entry (row). Can be one of the following: ■ active (1) ■ createAndGo (4) ■ destroy (6) To create a new entry the management application must set this object with value 'createAndGo (4)'. To delete an entry, the management application must set this object with value 'destroy (6)'. Once an entry is deleted, all subsequent entries in the table will be renumbered. The default is 1 (active)

AT-NTP-MIB

This MIB contains objects for managing the Allied Telesis Network Time Protocol (NTP) configuration (Table 89-19). The objects reside in the module atNtp { modules 502 }, organized in the following groups:

- NTP Peer/Server Table - a table containing information on the Network Time Protocol (NTP) peers or server configurations in the system.
- Associations Table - a list of installed software; used also to remove software from the device.
- Status Table - Objects in this group are not supported.

Table 89-19: Objects defined in AT-NTP-MIB

Object	Object Identifier	Description
atNtp	{ modules 502 }	MIB containing objects for configuring NTP.
atNtpPeerIndexNext	{ atNtp 6 }	The next available index number to be used for object 'atNtpPeerIndex'.
atNtpPeerTable	{ atNtp 7 }	Table containing information on the Network Time Protocol (NTP) peers or server configurations in the system. Indexed by: ■ atNtpPeerIndex
atNtpPeerEntry	{ atNtpPeerTable 1 }	Information about a single NTP server or peer configuration.
atNtpPeerIndex	{ atNtpPeerEntry 1 }	The index number corresponding to a particular NTP server or peer configuration in the system. To create a new entry, the value of this object should be the same as that of the value of atNtpPeerIndexNext object, otherwise the entry creation will fail.
atNtpPeerNameAddr	{ atNtpPeerEntry 2 }	The host name, or the IP address of the NTP peer. When a new row (entry) is created, this object is set with a default of '0.0.0.0', and the management application should change it to a desired value by using a SET operation.
atNtpPeerMode	{ atNtpPeerEntry 3 }	The mode of the peer. Can be one of the following: ■ server (1) ■ peer (2) - default
atNtpPeerPreference	{ atNtpPeerEntry 4 }	The values in this object specifies whether this peer is the preferred one. Valid values are 0 to 2: ■ 0 - unknown - default ■ 1 - not preferred ■ 2 - preferred When the value is 'not preferred' (1) NTP chooses the peer with which to synchronize the time on the local system. If the object is set to 'preferred' (2) NTP will choose the corresponding peer to synchronize the time with.

Table 89-19: Objects defined in AT-NTP-MIB(cont.)

Object	Object Identifier	Description
atNtpPeerVersion	{ atNtpPeerEntry 5 }	The NTP version the peer supports. Can be one of the following: ■ 0 - unknown - default ■ 1 - version 1 ■ 2 - version 2 ■ 3 - version 3 ■ 4 - version 4
atNtpPeerKeyNumber	{ atNtpPeerEntry 6 }	The authentication key number. Default number is 0.
atNtpPeerRow Status	{ atNtpPeerEntry 7 }	The current status of this peer entry. The following values may be returned when reading this object: ■ active (1) - this value is returned on reading of this entry. ■ createAndGo (4) - this value is set by the management application when creating a new entry ■ destroy (6) - value set by the management application when deleting the entry. When an entry is deleted, all subsequent entries in the table will be re-indexed.
atNtpAssociationTable	{ atNtp 10 }	Table containing information on the Network Time Protocol (NTP) associations. Indexed by: ■ atNtpAssociationIndex
atNtpAssociationEntry	{ atNtpAssociationTable 1 }	Information about a single NTP server or peer configuration.
atNtpAssociationIndex	{ atNtpAssociationEntry 1 }	The index number corresponding to a particular NTP server or peer configuration in the system. To create a new entry, the value of this object should be the same as that of the value of atNtpPeerIndexNext object, otherwise the entry creation will fail.
atNtpAssociationPeerAddr	{ atNtpAssociationEntry 2 }	The host name, or the IP address of the NTP peer. When a new row (entry) is created, this object is set with a default of '0.0.0.0', and the management application should change it to a desired value by using a SET operation.
atNtpAssociationStatus	{ atNtpAssociationEntry 3 }	The status of this association. Can be one of the following: ■ master (synced) ■ master (unsynced) ■ selected ■ candidate ■ configured ■ unknown
atNtpAssociationConfigured	{ atNtpAssociationEntry 4 }	The value in this object specifies whether the association is from configuration or not. Value can be: ■ configured ■ dynamic
atNtpAssociationRefClkAddr	{ atNtpAssociationEntry 5 }	The IP Address for the reference clock.
atNtpAssociationStratum	{ atNtpAssociationEntry 6 }	The stratum of the peer clock.

Table 89-19: Objects defined in AT-NTP-MIB(cont.)

Object	Object Identifier	Description
atNtpAssociationPoll	{ atNtpAssociationEntry 7 }	The time between NTP requests from the device to the server, in seconds.
atNtpAssociationReach	{ atNtpAssociationEntry 8 }	An integer that indicates the reachability status of the peer.
atNtpAssociationDelay	{ atNtpAssociationEntry 9 }	The round trip delay between the device and the server.
atNtpAssociationOffset	{ atNtpAssociationEntry 10 }	The difference between the device clock and the server clock.
atNtpAssociationDisp	{ atNtpAssociationEntry 11 }	The lowest measure of error associated with peer offset, based on delay, in seconds.
atNtpStatus	{ atNtp 11 }	Group of objects containing system status information. The objects in this group are not supported.
atNtpSysClockSync	{ atNtpStatus 1 }	Not supported.
atNtpSysStratum	{ atNtpStatus 2 }	Not supported.
atNtpSysReference	{ atNtpStatus 3 }	Not supported.
atNtpSysFrequency	{ atNtpStatus 4 }	Not supported.
atNtpSysPrecision	{ atNtpStatus 5 }	Not supported.
atNtpSysRefTime	{ atNtpStatus 6 }	Not supported.
atNtpSysClkOffset	{ atNtpStatus 7 }	Not supported.
atNtpSysRootDelay	{ atNtpStatus 8 }	Not supported.
atNtpSysRootDisp	{ atNtpStatus 9 }	Not supported.

AT-EPSRv2-MIB

The EPSRv2 Group-MIB defines objects for managing Epsrv2 objects and triggers (Figure 89-5, Table 89-20). Objects in this group have the object identifier Epsrv2 ({ modules 536 }).

Figure 89-5: The AT-EPSRv2 MIB sub-tree

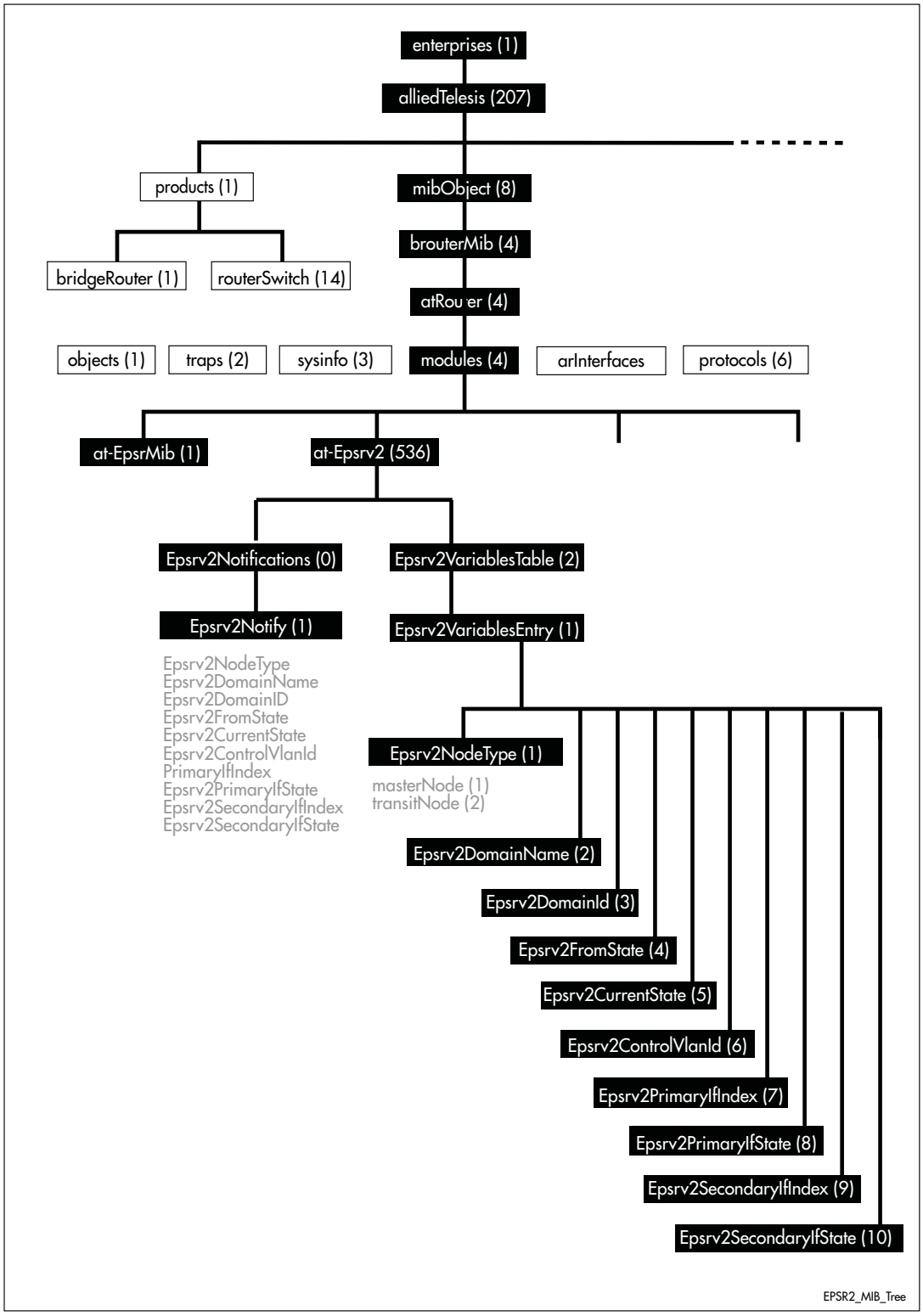


Table 89-20: atEpsrv2Objects Defined in the AT-EPSRV2 MIB

Object	Object Identifier	Description
{ at-Epsrv2 }	{ modules 536 }	The root of the Epsrv2 object sub tree.
{ atEpsrv2Notifications }	{ at-Epsrv2 0 }	
{ atEpsrv2Notify }	{ atEpsrv2Notifications 1 }	EPSR Master/Transit node state transition trap. Note that there is a one to one relationship between nodes and domains.
{ Epsrv2NodeType }	{ atEpsrv2VariablesEntry 1 }	The EPSR node type: either master or transit.
{ atEpsrv2DomainName }	{ atEpsrv2VariablesEntry 2 }	The name of the EPSR domain.
{ atEpsrv2DomainID }	{ atEpsrv2VariablesEntry 3 }	The ID of the EPSR domain.
{ Epsrv2FromState }	{ atEpsrv2VariablesEntry 4 }	The previous state of the EPSR domain
{ Epsrv2Current State }	{ atEpsrv2VariablesEntry 5 }	The current state of the EPSR domain.
{ Epsrv2ControlVlanId }	{ atEpsrv2VariablesEntry 6 }	The VLAN identifier for the control VLAN.
{ Epsrv2PrimaryIfIndex }	{ atEpsrv2VariablesEntry 7 }	The IfIndex of the primary interface.
{ atEpsrv2PrimaryIfState }	{ atEpsrv2VariablesEntry 8 }	The current state of the primary interface.
{ atEpsrv2SecondaryIfIndex }	{ atEpsrv2VariablesEntry 9 }	The IfIndex of the secondary interface.
{ atEpsrv2SecondaryIfState }	{ atEpsrv2VariablesEntry 10 }	The state of the secondary interface.
{ atEpsrv2VariablesTable }	{ at-Epsrv2 2 }	The enterprise Epsrv2VariablesTable.
{ atEpsrv2VariablesEntry }	{ atEpsrv2VariablesTable 1}	Contains entries within the enterprise atEpsrv2VariablesTable.
{ atEpsrv2NodeType }	{ atEpsrv2VariablesEntry 1 }	The EPSR domain node type: either ■ master (1) ■ transit (2)
{ atEpsrv2DomainName }	{ Epsrv2NodeType 2 }	The name of the EPSR domain.
{ atEpsrv2DomainID }	{ Epsrv2NodeType 3 }	The ID of the EPSR domain.
{ atEpsrv2FromState }	{ Epsrv2NodeType 4 }	The previous state of the EPSR domain
{ atEpsrv2Current State }	{ Epsrv2NodeType 5 }	The current state of the EPSR domain.
{ atEpsrv2ControlVlanId }	{ Epsrv2NodeType 6 }	The VLAN identifier for the control VLAN.
{ Epsrv2PrimaryIfIndex }	{ Epsrv2NodeType 7 }	The IfIndex of the primary interface.
{ atEpsrv2PrimaryIfState }	{ Epsrv2NodeType 8 }	The current state of the primary interface.
{ atEpsrv2SecondaryIfIndex }	{ Epsrv2NodeType 9 }	The IfIndex of the secondary interface.
{ atEpsrv2SecondaryIfState }	{ Epsrv2NodeType 10 }	The state of the secondary interface.
TEXTUAL CONVENTIONS		
{ atEpsrv2NodeState }		The trap states that can be advertised for an EPSR domain node. The following states are defined: ■ idle (1) ■ complete (2) ■ failed (3) ■ linksUp (4) ■ linksDown (5) ■ preForward (6) ■ unknown (7)
{ atEpsrv2InterfaceState }		The trap states that can be advertised for an EPSR interface. The following states are defined: ■ unknown (1) ■ down (2) ■ blocked (3) ■ forward (4)

AT-DHCPSN-MIB

This MIB contains objects for displaying and managing DHCP snooping and ARP security information on the switch. (Table 89-21). The objects reside in the module atDhcpsn { modules 537 }, organized in the following groups:

- The DHCP Snooping Events group (atDhcpsnEvents) contains notifications (traps)
- The DHCP Snooping table (atDhcpsnVariablesTable) contains DHCP snooping information
- The ARP Security table (atArpsecVariablesTable) contains ARP security information

Table 89-21: Objects defined in AT-DHCPSN-MIB

Object	Object Identifier	Description
atDhcpsn	{ modules 537 }	This MIB file contains definitions of managed objects for DHCP Snooping in AlliedWare Plus™.
atDhcpsnEvents	{ atDhcpsn 1 }	DHCP Snooping notifications (traps)
atDhcpsnTrap	{ atDhcpsnEvents 1 }	DHCP Snooping violation notification.
atArpsecTrap	{ atDhcpsnEvents 2 }	DHCP Snooping ARP Security violation notification.
atDhcpsnVariablesTable	{ atDhcpsn 1 }	The DHCP Snooping table. This table contains rows of DHCP Snooping information.
atDhcpsnVariablesEntry	{ atDhcpsnVariablesTable 1 }	A set of parameters that describe the DHCP Snooping features.
atDhcpsnIfIndex	{ atDhcpsnVariablesEntry 1 }	Ifindex of the port that the packet was received on.
atDhcpsnVid	{ atDhcpsnVariablesEntry 2 }	VLAN ID of the port that the packet was received on.
atDhcpsnSmac	{ atDhcpsnVariablesEntry 3 }	Source MAC address of the packet that caused the trap.
atDhcpsnOpcode	{ atDhcpsnVariablesEntry 4 }	Opcode value of the BOOTP packet that caused the trap. Only bootpRequest(1) or bootpReply(2) is valid.
atDhcpsnCiaddr	{ atDhcpsnVariablesEntry 5 }	Ciaddr value of the BOOTP packet that caused the trap.
atDhcpsnYiaddr	{ atDhcpsnVariablesEntry 6 }	Yiaddr value of the BOOTP packet that caused the trap.
atDhcpsnGiaddr	{ atDhcpsnVariablesEntry 7 }	Giaddr value of the BOOTP packet that caused the trap.
atDhcpsnSiaddr	{ atDhcpsnVariablesEntry 8 }	Siaddr value of the BOOTP packet that caused the trap.
atDhcpsnChaddr	{ atDhcpsnVariablesEntry 9 }	Chaddr value of the BOOTP packet that caused the trap.

Table 89-21: Objects defined in AT-DHCPSN-MIB(cont.)

Object	Object Identifier	Description
atDhcpsnVioType	{ atDhcpsnVariablesEntry 10 }	The reason that the trap was generated. ■ invalidBootp(1) indicates that the received BOOTP packet was invalid. For example, it is neither BootpRequest nor BootpReply. ■ invalidDhcpAck(2) indicates that the received DHCP ACK was invalid. ■ invalidDhcpRelDec(3) indicates the DHCP Release or Decline was invalid. ■ invalidIp(4) indicates that the received IP packet was invalid. ■ maxBindExceeded(5) indicates that if the entry was added, the maximum bindings configured for the port would be exceeded. ■ opt82InsertErr(6) indicates that the insertion of Option 82 failed. ■ opt82RxInvalid(7) indicates that the received Option 82 information was invalid. ■ opt82RxUntrusted(8) indicates that Option 82 information was received on an untrusted port. ■ opt82TxUntrusted(9) indicates that Option 82 would have been transmitted out an untrusted port. ■ replyRxUntrusted(10) indicates that a BOOTP Reply was received on an untrusted port. ■ srcMacChaddrMismatch(11) indicates that the source MAC address of the packet did not match the BOOTP CHADDR of the packet. ■ staticEntryExisted(12) indicates that the static entry to be added already exists. ■ dbAddErr(13) indicates that adding an entry to the database failed.
atArpsecVariablesTable	{ atDhcpsn 2 }	The ARP Security table. This table contains rows of DHCP Snooping ARP Security information.
atArpsecVariablesEntry	{ atArpsecVariablesTable 1 }	A set of parameters that describe the DHCP Snooping ARP Security features.
atArpsecIfIndex	{ atArpsecVariablesEntry 1 }	Ifindex of the port that the ARP packet was received on.
atArpsecClientIP	{ atArpsecVariablesEntry 2 }	Source IP address of the ARP packet.
atArpsecSrcMac	{ atArpsecVariablesEntry 3 }	Source MAC address of the ARP packet.
atArpsecVid	{ atArpsecVariablesEntry 4 }	VLAN ID of the port that the ARP packet was received on.

Table 89-21: Objects defined in AT-DHCPSN-MIB(cont.)

Object	Object Identifier	Description
atArpsecVioType	{ atArpsecVariablesEntry 5 }	The reason that the trap was generated. ■ srcIpNotFound(1) indicates that the Sender IP address of the ARP packet was not found in the DHCP Snooping database. ■ badVLAN(2) indicates that the VLAN of the DHCP Snooping binding entry associated with the Sender IP address of the ARP packet does not match the VLAN that the ARP packet was received on. ■ badPort(3) indicates that the port of the DHCP Snooping binding entry associated with the Sender IP address of the ARP packet does not match the port that the ARP packet was received on. ■ srcIpNotAllocated(4) indicates that the CHADDR of the DHCP Snooping binding entry associated with the Sender IP address of the ARP packet does not match the Source MAC and/or the ARP source MAC of the ARP packet.

AT-FILEv2-MIB

This MIB contains objects for displaying and managing file content of Flash, NVS and SD cards on local and stacked devices, and copying, moving and deleting files from local, stacked and remote sources (Table 89-22).

The objects reside in the module atFilev2 { modules 600 }, organized in the following groups:

- The file operation devices - object for various devices supported for file operations
- The SD Card Table - information about the SD Cards configured on the device
- The File Info Table - information about all files, including pathnames, that are present on the device

The procedure in "Copy a File to or from a TFTP Server" on page 87.21 shows how to use these MIB objects to upgrade to a new software version and boot configuration file.

Table 89-22: Objects defined in AT-FILEv2-MIB

Object	Object Identifier	Description
atFilev2	{ modules 600 }	MIB containing objects for listing and managing files.
atFilev2FileOperation	{ atFilev2 3 }	Collection of file operation objects available for configuration, to enable copying, moving and deleting files.
atFilev2SourceStackID	{ atFilev2Operation 1 }	Specifies the Stack ID of the source file. Set an integer corresponding to the stack ID of the stack member to use as the source. For devices that are not capable of being stacked, set with the value 1. This value is ignored if the source device is set to TFTP.
atFilev2SourceDevice	{ atFilev2Operation 2 }	Specifies the source device for the file to be copied. Valid values are 1 to 4. Set a value that corresponds with the various devices, as below: ■ 1 - Flash - default ■ 2 - Card ■ 3 - NVS ■ 4 - TFTP For copying files, you may use any combination of devices for the source and destination, except for copying from TFTP to TFTP. For moving files you cannot use TFTP as source or destination. For deleting files, the source cannot be TFTP. You must fully configure all required parameters before an operation can commence. Where a TFTP operation is configured, an IP address must also be set via atFilev2TftpIPAddr. To copy a file from TFTP to Flash, use 4 for source and 1 for destination.
atFilev2SourceFilename	{ atFilev2Operation 3 }	Specifies the filename of the source file to copy, move or delete. Include any path as required, but the storage type is not necessary. For example, to copy the file `latest.cfg` from the backupconfigs/routers directory on the TFTP server, you would set: `backupconfigs/routers/latest.cfg`

Table 89-22: Objects defined in AT-FILEv2-MIB(cont.)

Object(cont.)	Object Identifier	Description
atFilev2DestinationStackID	{ atFilev2Operation 4 }	Specifies the Stack ID for the destination file. For devices that are not capable of being stacked, set with the value 1. This value is ignored if the destination device is set to TFTP, or if a deletion operation is carried out.
atFilev2DestinationDevice	{ atFilev2Operation 5 }	Specifies the destination device for the files to be copied into. Valid values are 1 to 4. Set a value that corresponds with the various devices, as below: ■ 1 - Flash - default ■ 2 - Card ■ 3 - NVS ■ 4 - TFTP For copying files, you may use any combination of devices for the source and destination, except for copying from TFTP to TFTP. For moving files you cannot use TFTP as source or destination. For deleting files, this object is ignored. You must fully configure all required parameters before an operation can commence. Where a TFTP operation is configured, an IP address must also be set via atFilev2TftpIPAddr. To copy a file from TFTP to Flash, use 4 for source and 1 for destination.
atFilev2DestinationFilename	{ atFilev2Operation 6 }	Specifies the destination filename of the file to be copied or moved. Include any path as required, but the storage type is not necessary. The destination filename does not need to be the same as the source filename, and this object is ignored for file deletion operations. For example, to copy a release file from the TFTP server to the backup release directory on Flash, you would set: `backuprelease/latest.rel` Note: If the destination is set to Flash, card or NVS, any file at the destination that shares the destination filename will be overwritten by a move or copy operation.

Table 89-22: Objects defined in AT-FILEv2-MIB(cont.)

Object(cont.)	Object Identifier	Description
atFilev2CopyBegin	{ atFilev2Operation 7 }	Represents the status of the copy file operation, in the form of octet string. A read on this object can return several possible values, depending on the current status of the system and the various file operation objects: ■ idle - There is no file operation in progress and all required objects have been set correctly. Setting a '1' to this object will begin the file copy. ■ Error codes: [1-7] - A copy operation cannot be started until these errors are resolved. See below for key. ■ [action]ing x [--> y] - A file operation is currently in progress. You cannot start another operation while the object is returning this value. ■ [action] x [--> y] success - The last copy, move or delete operation was successfully completed. ■ [action] x [--> y] failure: [err] - The last copy, move or delete operation failed, with the error message attached. Common failures include lack of space on the destination file system, incorrect source file names or communication errors with remote services. Upon reading a success or failure message, the message will be cleared and the next read will result in either an 'idle' message or an 'Error codes' message if not all required objects have been correctly set. If the read returned 'idle', a new file operation can now be started. Following are possible values returned as Error codes for file copy: ■ 1 - atFilev2SourceDevice has not been set ■ 2 - atFilev2SourceFilename has not been set ■ 3 - atFilev2DestinationDevice has not been set ■ 4 - atFilev2DestinationFilename has not been set ■ 5 - atFilev2SourceDevice and atFilev2DestinationDevice are both set to TFTP ■ 6 - the combination of source device, stackID and filename is the same as the destination device, stackID and filename (i.e. it is not valid to copy a file onto itself. ■ 7 - TFTP IP address has not been set and TFTP has been set for one of the devices Provided all above requirements are met, immediately upon executing the SNMP set, the device will indicate that it was a success. The actual file copy itself will be started and continue on the device until it has completed. For large files, operations can take several minutes to complete. Subsequent reads of the object will return one of messages shown in the first table, to allow for tracking of the progress of the copy operation.

Table 89-22: Objects defined in AT-FILEv2-MIB(cont.)

Object(cont.)	Object Identifier	Description
atFilev2MoveBegin	{ atFilev2Operation 8 }	Represents the status of the move file operation, in the form of octet string. A read on this object can return several possible values, depending on the current status of the system and the various file operation objects: ■ idle - There is no file operation in progress and all required objects have been set correctly. Setting a '1' to this object will begin the file move. ■ Error codes: [1-6] - A move operation cannot be started until these errors are resolved. See below for key. ■ [action]ing x [--> y] - A file operation is currently in progress. You cannot start another operation while the object is returning this value. ■ [action] x [--> y] success - The last copy, move or delete operation was successfully completed. ■ [action] x [--> y] failure: [err] - The last copy, move or delete operation failed, with the error message attached. Common failures include lack of space on the destination file system, incorrect source file names or communication errors with remote services. Upon reading a success or failure message, the message will be cleared and the next read will result in either an 'idle' message or an 'Error codes' message if not all required objects have been correctly set. If the read returned 'idle', a new file operation can now be started. Following are possible values returned as Error codes for file move: ■ 1 - atFilev2SourceDevice has not been set ■ 2 - atFilev2SourceFilename has not been set ■ 3 - atFilev2DestinationDevice has not been set ■ 4 - atFilev2DestinationFilename has not been set ■ 5 - either atFilev2SourceDevice or atFilev2DestinationDevice are set to TFTP ■ 6 - the combination of source device, stackID and filename is the same as the destination device, stackID and filename (i.e. it is not valid to move a file onto itself. Provided all above requirements are met, immediately upon executing the SNMP set, the device will indicate that it was a success. The actual file move itself will be started and continue on the device until it has completed. For large files, operations can take several minutes to complete. Subsequent reads of the object will return one of messages shown in the first table, to allow for tracking of the progress of the move operation.

Table 89-22: Objects defined in AT-FILEv2-MIB(cont.)

Object(cont.)	Object Identifier	Description
atFilev2DeleteBegin	{ atFilev2Operation 9 }	Represents the status of the delete file operation, in the form of octet string. A read on this object can return several possible values, depending on the current status of the system and the various file operation objects: ■ idle - There is no file operation in progress and all required objects have been set correctly. Setting a '1' to this object will begin the file deletion. ■ Error codes: [1-3] - A delete operation cannot be started until these errors are resolved. See below for key. ■ [action]ing x [--> y] - A file operation is currently in progress. You cannot start another operation while the object is returning this value. ■ [action] x [--> y] success - The last copy, move or delete operation was successfully completed. ■ [action] x [--> y] failure: [err] - The last copy, move or delete operation failed, with the error message attached. Common failures include lack of space on the destination file system, incorrect source file names or communication errors with remote services. Upon reading a success or failure message, the message will be cleared and the next read will result in either an 'idle' message or an 'Error codes' message if not all required objects have been correctly set. If the read returned 'idle', a new file operation can be started. File deletion operations ignore the values set in the atFilev2DestinationStackID, atFilev2DestinationDevice and atFilev2DestinationFilename objects. The file deletion operation is equivalent to the CLI 'delete force [file]' command, so it is possible to delete any normally-protected system files, such as the currently configured boot release. Following are possible values returned as Error codes for file move: ■ 1 - atFilev2SourceDevice has not been set ■ 2 - atFilev2SourceFilename has not been set ■ 3 - atFilev2SourceDevicehas not been set to TFTP Provided all above requirements are met, immediately upon executing the SNMP set, the device will indicate that it was a success. The actual file move itself will be started and continue on the device until it has completed. For large files, operations can take several minutes to complete. Subsequent reads of the object will return one of messages shown in the first table, to allow for tracking of the progress of the move operation.
atFilev2Flash_1	{ atFilev2Operation 10 }	Represents the Flash operation device object
atFilev2Card_2	{ atFilev2Operation 11 }	Represents the Card operation device object
atFilev2Nvs_3	{ atFilev2Operation 12 }	Represents the NVS operation device object
atFilev2Tftp_4	{ atFilev2Operation 13 }	Represents the TFTP operation device object

Table 89-22: Objects defined in AT-FILEv2-MIB(cont.)

Object(cont.)	Object Identifier	Description
atFilev2TftpIPAddr	{ atFilev2Tftp_4 1 }	The IP address of the TFTP server that is to be used for the file copy process. This IP Address needs to be reachable from the device, or the file copy will fail.
atFilev2SDcardTable	{ atFilev2 4 }	The SD Card table, containing information related to SD Cards. Indexed by: ■ atFilev2SDcardStackMemberId
atFilev2SDcardEntry	{ atFilev2SDcardTable 1 }	Data pertaining to an SD Card instance.
atFilev2SDcardStackMemberId	{ atFilev2SDcardEntry 1 }	The index of the stack member hosting this SD Card.
atFilev2SDcardPresence	{ atFilev2SDcardEntry 2 }	This object indicates whether or not an SD Card is inserted into a slot. Possible values are: ■ notPresent (1) ■ present (2)
atFilev2InfoTable	{ atFilev2 5 }	A list of all files, including pathnames, that are present on the device. Hidden system files are not displayed.
atFilev2InfoEntry	{ atFilev2InfoTable 1 }	An entry in the list of files, containing information about a single file.
atFilev2InfoFilepath	{ atFilev2InfoEntry 1 }	The full path and name of the file. Files are sorted in alphabetical order and any filepath that is longer than 112 characters will not be displayed due to SNMP Object Identifier length limitations.
atFilev2InfoFileSize	{ atFilev2InfoEntry 2 }	The size of the file in bytes.
atFilev2InfoFileCreationTime	{ atFilev2InfoEntry 3 }	File creation time in the form <MMM DD YYYY HH:MM:SS>. For example, Sep 7 2008 06:07:54.
atFilev2InfoFileIsDirectory	{ atFilev2InfoEntry 4 }	This object will return the value TRUE if the entry is a directory, or FALSE if it is not.
atFilev2InfoFileIsReadable	{ atFilev2InfoEntry 5 }	This object will return the value TRUE if the file is readable, or FALSE if it is not.
atFilev2InfoFileIsWriteable	{ atFilev2InfoEntry 6 }	This object will return the value TRUE if the file is writeable, or FALSE if it is not.
atFilev2InfoFileIsExecutable	{ atFilev2InfoEntry 7 }	This object will return the value TRUE if the file is executable, or FALSE if it is not.

AT-LOG-MIB

The AT Log MIB contains objects for listing log entries from the buffered and permanent logs (Table 89-23). The objects reside in the module log { modules 601 }, organized in the following groups:

- Log Table - objects containing the information from log messages issued by the system, ordered from oldest to newest entry
- Log Options - contains objects used to set up the log options configuration

Table 89-23: Objects defined in AT-LOG-MIB

Object	Object Identifier	Description
log	{ modules 601 }	MIB containing objects for listing log entries from the buffered and permanent logs.
logTable	{ log 1 }	A list of log entries from the source specified in the 'logSource' object. The list is ordered from oldest entry to newest entry. Indexed by: ■ logIndex
logEntry	{ logTable 1 }	Information about a single log entry, from the source specified in the 'logSource' object.
logIndex	{ logEntry 1 }	An index integer. This index is not directly tied to any specific log entry. Over time, the log will grow larger and eventually older entries will be removed from the log.
logDate	{ logEntry 2 }	The date of the log entry. Data resides in the format octet string, in the form YYYY MMM DD, e.g. 2008 Oct 9.
logTime	{ logEntry 3 }	The time of the log entry. Data resides in the format octet string, in the form HH:MM:SS, e.g. 07:15:04.
logFacility	{ logEntry 4 }	The syslog facility that generated the log entry, in the format octet string. See the reference manual for more information.
logSeverity	{ logEntry 5 }	The severity level of the log entry, in the format octet string. Severities are given below: ■ emerg Emergency, system is unusable ■ alert Action must be taken immediately ■ crit Critical conditions ■ errr Error conditions ■ warning Warning conditions ■ notice Normal, but significant, conditions ■ info Informational messages ■ debug Debug-level messages
logProgram	{ logEntry 6 }	The program that generated the log entry, in the format octet string. See the reference manual for more information.
logMessage	{ logEntry 7 }	The message of thew log entry, in the format octet string.
logOptions	{ log 2 }	Contains objects used to set up the required log options configuration.

Table 89-23: Objects defined in AT-LOG-MIB(cont.)

Object	Object Identifier	Description
logSource	{ logOptions 1 }	An integer indicating the source from which the log entries are retrieved. The valid values are: ■ 1 - Buffered log (default) ■ 2 - Permanent log. This information is used when retrieving the logTable objects, and also specifies the log to be cleared when the 'clearLog' object is set.
logAll	{ logOptions 2 }	An integer indicating whether to display all log entries in the logTable objects, or not. The valid values are: ■ 0 - to display only the most recent log messages. This is the default ■ 1 - to show all available log entries. Note: Choosing to display all log entries may result in delays of several seconds when accessing the logTable objects.
clearLog	{ logOptions 3 }	An integer indicating whether to clear the log that is specified by the 'logSource' object. Valid values are: ■ 0 - do not clear log ■ 1 - clear log

AT-IP-MIB

This MIB contains objects for Allied Telesis specific IP address management (Table 89-24). The objects reside in the module atIpMib { modules 602 }.

Table 89-24: Objects defined in AT-IP-MIB

Object	Object Identifier	Description
atIpMib	{ modules 602 }	MIB containing objects for IP addressing management.
AtIpAddressAssignmentType	Textual Convention	Object containing conditional coded values for the IP address assignment type being applied to the interface, referred to by objects in this MIB. The possible values and explanation are: ■ notSet (0) - indicates that the IP address assignment type has not yet been configured. This value can only ever be read. ■ primary (1) - indicates that the address is a primary IP address; only one primary address is allowed per interface. ■ secondary (2) - indicates that the address is a secondary IP address; any number of secondary IP addresses may be applied
AtIpAddressTable	{ atIpMib 1 }	A table containing mappings between primary or secondary IP addresses, and the interfaces they are assigned to. Indexed by: ■ atIpAddressAddrType ■ atIpAddressAddr
AtIpAddressEntry	{ AtIpAddressTable 1 }	Information about the address mapping for a particular interface.
atIpAddressAddrType	{ AtIpAddressEntry 1 }	An indication of the IP version of 'atIpAddressAddr'
atIpAddressAddr	{ AtIpAddressEntry 2 }	The IP address to which this entry's addressing information pertains. The address type of this object is specified in object 'atIpAddressAddrType'.
atIpAddressPrefixLen	{ AtIpAddressEntry 3 }	An integer, specifying the prefix length of the IP address represented by this entry.
atIpAddressLabel	{ AtIpAddressEntry 4 }	The name assigned to the IP address represented by this entry.
atIpAddressIfIndex	{ AtIpAddressEntry 5 }	The index value that uniquely identifies the interface to which this entry is applicable. The interface identified by a particular value of this index corresponds to the interface identified by the same value of the IF-MIB's ifIndex.
atIpAddressAssignmentType	{ AtIpAddressEntry 6 }	The IP address assignment type for this entry (primary or secondary), as described in the Textual Convention 'AtIpAddressAssignmentType'.

Table 89-24: Objects defined in AT-IP-MIB(cont.)

Object	Object Identifier	Description
atIpAddressRowStatus	{ AtIpAddressEntry 7 }	The current status of the IP address entry. The following values may be returned when reading this object: ■ active (1) The IP address is currently mapped to an interface and is valid. ■ notReady (3) The IP address is currently partially configured and is not mapped to an interface. The following values may be written to this object: ■ active (1) An attempt will be made to map the IP address to the configured interface. ■ createAndWait (5) An attempt will be made to create a new IP address entry. ■ destroy (6) The IP address setting will be removed from the device. An entry cannot be made active until its atIpAddressPrefixLen, atIpAddressIfIndex and atIpAddressAssignmentType objects have been set to valid values.

Public MIBs

The following table lists the public MIBs supported by the AlliedWare Plus™ Operating System. In general, all objects are supported except where the relevant protocol or feature is either not supported or not applicable to the device. Any variations from the standard are listed.

Table 89-25: Public MIBs Supported by AlliedWare Plus™

MIB Name	Reference / Implementation
IANAifType-MIB	www.iana.org/assignments/ianaiftype-mib, IANAifType textual convention.
RFC1155-SMI	RFC 1155, *Structure and Identification of Management Information for TCP/IP-based Internets.*
-	RFC 1212, *Concise MIB Definitions.*
RFC1213-MIB	See IP-MIB.
-	RFC 1215, *A Convention for Defining Traps for use with the SNMP.*
-	RFC 1239, *Reassignment of Experimental MIBs to Standard MIBs.*
IP-MIB	The IP MIB tree encompasses IP-MIB, RFC1213-MIB and IP-FORWARD-MIB definitions. The following documents define the components: ■ RFC 1213, *Management Information Base for Network Management of TCP/IP-based internets: MIB-II* ■ RFC 4292, *IP Forwarding Table MIB* ■ RFC 4293, *Management Information Base for the Internet Protocol (IP)* The following objects are supported: ■ ipForwarding ■ ipDefaultTTL ■ All ipAddrTable objects except ipAdEntReasmMaxSize ■ All ipNetToPhysicalTable objects except ipNetToPhysicalRowStatus (all read-only) ■ ipCidrRouteNumber ■ All ipCidrRouteTable objects except ipCidrRouteTos All other objects in these MIBs are not supported. Note that an Enterprise version of ipAddressTable objects is provided by atIpAddressTable in AT-IP-MIB. This provides equivalent functionality along with support for primary and secondary IP addresses.
TCP-MIB	RFC 2012, *SNMPv2 Management Information Base for the Transmission Control Protocol using SMIv2.*
UDP-MIB	RFC 2013, *SNMPv2 Management Information Base for the User Datagram Protocol using SMIv2.*
IP-FORWARD-MIB	See IP-MIB.
-	RFC 2257, *Agent Extensibility (AgentX) Protocol Version 1.*
SNMP-MPD-MIB	RFC 2572, *Message Processing and Dispatching for the Simple Network Management Protocol (SNMP).*
SNMP-COMMUNITY-MIB	RFC 2576, *Coexistence between Version 1, Version 2, and Version 3 of the Internet-standard Network Management Framework.*
SNMPv2-SMI	RFC 2578, *Structure of Management Information Version 2 (SMIv2).*
SNMPv2-TC	RFC 2579, *Textual Conventions for SMIv2.*

Table 89-25: Public MIBs Supported by AlliedWare Plus™(cont.)

MIB Name	Reference / Implementation
SNMPv2-CONF	RFC 2580, *Conformance Statements for SMIv2*.
P-BRIDGE-MIB	RFC 2674, *Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering and Virtual LAN Extensions*. The following objects are not supported: ■ dot1dTpPortOverflowTable ■ dot1dTrafficClassesEnabled ■ dot1dGmrpStatus ■ dot1dPortCapabilitiesTable ■ dot1dUserPriority ■ dot1dTrafficClassPriority ■ dot1dPortOutboundAccessPriorityTable ■ all objects in the dot1dGarp group ■ all objects in the dot1dGmrp group The following read-write object is implemented as read-only: ■ dot1dPortNumTrafficClasses
Q-BRIDGE-MIB	RFC 2674, *Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering and Virtual LAN Extensions*. The following objects are not supported: ■ dot1qGvrpStatus ■ dot1qFdbId ■ dot1qTpFdbAddress ■ dot1qTpGroupTable ■ dot1qForwardAllTable ■ dot1qForwardUnregisteredTable ■ all objects in the dot1qStatic group ■ dot1qVlanTimeMark ■ dot1qVlanIndex ■ dot1qVlanCurrentEgressPorts ■ dot1qVlanCurrentUntaggedPorts ■ dot1qVlanForbiddenEgressPorts ■ dot1qPortGvrpStatus ■ dot1qPortGvrpFailedRegistrations ■ dot1qPortGvrpLastPduOrigin ■ dot1qPortRestrictedVlanRegistration ■ dot1qPortVlanStatisticsTable ■ dot1qPortVlanHCStatisticsTable ■ dot1qLearningConstraintsTable The following read-write objects are implemented as read-only: ■ dot1qPvid ■ dot1qPortAcceptableFrameTypes
VRRP-MIB	RFC 2787, *Definitions of Managed Objects for the Virtual Router Redundancy Protocol*. All objects with read-write and read-create access are implemented as read-only.

Table 89-25: Public MIBs Supported by AlliedWare Plus™(cont.)

MIB Name	Reference / Implementation
HOST-RESOURCES-MIB	RFC 2790, *Host Resources MIB*. The following objects are not supported: ■ hrStorageAllocationFailures ■ All objects in hrDevice ■ All objects in hrSWRun ■ All objects in hrSWRunPerf ■ All objects in hrSWInstalled ■ All objects in hrMIBAdminInfo
SNMPv2-PDU	RFC 3416, *Version 2 of the Protocol Operations for the Simple Network Management Protocol (SNMP)*.
SNMPv2-TM	RFC 3417, *Transport Mappings for the Simple Network Management Protocol (SNMP)*.
SNMPv2-MIB	RFC 3418, *Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)*.
EtherLike-MIB	RFC 3635, *Definitions of Managed Objects for the Ethernet-like Interface Types*. The following objects are deprecated: ■ dot3StatsEtherChipSet ■ all objects in the dot3Tests group ■ all objects in the dot3Errors group The following read-write object is implemented as read-only: ■ dot3PauseAdminMode
MAU-MIB	RFC 3636, *Definitions of Managed Objects for IEEE 802.3 Medium Attachment Units (MAUs)*. The following objects are not supported: ■ all objects in the dot3RpMauBasicGroup group ■ ifMauTypeListBits ■ ifMauHCFalseCarriers ■ all object identifiers in the dot3MauType group ■ ifMauAutoNegCapabilityBits ■ ifMauAutoNegCapAdvertisedBits ■ ifMauAutoNegCapReceivedBits ■ ifMauAutoNegRemoteFaultAdvertised ■ ifMauAutoNegRemoteFaultReceived ■ all objects in the mauMod group The following objects are deprecated: ■ ifMauTypeList ■ all objects in the dot3BroadMauBasicGroup group ■ ifMauAutoNegCapability ■ ifMauAutoNegCapAdvertised ■ ifMauAutoNegCapReceived The following read-write object is implemented as read-only: ■ ifMauStatus
INET-ADDRESS-MIB	RFC 4001, *Textual Conventions for Internet Network Addresses*.
BRIDGE-MIB	RFC 4188, *Definitions of Managed Objects for Bridges*. The following objects are not supported: ■ dot1dStaticTable ■ dot1dBaseDelayExceededDiscards ■ dot1dBasePortMtuExceededDiscards

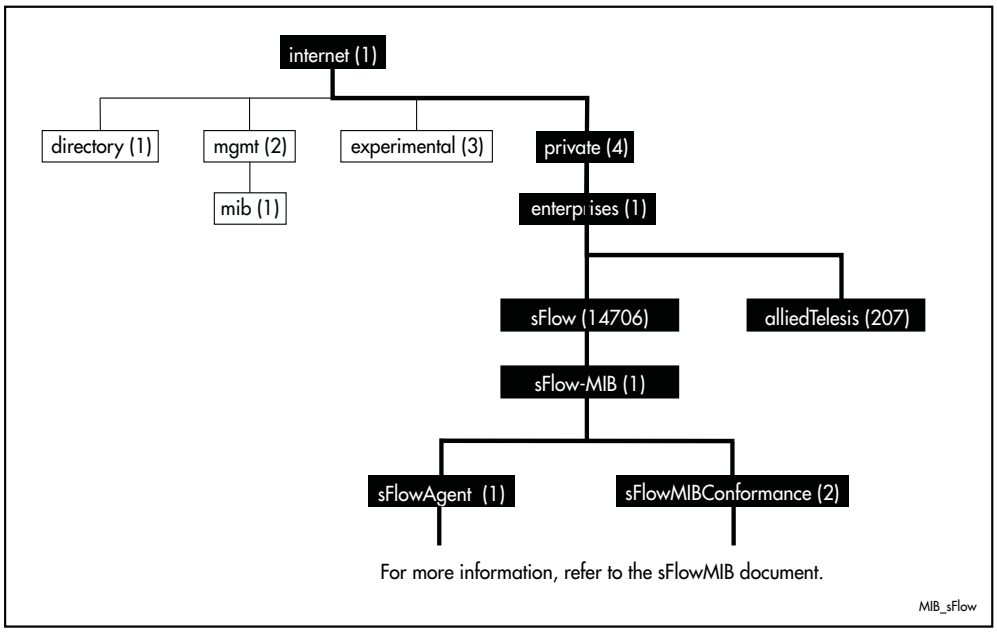
Table 89-25: Public MIBs Supported by AlliedWare Plus™(cont.)

MIB Name	Reference / Implementation
RSTP-MIB	RFC 4318, *Definitions of Managed Objects for Bridges with Rapid Spanning Tree Protocol.* The following object is deprecated: ■ dot1dStpPathCostDefault
DISMAN-PING-MIB	RFC 4560, *Definitions of Managed Objects for Remote Ping, Traceroute, and Lookup Operations.* The following (lldpLocManAddrTable and lldpConfigManAddrTable) read-write object is implemented as read-only: ■ pingMaxConcurrentRequests You can specify multiple ping operations, but the device only performs one ping at a time (pingMaxConcurrentRequests). The device uses ICMP echo for ping operations (pingImplementationTypeDomains).
LLDP-MIB	*IEEE Standard 802.1AB-2005, Section 12, LLDP MIB Definitions.* The following local management address table supports only a single management address per port: ■ lldpConfigManAddrTable
LLDP-EXT-DOT1-MIB	*IEEE Standard 802.1AB-2005, Annex F, IEEE 802.1 Organizationally Specific TLVs., Section F.7.1, IEEE 802.1LLDP extension MIB module.* In each of the following tables, if one entry is set, all other entries in the table are set to the same value. ■ lldpXdot1ConfigVlanNameTxEnable ■ lldpXdot1ConfigProtoVlanTxEnable ■ lldpXdot1ConfigProtocolTxEnable
LLDP-EXT-DOT3-MIB	*IEEE Standard 802.1AB-2005, Annex G, IEEE 802.3 Organizationally Specific TLVs, Section G.7.1, IEEE 802.3 LLDP extension MIB module*
LLDP-EXT-MED-MIB	*ANSI/TIA-1057- 2006, Section 13.3, LLDP-MED MIB Definition*
RIPv2-MIB	*RFC1724 - RIP Version 2 MIB Extension*

Private MIBs

In general, all objects are supported except where the relevant protocol or feature is either not supported or not applicable to the device. The following table lists the private MIBs supported by the AlliedWare Plus™ Operating System. Any variations from the standard are listed.

MIB Name	Reference / Implementation
sFlow-MIB	All MIB objects are fully supported For more information, see www.sflow.org/SFLOW-MIB5.txt



Chapter 90: LLDP Introduction and Configuration

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Introduction

This chapter describes the Link Layer Discovery Protocol (LLDP), LLDP for Media Endpoint Devices (LLDP-MED) and Voice VLAN, and general configuration information for these.

LLDP is designed to be managed with the Simple Network Management Protocol (SNMP), and SNMP-based Network Management Systems (NMS). LLDP can be configured, and the information it provides can be accessed, using either the command line interface or SNMP.

- For detailed descriptions of the commands used to configure LLDP and LLDP-MED, see Chapter 91, LLDP Commands.
- For Voice VLAN commands, see Chapter 17, VLAN Commands.
- For information about the LLDP and LLDP-MED MIBs, see "Public MIBs" on page 89.66.

Link Layer Discovery Protocol

Link Layer Discovery Protocol (LLDP) is a Layer 2 protocol defined by the *IEEE Standard 802.1AB-2005*. This switch supports LLDP as specified in this standard, including *Annex F* and *Annex G*.

LLDP enables Ethernet network devices, such as switches and routers, to transmit and/or receive device-related information to or from directly connected devices on the network, and to store such information learned about other devices. The data sent and received by LLDP is useful for many reasons. The switch can discover neighbors—other devices directly connected to it. Devices can use LLDP to advertise some parts of their Layer 2 configuration to their neighbors, enabling some kinds of misconfiguration to be more easily detected and corrected.

LLDP is a link level ("one hop") protocol; LLDP information can only be sent to and received from devices that are directly connected to each other, or connected via a hub or repeater. Advertised information is not forwarded on to other devices on the network.

The information transmitted in LLDP advertisements flows in one direction only, from one device to its neighbors, and the communication ends there. Transmitted advertisements do not solicit responses, and received advertisements do not solicit acknowledgement.

LLDP operates over physical ports (Layer 2) only. For example, it can be configured on switch ports that belong to static or dynamic aggregated links (channel groups), but not on the aggregated links themselves; and on switch ports that belong to VLANs, but not on the VLANs themselves.

LLDP provides a way for the switch to:

- transmit information about itself to neighbors
- receive device information from neighbors
- store and manage information in an LLDP MIB

Each port can be configured to transmit local information, receive neighbor information, or both.

LLDP defines:

- a set of common advertisements ("LLDP Advertisements" on page 90.4)
- a protocol for transmitting and receiving advertisements ("Transmission and Reception" on page 90.8)
- a method for storing the information that is contained within received advertisements ("Storing LLDP Information" on page 90.10)

Interactions

LLDP has the following interactions with other switch features:

- Spanning tree

  Ports blocked by a spanning tree protocol can still transmit and receive LLDP advertisements.

- 802.1x

  Ports blocked by 802.1x port authorization cannot transmit or receive LLDP advertisements. If LLDP has stored information for a neighbor on the port before it was blocked, this information will eventually time out and be discarded.

- VLAN tagging

  LLDP packets are untagged; they do not contain 802.1Q header information with VLAN identifier and priority tagging.

- Virtual Chassis Stacking (VCStack) resiliency link

  When a port is configured as a VCStack resiliency link port, LLDP does not operate on the port; LLDP neither transmits nor receives advertisements, and any LLDP configuration and data stored for the port, including counters, is discarded.

- Mirror ports

  LLDP does not operate on mirror analyzer ports.

LLDP-MED

LLDP for Media Endpoint Devices (LLDP-MED), is an extension of LLDP used between LAN network connectivity devices, such as this switch, and the media endpoint devices connected to them, such as IP phones. LLDP-MED is specified in *ANSI/TIA-1057-2006*. Of the application types specified in *ANSI/TIA-1057-2006*, the switch supports Application Type 1: Voice.

LLDP-MED uses the LLDP advertisement, transmission and storage mechanisms, but transmits, receives, and stores data specifically related to managing the voice endpoint devices. This includes information about network policy, location, hardware configuration, and, for Power over Ethernet-capable devices, power management.

Voice VLAN

Many IP phones (or other IP voice devices) have two interfaces: one to connect to the network and another that allows a computer or similar device to connect to the network via the IP phone. It is often desirable to treat the voice and data traffic separately so that appropriate Quality of Service (QoS) policies can be applied to each. The Voice VLAN feature uses LLDP-MED to convey configuration information (such as VLAN ID and User Priority tagging, and DiffServ Code Point (DSCP)—"Differentiated Services Architecture" on page 60.4) for the voice traffic to the IP phone. In response, the IP phone sends voice traffic according to this

configuration. The data traffic coming through the IP phone from the PC is sent with the default configuration, typically untagged with normal priority.

LLDP Advertisements

LLDP transmits advertisements as packets called LLDP Data Units (LLDPDUs). An LLDPDU consists of a set of Type-Length-Value elements (TLV), each of which contains a particular type of information about the device or port transmitting it.

Type-Length-Value (TLV)

A single LLDPDU contains multiple TLVs. TLVs are short information elements that communicate complex data, such as variable length strings, in a standardized format. Each TLV advertises a single type of information, such as its device ID, type, or management addresses. The following table describes fields in a TLV.

Table 90-1: Fields in a Type Length Value element

Field	Description
Type	Identifies the kind of information. It consists of a 7-bit Type code.
Length	Identifies the length of the information. It consists of a 9-bit value that specifies the number of bytes of data in the Value field.
Value	Contains the actual value of the advertised information. This is a variable length data field.

LLDP sends mandatory TLVs in each advertisement; it can also be configured to send one or more optional TLVs, from the following groups:

- Mandatory Base TLVs, included in all LLDP advertisements. See IEEE 802.1AB-2005.
- Optional Base TLVs, which may be included in any LLDP advertisements. See IEEE 802.1AB-2005.
- IEEE 802.1 Organizationally Specific TLVs (802.1 TLVs). See IEEE 802.1AB-2005 Annex F.
- IEEE 802.3 Organizationally Specific TLVs (802.3 TLVs). See IEEE 802.1AB-2005 Annex G.
- LLDP-MED Organizationally Specific TLVs (LLDP-MED TLVs), included in LLDP-MED advertisements. See ANSI/TIA-1057- 2006.

Mandatory and optional TLVs for LLDP and LLDP-MED advertisements are shown in Table 90-2.

Table 90-2: TLVs in LLDP advertisements

TLV	Description
Mandatory Base TLVs—IEEE 802.1AB-2005	
Chassis ID	Identifies the device's chassis. On this switch, this is the MAC address of the switch or stack.
Port ID	Identifies the port that transmitted the LLDPDU.

Table 90-2: TLVs in LLDP advertisements(cont.)

TLV	Description
Time To Live (TTL)	Indicates the length of time in seconds for which the information received in the LLDPDU remains valid. If the value is greater than zero, the information is stored in the LLDP remote system MIB. If the value is zero, the information previously received is no longer valid, and is removed from the MIB.
End of LLDPDU	Signals that there are no more TLVs in the LLDPDU.
Optional Base TLVs—IEEE 802.1AB-2005	
Port description	A description of the device's port in alpha-numeric format.
System name	The system's assigned name in alpha-numeric format.
System description	A description of the device in alpha-numeric format. This includes information about the device's hardware and operating system.
System capabilities	The device's router and bridge functions, and whether or not these functions are currently enabled.
Management address	The address of the local LLDP agent. This can be used to obtain information related to the local device.
IEEE 802.1 Organizationally Specific TLVs (802.1 TLVs)—IEEE 802.1AB-2005 Annex F	
Port VLAN	VLAN identifier that the local port associates with untagged or priority tagged frames.
Port & Protocol VLANs	Whether Port & Protocol VLAN is supported and enabled on the port, and the list of Port & Protocol VLAN identifiers.
VLAN Names	List of VLAN names that the port is assigned to.
Protocol IDs	List of protocols that are accessible through the port, for instance: ■ 9000 (Loopback) ■ 00 26 42 42 03 00 00 00 (STP) ■ 00 27 42 42 03 00 00 02 (RSTP) ■ 00 69 42 42 03 00 00 03 (MSTP) ■ 888e01 (802.1x) ■ aa aa 03 00 e0 2b 00 bb (EPSR) ■ 88090101 (LACP) ■ 00540000e302 (Loop protection) ■ 0800 (IPv4) ■ 0806 (ARP) ■ 86dd (IPv6)
IEEE 802.3 Organizationally Specific TLVs (802.3 TLVs)—IEEE 802.1AB-2005 Annex G	
MAC/PHY Configuration/Status	The current values of the following for the port: ■ Speed and duplex mode auto-negotiation support ■ Auto-negotiation status ■ PMD (physical media dependent) auto-negotiation advertised capability ■ Operational MAU type This TLV is always included in LLDP-MED advertisements.
Power Via MDI	The power-via-MDI capabilities. On devices that are LLDP-MED and PoE-capable, we recommend using the Extended Power-via-MDI TLV instead of this TLV.
Link Aggregation	Whether the link is capable of being aggregated, whether it is currently in an aggregation and if in an aggregation, the port of the aggregation.

Table 90-2: TLVs in LLDP advertisements(cont.)

TLV	Description
Maximum Frame Size	The maximum supported 802.3 frame size that the sending device is capable of receiving—larger frames will be dropped.
LLDP-MED Organizationally Specific TLVs (LLDP-MED TLVs)—ANSI/TIA-1057- 2006	
LLDP-MED Capabilities	Indicates an LLDP-MED capable device, and advertises which LLDP-MED TLVs are supported and enabled, and the device type. For this switch, the device type is Network Connectivity Device. An advertisement containing this TLV is an LLDP-MED advertisement.
Network Policy	Network policy information configured on the port for connected media endpoint devices. The switch supports Application Type 1: Voice, including the following network policy for connected voice devices to use for voice data: ■ Voice VLAN ID ■ Voice VLAN User Priority tagging ■ Voice VLAN Diffserv Code Point (DSCP)
Location Identification	Location information configured for the port, in one or more of the following formats: ■ Civic address ■ Coordinate-based LCI ■ Emergency Location Identification Number (ELIN) For more information, see "LLDP-MED: Location Identification TLV" on page 90.7.
Extended Power-via-MDI	For PoE-capable devices, this TLV includes: ■ Power Type field: Power Sourcing Entity (PSE). ■ Power Source field: current power source, either Primary Power Source or Backup Power Source. ■ Power Priority field: power priority configured on the port. ■ Power Value field: In TLVs transmitted by a Power Sourcing Equipment (PSE) such as this switch, this advertises the power that the port can supply over a maximum length cable based on its current configuration (that is, it takes into account power losses over the cable). In TLVs received from Powered Device (PD) neighbors, the power value is the power the neighbor requests. Available on devices that are PoE-capable.
Inventory Management TLV Set	Includes the following TLVs, based on the current hardware platform and the software version, identical on every port on the switch: ■ Hardware Revision ■ Firmware Revision ■ Software Revision ■ Serial Number ■ Manufacturer Name ■ Model Name ■ Asset ID On Virtual Chassis Stacking devices, the inventory information is based on the current master.

LLDP-MED: Location Identification TLV

Location information can be configured for each port, and advertised to remote devices, which can then transmit this information in calls; the location associated with voice devices is particularly important for emergency call services. All ports may be configured with the location of the switch, or each port may be configured with the location of the remote voice device connected to it.

The location information for a particular port can be configured using one or more of the following three data formats: coordinate-based, Emergency Location Identification Number (ELIN), and civic address. Up to one location of each type can be assigned to a port.

Location configuration information (LCI) in all configured data formats is transmitted in Location Identification TLVs. When LLDP receives a Location Identification TLV, it updates the remote entry in the LLDP-MED MIB with this information.

Co-ordinate LCI Coordinate-based location data format uses geospatial data, that is, latitude, longitude, and altitude (height or floors), including indications of resolution, with reference to a particular datum: WGS 84, NAD83—North American Vertical Datum of 1988 (NAVD88), or NAD83—Mean Lower Low Water (MLLW). For more information, see *RFC 3825, Dynamic Host Configuration Protocol Option for Coordinate-based Location Configuration Information.*

ELIN LCI Emergency Location Identification Number (ELIN) location data format provides a unique number for each location for Emergency Call Services (ECS). In North America, ELINs are typically 10 digits long; ELINs up to 25 digits are supported.

Civic Address LCI The Civic Address location data format uses common street address format, as described in *RFC4776*.

Transmission and Reception

Table 90-3 describes the LLDP transmission and reception processes. Additional LLDP-MED processes are described in "LLDP-MED Operation" on page 90.9.

Table 90-3: LLDP transmission and reception processes

When ...	And ...	Then ...
LLDP is enabled	Ports are configured to transmit LLDP advertisements	Regular LLDP advertisements are sent via these ports at intervals determined by the transmit interval. Each advertisement contains local information (from the Local Systems MIB) for all the mandatory TLVs and the optional TLVs that the port is configured to send.
	Ports are configured to receive LLDP advertisements	Information received in advertisements via these ports is stored in the Neighbor table (Remote Systems MIB). This information is retained until it is replaced by a more recent advertisement from the same neighbor or it times out (the TTL elapses).
Local information changes	The transmission delay time has elapsed since the last advertisement was transmitted	New advertisements are sent containing the new set of local information.
Neighbor information changes	Notifications are enabled, and the notification interval has elapsed since the last notification was sent	The SNMP notification (trap) lldpRemTablesChange is sent.
LLDP transmission and reception is disabled on a port.	An LLDP command was used to do this	It transmits a final 'shutdown' LLDPDU with a Time-To-Live (TTL) TLV that has a value of "0". This tells any remote neighboring devices to remove the information associated with this switch from their remote systems MIB. Then it stops transmitting and receiving advertisements. The neighbor information remains in the Remote Systems MIB until it times out.
	A shutdown command was used on the port	It makes a best effort to send a shutdown LLDPDU. Then it stops transmitting and receiving advertisements. The neighbor information remains in the Remote Systems MIB until it times out.
	Something else disabled LLDP, such as Virtual Chassis Stacking (VCStack) failover	It does not send a shutdown LLDPDU. It stops transmitting and receiving advertisements. The neighbor information remains in the Remote Systems MIB until it times out.
	It is enabled again	LLDP reinitializes and resumes transmitting and receiving advertisements after the reinitialization interval has elapsed.
The Neighbor table has 1600 neighbors		It discards any further neighbors.
LLDP receives a LLDPDU or TLV with a detectable error		It discards the incorrect TLV.
LLDP receives a TLV it does not recognize	It contains no basic format errors	It stores it for possible later retrieval by network management (in the unrecognized TLV information table lldpRemUnknownTLVTable in the LLDP MIB).

LLDP-MED Operation

When LLDP is enabled, LLDP-MED is enabled by default, and uses the same LLDP transmission and reception process described in Table 90-3. When LLDP receives an advertisement indicating a newly connected LLDP-MED-capable device on a port, it transmits one LLDP-MED advertisement per second via this port, a configurable number of times (the *fast start count*). Thereafter, it sends regular advertisements at the LLDP transmit interval. When the last advertisement for an LLDP-MED-capable device connected to the port times out, it stops sending LLDP-MED advertisements via the port.

If LLDP-MED notifications are enabled for a port, and SNMP traps for LLDP are enabled, LLDP-MED generates a *Topology Change Notification (LLDP-MED lldpXMedTopology ChangeDetected)* when a new LLDP-MED compliant IP telephony device is connected to a port or removed from a port. This notification includes the following information:

- IP Phone Chassis ID and Chassis ID sub-type (IP address)
- LLDP Endpoint Device Class
- Switch Chassis ID (MAC address) and Port ID where the device is attached.

Storing LLDP Information

When an LLDP device receives a valid LLDP advertisement from a neighboring network device, it stores the information in an IEEE-defined Simple Network Management Protocol (SNMP) Management Information Base (MIB).

LLDP stores information in the LLDP MIB defined in Section 12 of the *IEEE Standard 802.1AB-2005*, its extensions defined in *Annex F*, *Annex G*, and ANSI/TIA-1057- 2006, about:

LLDP-EXT-MED-MIB ANSI/TIA-1057- 2006, Section 13.3, LLDP-MED MIB Definition

- Local system information. This is the information that LLDP can transmit in advertisements to its neighbors.
- Remote systems information. This is the data that the device receives in advertisements from its neighbors.
- LLDP configuration. This can be used with SNMP to configure LLDP on the device.
- LLDP statistics. This includes information about LLDP operation on the device, including packet and event counters.

This information can be accessed either via SNMP, or directly using the command line interface.

Local system

Information about your device is called local system information. The LLDP local system MIB maintains this information, which consists of device details, as well as any user-configured information that you have set up for your switch, for example a port description or a management address.

LLDP on this device can store one management address per port, and transmit this in LLDP advertisements. It can store multiple management addresses received from each neighbor.

Remote systems

Information gained from neighboring devices is called remote system information. The LLDP remote systems MIB maintains this information.

The length of time for which neighbor information remains in the LLDP remote systems MIB is determined by the Time-To-Live (TTL) value of received LLDPDUs. When it receives an advertisement from a neighbor, LLDP starts a timer based on the Time To Live (TTL) information in the advertisement. The Time To Live (TTL) information in an advertisement is: TTL=transmit interval x holdtime multiplier. If the TTL elapses, for instance if the neighbor has been removed, LLDP deletes the neighbor's information from the MIB. This ensures that only valid LLDP information is stored.

Whenever a new neighbor is discovered, or an existing neighbor sends an advertisement with new information that differs from the previous advertisement, for example a new or changed TLV, a remote tables change event is activated. If SNMP notifications are enabled, the notification lldpRemTablesChange is sent.

To prevent the remote systems MIB from using large amounts of memory and possibly affecting the operation of your switch, it limits the number of neighbors it stores information for to 1600. If it is storing information from 1600 neighbors, and detects any more neighbors, it is considered to have too many neighbors, and discards advertisements from the rest. There is no per-port limit to the number of neighbors.

SNMP utilities

An SNMP utility can read the Neighbors table MIB (Remote Systems Data in the LLDP MIB) on a device to find out about the LLDP neighbors it is directly connected to on each port. Then it can read the Neighbors table MIB on each of these neighbors to find out about their neighboring LLDP devices, and so on.

Configuring LLDP

You can configure LLDP on the device using either:

- the command line interface. For detailed descriptions of the commands, see Chapter 91, LLDP Commands, or
- SNMP—see Chapter 89, SNMP MIBs.

This section includes the following command line interface configuration procedures:

- "Configure LLDP" on page 90.12— This procedure includes configuration for LLDP between network connectivity devices; it does not include LLDP-MED. If you are configuring LLDP-MED only, use the following procedure instead of this one.
- "Configure LLDP-MED" on page 90.14—This procedure includes the LLDP configuration required to support LLDP-MED, as well as specific LLDP-MED and Voice VLAN configuration.
- "Configure Authentication for Voice VLAN" on page 90.18—This procedure includes 802.1X port authentication configuration including dynamic VLAN assignment to be used with LLDP-MED. Use the previous procedure before using this one.

Because LLDP is often used together with SNMP, consider configuring SNMP before you configure LLDP. LLDP transmits large amounts of data about the network. For security reasons, we recommend configuring SNMP for SNMP version 3 only (for read and write access). Remove all SNMPv1 and SNMPv2 configuration. See Chapter 87, SNMP Introduction, and Chapter 88, SNMP Commands.

Configure LLDP

Use the procedure in Table 90-4 below to configure LLDP.

Some optional TLVs send information that can be configured by other commands. If LLDP will be configured to send these TLVs, consider whether to configure the corresponding parameters first.

- Port Description. See the description (interface) command on page 11.2.
- System Name. See the hostname command on page 8.18.

Table 90-4: Configuration procedure for LLDP

Enable LLDP		
1.	`awplus#configure terminal`	Enter Configuration mode.
2.	`awplus(config)#lldp run`	Enable LLDP.
Configure ports for LLDP		
Configure each port to determine whether and which LLDP messages are transmitted and received. If all the ports running LLDP require the same configuration, configure them all together. Otherwise repeat these commands for each port or group of ports that requires a particular configuration.		
3.	`awplus(config)# interface <port-list>`	Enter Interface Configuration mode for the switch ports.
4.	`awplus(config-if)#lldp tlv-select {[<tlv>]...}` `awplus(config-if)#lldp tlv-select all`	By default, the mandatory TLVs are included in LLDP messages. Enable the transmission of one or more optional TLVs through these port as required.
5.	`awplus(config-if)#exit`	Return to Global Configuration mode.
6.	`awplus(config)#interface <port-list>`	By default, transmission and reception of LLDP advertisements is enabled on all ports. Enter Interface Configuration mode for any switch ports that should have transmission or reception disabled.
7.	`awplus(config-if)#no lldp {[transmit] [receive]}`	Disable transmission and/or reception as required.
8.	`awplus(config-if)#exit`	Return to Global Configuration mode.
9.	`awplus(config)#exit`	Return to Privileged Exec mode.
Check LLDP configuration		

10.	`awplus#show lldp`
	`awplus#show lldp interface [<port-list>]`
	`awplus#show lldp local-info [base] [dot1] [dot3] [med] [interface <port-list>]`
	`awplus#show running-config lldp`
		Review the LLDP configuration.

Monitor LLDP		

11.	`awplus#show lldp neighbors`
	`awplus#show lldp neighbors detail`
	`awplus#show lldp statistics`
	`awplus#show lldp statistics interface [<port-list>]`
		Monitor LLDP operations and display neighbor information as required.

Table 90-4: Configuration procedure for LLDP**(cont.)**

Advanced LLDP configuration		
The configuration procedure above and the defaults for other settings suit most networks. Use the following commands for fine tuning if necessary. Timer intervals should be long enough not to create unnecessarily high numbers of advertisements when there are topology changes. However, be aware that if the intervals are long, a neighbor's information can continue to be stored after its information has changed, or after it is disconnected.		
12.	`awplus#configure terminal`	Enter Configuration mode.
13.	`awplus(config)#interface <port-list>`	Enter Interface Configuration mode for the switch ports.
14.	`awplus(config-if)#lldp management-address <ipaddr>`	Override the default LLDP management address advertised through this port if required. This must be an IPv4 address that is already configured on the device. To see the management address that will be advertised, use the show lldp local-info command on page 91.39.
15.	`awplus(config-if)#lldp notifications`	By default, SNMP notifications are not transmitted. Enable them for these ports if required. (SNMP LLDP traps (notifications) must also be enabled.)
16.	`awplus(config-if)#exit`	Return to Global Configuration mode.
17.	`awplus(config)#lldp timer <5-32768>`	The transmit interval determines how often regular LLDP transmits advertisements from each port. The transmit interval must be at least four times the transmission delay. Default: 30 seconds
18.	`awplus(config)#lldp notification-interval <5-3600>`	The notification interval determines the minimum interval between sending SNMP notifications (traps). Default: 5 seconds
19.	`awplus(config)#lldp tx-delay <1-8192>`	A series of successive changes over a short period of time can trigger the agent to send a large number of LLDPDUs. To prevent this, there is a transmission delay timer. This establishes a minimum length of time that must elapse between successive LLDP transmissions. The transmission delay cannot be greater than a quarter of the transmit interval. Default: 2 seconds
20.	`awplus(config)#lldp reinit <1-10>`	Reinitialization delay timer determines the minimum time after disabling LLDP on a port before it can reinitialize. Default: 2 seconds
21.	`awplus(config)#lldp holdtime-multiplier <2-10>`	The transmit interval is multiplied by the holdtime multiplier to give the Time To Live (TTL) value that is advertised to neighbors. Default: 4
22.	`awplus(config)#exit`	Return to Privileged Exec mode.
Clear data		
If necessary, you can clear either neighbor information or LLDP statistics for particular ports or all ports.		
23.	`awplus#clear lldp table [interface <port-list>]`	Clear the information from the table of neighbor information.
24.	`awplus#clear lldp statistics [interface <port-list>]`	Clear LLDP statistics (packet and event counters).

Configure LLDP-MED

Use the procedure in Table 90-5 to configure LLDP-MED and Voice VLAN for voice devices connected to the switch.

Consider whether you also need to configure:

- Simple Network Management Protocol (Chapter 88, SNMP Commands)
- 802.1X port authentication (Chapter 63, 802.1X Commands, Chapter 65, Authentication Commands, Chapter 67, AAA Commands)
- RADIUS server (Chapter 73, Local RADIUS Server Commands, or Chapter 69, RADIUS Commands)
- Quality of Service (Chapter 61, QoS Commands)
- Access Control Lists (Chapter 56, IPv4 Hardware Access Control List (ACL) Commands and Chapter 57, IPv4 Software Access Control List (ACL) Commands)

In most cases, configuring LLDP-MED using SNMP or using the CLI command line interface (CLI) described in Chapter 91, LLDP Commands has the same effect. However, the effect of configuring location information using SNMP differs from the CLI. When location information is assigned to a port by SNMP and a matching location is not found on the device, then a new location is automatically created and assigned to the specified port. If the location is unset by SNMP later, then the location is removed to prevent accumulating SNMP-set location information. However, if the location is being used for other ports, the automatically created location is not removed until no ports use it. Once it is modified or assigned to other ports by CLI commands, the location remains even after no ports use the location.

Table 90-5: Configuration procedure for Voice VLAN and LLDP-MED

Configure a Voice VLAN		
Create a VLAN for voice data from voice endpoint devices connected to ports on the switch. Specify the network policy for voice data in this voice VLAN. LLDP-MED sends the network policy to voice devices connected to these ports. The voice devices use this network policy to determine the VLAN, priority and DSCP tagging of voice data it transmits.		
1.	`awplus# configure terminal`	Enter Global Configuration mode.
2.	`awplus(config)# vlan database`	Enter VLAN Database Configuration mode.
3.	`awplus(config-vlan)# vlan <vid> [name <vlan-name>] [state {enable|disable}]`	Create a VLAN to be used for the voice data to and from voice devices connected to the switch. By default, the new VLAN is enabled.
4.	`awplus(config-vlan)# exit`	Return to global configuration mode.
5.	`awplus(config)# interface <port-list>`	Enter interface configuration mode for the ports to be configured with the same network policy. This may be all the switch ports with voice devices connected to them, or a subset if the network policy will differ between ports.
6.	`awplus(config-if)# switchport voice vlan [<vid>|dot1p|dynamic|untagged]`	Specify the VLAN tagging to be used for voice data on these ports. Use the dynamic option if the VLAN tagging will be allocated dynamically by a RADIUS server. To configure authentication and dynamic VLAN allocation using the local RADIUS server, see the procedure in Table 90-6 on page 90.18. Default: none.

Table 90-5: Configuration procedure for Voice VLAN and LLDP-MED(cont.)

7.	`awplus(config-if)#` switchport voice vlan priority <0-7>	Specify the priority-tagging that voice endpoint devices should put into their data packets. Default: 5.
8.	`awplus(config-if)#` switchport voice dscp <0-63>	Specify the DSCP value that voice endpoint devices should put into their data packets. Default: 0.
9.	`awplus(config-if)#` exit	Return to global configuration mode.
Enable LLDP		
10.	`awplus(config)#` lldp run	Enable LLDP on the switch. Default: LLDP is disabled.
11.	`awplus(config)#` interface *<port-list>*	Enter interface configuration mode for the switch ports LLDP is NOT to run on.
12.	`awplus(config-if)#` no lldp {[transmit] [receive]}	Disable transmission or reception on these ports as required. Default: transmit and receive enabled.
13.	`awplus(config-if)#` exit	Return to global configuration mode.
Configure LLDP-MED location information		
Create civic address, coordinate, and/or ELIN locations, and assign them to switch ports.		
14.	`awplus(config)#` location civic-location identifier <civic-loc-id>	Specify a civic location ID, and enter configuration mode for this identifier.
15.	`awplus(config-civic)#` country <country> `awplus(config-civic)#` city <city> `awplus(config-civic)#` primary-road-name <primary-road-name> `awplus(config-civic)#` street-suffix <street-suffix> `awplus(config-civic)#` house-number <house-number> `awplus(config-civic)#` *<other-civic-location-parameters …>*	Specify the civic address location information for the civic address location ID. You must specify a country first, using the upper-case two-letter country code, and then at least one more parameter. For the full set of parameters you can use to specify civic address location, see the location civic-location configuration command on page 91.22.
16.	`awplus(config-civic)#` exit	Return to global configuration mode.
17.	`awplus(config)#` location coord-location identifier <coord-loc-id>	Specify a coordinate location identifier, and enter configuration mode for this identifier.
18.	`awplus(config-coord)#` latitude <latitude> `awplus(config-coord)#` lat-resolution <lat-resolution> `awplus(config-coord)#` longitude <longitude> `awplus(config-coord)#` long-resolution <long-resolution> `awplus(config-coord)#` altitude <altitude> {meters|floor} `awplus(config-coord)#` alt-resolution <alt-resolution> `awplus(config-coord)#` datum {wgs84|nad83-navd|nad83-mllw}	Specify the coordinate location for the coordinate location identifier.
19.	`awplus(config-coord)#` exit	Return to global configuration mode.

Table 90-5: Configuration procedure for Voice VLAN and LLDP-MED(cont.)

20.	`awplus(config)#` location elin-location <elin> identifier <elin-loc-id>	Specify an ELIN location identifier, and the ELIN for this identifier.
21.	`awplus(config)#` interface *<port-list>*	Enter interface configuration mode for one or more switch ports which require the same location information.
22.	`awplus(config-if)#` location civic-location-id <civic-loc-id> `awplus(config-if)#` location coord-location-id <coord-loc-id> `awplus(config-if)#` location elin-location-id <elin-loc-id>	Assign the civic, coordinate, and/or ELIN location identifier to these ports. LLDP-MED will send the location information associated with a port to the voice endpoint device attached to it.
23.	`awplus(config-if)#` exit	Return to global configuration mode.
24.	`awplus(config)#` exit	Return to Privileged Exec mode.
Review the LLDP configuration		
25.	`awplus#` show lldp	Check general LLDP configuration settings.
26.	`awplus#` show lldp interface [<port-list>]	Check LLDP configuration for ports.
27.	`awplus#` show lldp local-info [base] [dot1] [dot3] [med] [interface <port-list>]	Check the information that may be transmitted in LLDP advertisements from ports.
28.	`awplus#` show location {civic-location|coord-location|elin-location} `awplus#` show location {civic-location|coord-location|elin-location} identifier {<civic-loc-id>|<coord-loc-id>|<elin-loc-id>} `awplus#` show location {civic-location|coord-location|elin-location} interface <port-list>	Check the location information.
29.	`awplus#` show running-config lldp	If you want to display all the LLDP configuration, use this command.
Monitor LLDP-MED		
30.	`awplus#` show lldp neighbors [interface <port-list>] `awplus#` show lldp neighbors detail [base] [dot1] [dot3] [med] [interface <port-list>] `awplus#` show lldp statistics `awplus#` show lldp statistics interface [<port-list>]	Monitor LLDP operation.
Advanced configuration		
The configuration procedure above and the defaults for other settings suit most networks. Use the following commands for fine tuning if necessary. For information about other advanced configuration for LLDP, including LLDP timers, see Table 90-4.		
31.	`awplus#`configure terminal	Enter Global Configuration mode.
32.	`awplus(config)#` lldp faststart-count <1-10>	By default, when LLDP-MED detects an LLDP-MED capable device on a port, it sends 3 advertisements at 1s intervals. Change the fast start count if required. Default: fast start count is 3

Table 90-5: Configuration procedure for Voice VLAN and LLDP-MED(cont.)

33.	`awplus(config)#` lldp non-strict-med-tlv-order-check	By default non-strict order checking for LLDP-MED advertisements is disabled. That is, strict order checking is applied to LLDP-MED advertisements, and LLDP-MED TLVs in non-standard order are discarded. If you require LLDP-MED advertisements with non-standard TLV order to be received and stored, enable non-strict order checking.
34.	`awplus(config)#` interface *<port-list>*	Enter interface configuration mode for switch ports which will have the same advanced configuration.
35.	`awplus(config-if)#` lldp management-address <ipaddr>	Override the default LLDP management address advertised through this port if required. This must be an IPv4 address that is already configured on the device. To see the management address that will be advertised, use the show lldp local-info command on page 91.39.
36.	`awplus(config-if)#` lldp med-notifications	By default, SNMP notifications are not transmitted. Enable LLDP-MED Topology Change Detected notifications for these ports if required. (SNMP LLDP traps (notifications) must also be enabled.) Default: LLDP-MED notifications disabled
37.	`awplus(config-if)#` lldp tlv-select {[<tlv>]...}	Enable the transmission of one or more optional LLDP TLVs in LLDP-MED advertisements through this port as required. The mac-phy-config TLV is transmitted in LLDP-MED advertisements whether or not it is enabled by this command. Default: all mandatory TLVs are enabled.
38.	`awplus(config-if)#` lldp med-tlv-select {[capabilities] [network-policy] [location] [inventory-management]} `awplus(config-if)#` lldp med-tlv-select all `awplus(config-if)#` no lldp med-tlv-select {[capabilities] [network-policy] [location] [inventory-management]} `awplus(config-if)#` no lldp med-tlv-select all	Enable or disable the transmission of optional LLDP-MED TLVs in LLDP-MED advertisements through these ports as required. Default: capabilities, network-policy, location, power-management are enabled.
39.	`awplus(config-if)#` exit	Return to global configuration mode.
40.	`awplus(config)#` exit	Return to privileged exec mode.

Clear data

If necessary, you can clear either neighbor information or LLDP statistics for particular ports or all ports.

41.	`awplus#` clear lldp table [interface <port-list>]	Clear the information from the table of neighbor information.
42.	`awplus#` clear lldp statistics [interface <port-list>]	Clear LLDP statistics (packet and event counters).

Configure Authentication for Voice VLAN

Use the following procedure with LLDP-MED and Voice VLAN to configure 802.1X port authentication and dynamic VLAN assignment using the local RADIUS server on the switch to which the voice endpoint devices are connected.

This procedure assumes that you have already:

- configured Voice VLAN and LLDP-MED using the procedure in Table 90-5 on page 90.14
- set switchport voice vlan to dynamic in the above procedure

This procedure configures the local RADIUS server. If your configuration uses one or more remote RADIUS servers instead, set the IP addresses of the remote RADIUS servers using the radius-server host command (Step 3 on page 18), and skip all the steps that configure the local RADIUS server (Step 3 on page 18 to Step 14 on page 19).

Table 90-6: Configuration procedure for Voice VLAN with RADIUS authentication and dynamic VLAN

Configure the IP address of the RADIUS host.		
1.	`awplus#configure terminal`	Enter Global Configuration mode.
2.	`awplus(config)#radius-server host` 127.0.0.1 key *<key-string>*	Configure the IP address for the RADIUS server to be the local loopback interface address, so that RADIUS requests are sent to the local RADIUS server. Set the key that Network Access Servers (NAS) will need to use to get access to this RADIUS server. RADIUS server hosts configured using this command are included in the default RADIUS server group.
Enable the local RADIUS server.		
3.	`awplus(config)# radius-server local`	Enter RADIUS Server Configuration mode.
4.	`awplus(config-radsrv)# server enable`	Enable the local RADIUS server.
5.	`awplus(config-radsrv)# nas` 127.0.0.1 key *<key-string>*	Set the switch as a client device (Network Access Server), to allow it to send authentication requests to the local RADIUS server. Use the same local loopback interface IP address and key as in the radius-server host command used in Step 2 on page 18.
Configure a local RADIUS user group for connected PCs.		
6.	`awplus(config-radsrv)# group <user-group-name>`	Create a local RADIUS server user group for PCs connected to the switch, and enter RADIUS Server Group Configuration mode.
7.	`awplus(config-radsrv-group)# vlan {<vid>|<vlan-name>}`	Set the VLAN ID for the user group. This will assign the untagged VLAN ID to authenticated ports for PCs connected to the switch. To create multiple user groups for PCs with different VLANs, repeat these two steps.
8.	`awplus(config-radsrv-group)#exit`	Return to RADIUS Server Configuration mode.
Configure a local RADIUS user group for connected phones.		
9.	`awplus(config-radsrv)# group <user-group-name>`	Create a new local RADIUS server user group for phones connected to the switch, and enter RADIUS Server Group Configuration mode.

Table 90-6: Configuration procedure for Voice VLAN with RADIUS authentication and dynamic VLAN(cont.)

10.	`awplus(config-radsrv-group)#` vlan {<vid>|<vlan-name>}	Configure the local RADIUS user group for connected phones to use the same VLAN as the PCs in Step 7, so that the phones have access to the same untagged VLAN as the PCs.
11.	`awplus(config-radsrv-group)#` egress-vlan-id <*vid*> tagged	Set the Egress-VLAN ID attribute for the user group, and set it to send tagged frames. This will assign the tagged VLAN ID to authenticated ports for phones connected to the switch. To create multiple user groups for phones with different VLANs, repeat these two steps.
12.	`awplus(config-radsrv-group)#` exit	Return to RADIUS Server Configuration mode.
Add users to the local RADIUS server.		
13.	`awplus(config-radsrv)#` user <radius-user-name> password <user-password> group <user-group>	Add RADIUS user names and passwords to the local RADIUS server for authenticating PCs and phones. Assign the corresponding RADIUS server user groups configured in Step 6 and Step 9. See the user (RADIUS server) command on page 73.36.
14.	`awplus(config-radsrv)#` exit	Return to Global Configuration mode.
Create VLANs.		
15.	`awplus(config)#` vlan database	Enter VLAN Database Configuration mode.
16.	`awplus(config-vlan)#` vlan <*vid-range*>	Create the VLANs corresponding to the VLAN IDs that will be allocated to the authenticated ports, as configured in Step 7, Step 10, and Step 11.
17.	`awplus(config-vlan)#` exit	Return to Global Configuration mode.
Configure 802.1X port authentication.		
18.	`awplus(config)#` aaa authentication dot1x default group radius	Enable 802.1X port authentication and set it to use the default group of RADIUS servers that contains all RADIUS server hosts configured using the radius-server host command—in this procedure, the default group consists of the local RADIUS server.
19.	`awplus(config)#` interface <*port-list*>	Enter interface configuration mode for the ports that have users (PCs and phones) connected to them.
20.	`awplus(config-if)#` dot1x port-control auto	Enable 802.1X for port authentication on these ports.
21.	`awplus(config-if)#` auth host-mode multi-supplicant	Configure the ports to use multi-supplicant mode for authentication, so that the phone and PC can be dynamically allocated to different VLANs.
22.	`awplus(config-if)#` auth dynamic-vlan-creation	Configure the ports to accept dynamic VLAN allocation. In this procedure, the RADIUS server user groups for both the PCs and the phones use the same VLAN (Step 7 and Step 10), so the default rule (deny) allows them both the access they need to the port VLAN. For other options, see the auth dynamic-vlan-creation command on page 65.7. Default: deny differently assigned VLAN IDs.
23.	`awplus(config-if)#` exit	Return to Global Configuration mode.
24.	`awplus(config)#` exit	Return to Privileged Exec mode.

Table 90-6: Configuration procedure for Voice VLAN with RADIUS authentication and dynamic VLAN(cont.)

Review the authentication configuration.		
25.	awplus# show radius local-server group [<user-group-name>] awplus# show radius local-server nas [<ip-address>] awplus# show radius local-server user [<user-name>]	Check the local RADIUS server configuration.
26.	awplus# show vlan {all|brief|dynamic|static|<1-4094>}	Check the VLAN configuration.
27.	awplus# show dot1x [all]	Check the 802.1X authentication configuration.

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Introduction

LLDP and LLDP-MED can be configured using the commands in this chapter, or by using SNMP with the LLDP-MIB and LLDP-EXT-DOT1-MIB ("Public MIBs" on page 89.66). The Voice VLAN feature can be configured using commands in Chapter 17, VLAN Commands. For more information about LLDP, see Chapter 90, LLDP Introduction and Configuration.

LLDP can transmit a lot of data about the network. Typically, the network information gathered using LLDP is transferred to a Network Management System by SNMP. For security reasons, we recommend using SNMPv3 for this purpose (Chapter 87, SNMP Introduction, Chapter 88, SNMP Commands).

LLDP operates over physical ports only. For example, it can be configured on switch ports that belong to static or dynamic channel groups, but not on the channel groups themselves.

Command List

This chapter contains an alphabetical list of commands used to configure LLDP.

clear lldp statistics

This command clears all LLDP statistics (packet and event counters) associated with specified ports. If no port list is supplied, LLDP statistics for all ports are cleared.

Syntax `clear lldp statistics [interface <port-list>]`

Parameter	Description
<port-list>	The ports for which the statistics are to be cleared.

Mode Privileged Exec

Examples To clear the LLDP statistics on ports 1.0.1 and 1.0.7, use the command:

```
awplus# clear lldp statistics interface port1.0.1,port1.0.7
```

To clear all LLDP statistics for all ports, use the command:

```
awplus# clear lldp statistics
```

Related Commands show lldp statistics
show lldp statistics interface

clear lldp table

This command clears the table of LLDP information received from neighbors through specified ports. If no port list is supplied, neighbor information is cleared for all ports.

Syntax `clear lldp table [interface <port-list>]`

Parameter	Description
<port-list>	The ports for which the neighbor information table is to be cleared.

Mode Privileged Exec

Examples To clear the table of neighbor information received on ports 1.0.1 and 1.0.7, use the command:

```
awplus# clear lldp table interface port1.0.1,port1.0.7
```

To clear the entire table of neighbor information received through all ports, use the command:

```
awplus# clear lldp table
```

Related Commands show lldp neighbors

debug lldp

This command enables specific LLDP debug for specified ports. When LLDP debugging is enabled, diagnostic messages are entered into the system log. If no port list is supplied, the specified debugging is enabled for all ports.

The no variant of this command disables specific LLDP debug for specified ports. If no port list is supplied, the specified debugging is disabled for all ports.

Syntax

```
debug lldp {[rx][rxpkt][tx][txpkt]} [interface [<port-list>]]
debug lldp operation
no debug lldp {[rx][rxpkt][tx][txpkt]} [interface [<port-list>]]
no debug lldp operation
no debug lldp all
```

Parameter	Description
`rx`	LLDP receive debug.
`rxpkt`	Raw LLDPDUs received in hex format.
`tx`	LLDP transmit debug.
`txpkt`	Raw Tx LLDPDUs transmitted in hex format.
<port-list>	The ports for which debug is to be configured.
`operation`	Debug for LLDP internal operation on the switch.
`all`	Disables all LLDP debugging for all ports.

Default By default no debug is enabled for any ports.

Mode Privileged Exec

Examples To enable debugging of LLDP receive on ports 1.0.1 and 1.0.7, use the command:

```
awplus# debug lldp rx interface port1.0.1,port1.0.7
```

To enable debugging of LLDP transmit with packet dump on all ports, use the command:

```
awplus# debug lldp tx txpkt
```

To disable debugging of LLDP receive on ports 1.0.1 and 1.0.7, use the command:

```
awplus# no debug lldp rx interface port1.0.1,port1.0.7
```

To turn off all LLDP debugging on all ports, use the command:

```
awplus# no debug lldp all
```

Related Commands
show debugging lldp
show running-config lldp
terminal monitor

lldp faststart-count

Use this command to set the fast start count for LLDP-MED. The fast start count determines how many fast start advertisements LLDP sends from a port when it starts sending LLDP-MED advertisements from the port, for instance, when it detects a new LLDP-MED capable device.

The no variant of this command resets the LLDPD-MED fast start count to the default (3).

Syntax

```
lldp faststart-count <1-10>
no lldp faststart-count
```

Parameter	Description
<1-10>	The number of fast start advertisements to send.

Default The default fast start count is 3.

Mode Global Configuration

Examples To set the fast start count to 5, use the command:

```
awplus# configure terminal
awplus(config)# lldp faststart-count 5
```

To reset the fast start count to the default setting (3), use the command:

```
awplus# configure terminal
awplus(config)# no lldp faststart-count
```

Related Commands show lldp

lldp holdtime-multiplier

This command sets the holdtime multiplier value. The transmit interval is multiplied by the holdtime multiplier to give the Time To Live (TTL) value that is advertised to neighbors.

The no variant of this command sets the multiplier back to its default.

Syntax

```
lldp holdtime-multiplier <2-10>
no lldp holdtime-multiplier
```

Parameter	Description
<2-10>	The multiplier factor.

Default The default holdtime multiplier value is 4.

Mode Global Configuration

Usage The Time-To-Live defines the period for which the information advertised to the neighbor is valid. If the Time-To-Live expires before the neighbor receives another update of the information, then the neighbor discards the information from its database.

Examples To set the holdtime multiplier to 2, use the commands:

```
awplus# configure terminal
awplus(config)# lldp holdtime-multiplier 2
```

To set the holdtime multiplier back to its default, use the commands:

```
awplus# configure terminal
awplus(config)# no lldp holdtime-multiplier 2
```

Related Commands show lldp

lldp management-address

This command sets the IPv4 address to be advertised to neighbors (in the Management Address TLV) via the specified ports. This address will override the default address for these ports.

The no variant of this command clears the user-configured management IP address advertised to neighbors via the specified ports. The advertised address reverts to the default.

Syntax

```
lldp management-address <ipaddr>
no lldp management-address
```

Parameter	Description
<ipaddr>	The IPv4 address to be advertised to neighbors, in dotted decimal format. This must be one of the IP addresses already configured on the device.

Default The local loopback interface primary IPv4 address if set, else the primary IPv4 interface address of the lowest numbered VLAN the port belongs to, else the MAC address of the device's baseboard if no VLAN IP addresses are configured for the port.

Mode Interface Configuration

Usage To see the management address that will be advertised, use the show lldp interface command or show lldp local-info command.

Examples To set the management address advertised by ports 1.0.1 and 1.0.7, to be 192.168.1.6, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# lldp management-address 192.168.1.6
```

To clear the user-configured management address advertised by ports 1.0.1 and 1.0.7, and revert to using the default address, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# no lldp management-address
```

Related Commands
show lldp interface
show lldp local-info

lldp med-notifications

Use this command to enable LLDP to send LLDP-MED Topology Change Detected SNMP notifications relating to the specified ports. The switch sends an SNMP event notification when a new LLDP-MED compliant IP Telephony device is connected to or disconnected from a port on the switch.

Use the no variant of this command to disable the sending of LLDP-MED Topology Change Detected notifications relating to the specified ports.

Syntax

```
lldp med-notifications
no lldp med-notifications
```

Default The sending of LLDP-MED notifications is disabled by default.

Mode Interface Configuration

Examples To enable the sending of LLDP-MED Topology Change Detected notifications relating to ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# lldp med-notifications
```

To disable the sending of LLDP-MED notifications relating to ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# no lldp med-notifications
```

Related Commands

lldp notification-interval
lldp notifications
snmp-server enable trap
show lldp interface

lldp med-tlv-select

Use this command to enable LLDP-MED Organizationally Specific TLVs for transmission in LLDP advertisements via the specified ports. The LLDP-MED Capabilities TLV must be enabled before any of the other LLDP-MED Organizationally Specific TLVs are enabled.

Use the no variant of this command to disable the specified LLDP-MED Organizationally Specific TLVs for transmission in LLDP advertisements via these ports. In order to disable the LLDP-MED Capabilities TLV, you must also disable the rest of these TLVs. Disabling all these TLVs disables LLDP-MED advertisements.

Syntax

```
lldp med-tlv-select {[capabilities] [network-policy] [location]
   [inventory-management]}

lldp med-tlv-select all

no lldp med-tlv-select {[capabilities] [network-policy] [location]
   [inventory-management]}

no lldp med-tlv-select all
```

Parameter	Description
`capabilities`	LLDP-MED Capabilities TLV. When this is enabled, the MAC/PHY Configuration/Status TLV from IEEE 802.3 Organizationally Specific TLVs is also automatically included in LLDP-MED advertisements, whether or not it has been explicitly enabled by the lldp tlv-select command.
`network-policy`	Network Policy TLV. This TLV is transmitted if Voice VLAN parameters have been configured using the commands: ■ switchport voice dscp ■ switchport voice vlan ■ switchport voice vlan priority
`location`	Location Identification TLV. This TLV is transmitted if location information has been configured using the commands: ■ location elin-location-id ■ location civic-location identifier ■ location civic-location configuration ■ location coord-location identifier ■ location coord-location configuration ■ location elin-location
`inventory-management`	Inventory Management TLV Set, including the following TLVs: ■ Hardware Revision ■ Firmware Revision ■ Software Revision ■ Serial Number ■ Manufacturer Name ■ Model Name ■ Asset ID
`all`	All LLDP-MED Organizationally Specific TLVs.

Default By default LLDP-MED Capabilities, Network Policy, Location Identification and Extended Power-via-MDI TLVs are enabled. Therefore, if LLDP is enabled using the lldp run command, by default LLDP-MED advertisements are transmitted on ports that detect LLDP-MED neighbors connected to them.

Mode Interface Configuration

Usage LLDP-MED TLVs are only sent in advertisements via a port if there is an LLDP-MED-capable device connected to it. To see whether there are LLDP-MED capable devices connected to the ports, use the show lldp neighbors command.

Examples To enable inclusion of the Inventory TLV Set in advertisements transmitted via ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# lldp med-tlv-select inventory-management
```

To exclude the Inventory TLV Set in advertisements transmitted via ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# no lldp med-tlv-select inventory-management
```

To disable LLDP-MED advertisements transmitted via ports 1.0.1 and 1.0.7, disable all these TLVs using the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# no lldp med-tlv-select all
```

Related Commands
lldp tlv-select
location elin-location-id
location civic-location identifier
location civic-location configuration
location coord-location identifier
location coord-location configuration
location elin-location
show lldp interface
switchport voice dscp
switchport voice vlan
switchport voice vlan priority

lldp non-strict-med-tlv-order-check

Use this command to enable non-strict order checking for LLDP-MED advertisements it receives. That is, use this command to enable LLDP to receive and store TLVs from LLDP-MED advertisements even if they do not use standard TLV order.

Use the no variant of this command to disable non-strict order checking for LLDP-MED advertisements, that is, to set strict TLV order checking, so that LLDP discards any LLDP-MED TLVs that occur before the LLDP-MED Capabilities TLV in an advertisement.

Syntax

```
lldp non-strict-med-tlv-order-check
no lldp non-strict-med-tlv-order-check
```

Default By default TLV non-strict order checking for LLDP-MED advertisements is disabled. That is, strict order checking is applied to LLDP-MED advertisements, according to ANSI/TIA-1057, and LLDP-MED TLVs in non-standard order are discarded.

Mode Global Configuration

Usage The ANSI/TIA-1057 specifies standard order for TLVs in LLDP-MED advertisements, and specifies that if LLDP receives LLDP advertisements with non-standard LLDP-MED TLV order, the TLVs in non-standard order should be discarded. This implementation of LLDP-MED follows the standard: it transmits TLVs in the standard order, and by default discards LLDP-MED TLVs that occur before the LLDP-MED Capabilities TLV in an advertisement. However, some implementations of LLDP transmit LLDP-MED advertisements with non-standard TLV order. To receive and store the data from these non-standard advertisements, enable non-strict order checking for LLDP-MED advertisements using this command.

Examples To enable strict TLV order checking, use the commands:

```
awplus# configure terminal
awplus(config)# lldp tlv-order-check
```

To disable strict TLV order checking, use the commands:

```
awplus# configure terminal
awplus(config)# no lldp tlv-order-check
```

Related Commands show running-config lldp

lldp notification-interval

This command sets the notification interval. This is the minimum interval between LLDP SNMP notifications (traps) of each kind (LLDP Remote Tables Change Notification and LLDP-MED Topology Change Notification).

The no variant of this command sets the notification interval back to its default.

Syntax

```
lldp notification-interval <5-3600>
no lldp notification-interval
```

Parameter	Description
<5-3600>	The interval in seconds.

Default The default notification interval is 5 seconds.

Mode Global Configuration

Examples To set the notification interval to 20 seconds, use the commands:

```
awplus# configure terminal
awplus(config)# lldp notification-interval 20
```

To set the notification interval back to its default, use the commands:

```
awplus# configure terminal
awplus(config)# no lldp notification-interval
```

Related Commands lldp notifications
show lldp

lldp notifications

This command enables the sending of LLDP SNMP notifications (traps) relating to specified ports.

The no variant of this command disables the sending of LLDP SNMP notifications for specified ports.

Syntax

```
lldp notifications
no lldp notifications
```

Default The sending of LLDP SNMP notifications is disabled by default.

Mode Interface Configuration

Examples To enable sending of LLDP SNMP notifications for ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# lldp notifications
```

To disable sending of LLDP SNMP notifications for ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# no lldp notifications
```

Related Commands

lldp notification-interval
show lldp interface
snmp-server enable trap

lldp port-number-type

This command sets the type of port identifier used to enumerate, that is to count, the LLDP MIB local port entries. The LLDP MIB (*IEEE Standard 802.1AB-2005, Section 12, LLDP MIB Definitions*.) requires the port number value to count LLDP local port entries.

This command also enables you to optionally set an interface index to enumerate the LLDP MIB local port entries, if required by your management system.

The no variant of this command resets the type of port identifier back to the default setting (number).

Syntax

```
lldp port-number-type [number|ifindex]
no lldp port-number-type
```

Parameter	Description
`number`	Set the type of port identifier to a port number to enumerate the LLDP MIB local port entries.
`ifindex`	Set the type of port identifier to an interface index to enumerate the LLDP MIB local port entries.

Default The default port identifier type is number. The no variant of this command sets the port identifier type to the default.

Mode Global Configuration

Examples To set the type of port identifier used to enumerate LLDP MIB local port entries to port numbers, use the commands:

```
awplus# configure terminal
awplus(config)# lldp port-number-type number
```

To set the type of port identifier used to enumerate LLDP MIB local port entries to interface indexes, use the commands:

```
awplus# configure terminal
awplus(config)# lldp port-number-type ifindex
```

To reset the type of port identifier used to enumerate LLDP MIB local port entries the default (port numbers), use the commands:

```
awplus# configure terminal
awplus(config)# no lldp port-number-type
```

Related Commands show lldp

lldp reinit

This command sets the value of the reinitialization delay. This is the minimum time after disabling LLDP on a port before it can reinitialize.

The no variant of this command sets the reinitialization delay back to its default setting.

Syntax

```
lldp reinit <1-10>
no lldp reinit
```

Parameter	Description
<1-10>	The delay in seconds.

Default The default reinitialization delay is 2 seconds.

Mode Global Configuration

Examples To set the reinitialization delay to 3 seconds, use the commands:

```
awplus# configure terminal
awplus(config)# lldp reinit 3
```

To set the reinitialization delay back to its default, use the commands:

```
awplus# configure terminal
awplus(config)# no lldp reinit
```

Related Commands show lldp

lldp run

This command enables the operation of LLDP on the device.

The no variant of this command disables the operation of LLDP on the device. The LLDP configuration remains unchanged.

Syntax

```
lldp run
no lldp run
```

Default LLDP is disabled by default.

Mode Global Configuration

Examples To enable LLDP operation, use the commands:

```
awplus# configure terminal
awplus(config)# lldp run
```

To disable LLDP operation, use the commands:

```
awplus# configure terminal
awplus(config)# no lldp run
```

Related Commands show lldp

lldp timer

This command sets the value of the transmit interval. This is the interval between regular transmissions of LLDP advertisements.

The no variant of this command sets the transmit interval back to its default.

Syntax

```
lldp timer <5-32768>
no lldp timer
```

Parameter	Description
<5-32768>	The transmit interval in seconds. The transmit interval must be at least four times the transmission delay timer (lldp tx-delay command).

Default The default transmit interval is 30 seconds.

Mode Global Configuration

Examples To set the transmit interval to 90 seconds, use the commands:

```
awplus# configure terminal
awplus(config)# lldp timer 90
```

To set the transmit interval back to its default, use the commands:

```
awplus# configure terminal
awplus(config)# no lldp timer
```

Related Commands

lldp tx-delay
show lldp

lldp tlv-select

This command enables one or more optional TLVs, or all TLVs, for transmission in LLDP advertisements via the specified ports. The TLVs can be specified in any order; they are placed in LLDP frames in a fixed order (as described in IEEE 802.1AB). The mandatory TLVs (Chassis ID, Port ID, Time To Live, End of LLDPDU) are always included in LLDP advertisements.

In LLDP-MED advertisements the MAC/PHY Configuration/Status TLV will be always be included regardless of whether it is selected by this command.

The no variant of this command disables the specified optional TLVs, or all optional TLVs, for transmission in LLDP advertisements via the specified ports.

Syntax

```
lldp tlv-select {[<tlv>]...}

lldp tlv-select all

no lldp tlv-select {[<tlv>]...}

no lldp tlv-select all
```

Parameter	Description
<tlv>	The TLV to transmit in LLDP advertisements. One of these keywords: ■ port-description (specified by the description (interface) command on page 11.2) ■ system-name (specified by the hostname command on page 8.18) ■ system-description ■ system-capabilities ■ management-address ■ port-vlan ■ port-and-protocol-vlans ■ vlan-names ■ protocol-ids ■ mac-phy-config ■ power-management (Power Via MDI TLV) ■ link-aggregation ■ max-frame-size
`all`	All TLVs.

Default By default no optional TLVs are included in LLDP advertisements. The MAC/PHY Configuration/Status TLV (mac-phy-config) is included in LLDP-MED advertisements whether or not it is selected by this command.

Mode Interface Configuration

Examples To include the management-address and system-name TLVs in advertisements transmitted via ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# lldp tlv-select management-address system-
name
```

To include all optional TLVs in advertisements transmitted via ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# lldp tlv-select all
```

To exclude the management-address and system-name TLVs from advertisements transmitted via ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# no lldp tlv-select management-address
system-name
```

To exclude all optional TLVs from advertisements transmitted via ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# no lldp tlv-select all
```

Related Commands

description (interface)
hostname
lldp med-tlv-select
show lldp interface
show lldp local-info

lldp transmit receive

This command enables transmission and/or reception of LLDP advertisements to or from neighbors through the specified ports.

The no variant of this command disables transmission and/or reception of LLDP advertisements through specified ports.

Syntax

```
lldp {[transmit] [receive]}
no lldp {[transmit] [receive]}
```

Parameter	Description
`transmit`	Enable or disable transmission of LLDP advertisements via this port or ports.
`receive`	Enable or disable reception of LLDP advertisements via this port or ports.

Default LLDP advertisement transmission and reception are enabled on all ports by default.

Mode Interface Configuration

Examples To enable transmission of LLDP advertisements on ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# lldp transmit
```

To enable LLDP advertisement transmission and reception on ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# lldp transmit receive
```

To disable LLDP advertisement transmission and reception on ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# no lldp transmit receive
```

Related Commands show lldp interface

lldp tx-delay

This command sets the value of the transmission delay timer. This is the minimum time interval between transmitting LLDP advertisements due to a change in LLDP local information.

The no variant of this command sets the transmission delay timer back to its default setting.

Syntax

```
lldp tx-delay <1-8192>
no lldp tx-delay
```

Parameter	Description
<1-8192>	The transmission delay in seconds. The transmission delay cannot be greater than a quarter of the transmit interval (lldp timer command).

Default The default transmission delay timer is 2 seconds.

Mode Global Configuration

Examples To set the transmission delay timer to 12 seconds, use the commands:

```
awplus# configure terminal
awplus(config)# lldp tx-delay 12
```

To set the transmission delay timer back to its default, use the commands:

```
awplus# configure terminal
awplus(config)# no lldp tx-delay
```

Related Commands
lldp timer
show lldp

location civic-location configuration

Use these commands to configure a civic address location. The country parameter must be specified first, and at least one of the other parameters must be configured before the location can be assigned to a port.

Use the no variants of this command to delete civic address parameters from the location.

Syntax

```
country <country>
state <state>
no state
county <county>
no county
city <city>
no city
division <division>
no division
neighborhood <neighborhood>
no neighborhood
street-group <street-group>
no street-group
leading-street-direction <leading-street-direction>
no leading-street-direction
trailing-street-suffix <trailing-street-suffix>
no trailing-street-suffix
street-suffix <street-suffix>
no street-suffix
house-number <house-number>
no house-number
house-number-suffix <house-number-suffix>
no house-number-suffix
landmark <landmark>
no landmark
additional-information <additional-information>
no additional-information
name <name>
no name
postalcode <postalcode>
no postalcode
```

```
building <building>
no building
unit <unit>
no unit
floor <floor>
no floor
room <room>
no room
place-type <place-type>
no place-type
postal-community-name <postal-community-name>
no postal-community-name
post-office-box <post-office-box>
no post-office-box
additional-code <additional-code>
no additional-code
seat <seat>
no seat
primary-road-name <primary-road-name>
no primary-road-name
road-section <road-section>
no road-section
branch-road-name <branch-road-name>
no branch-road-name
sub-branch-road-name <sub-branch-road-name>
no sub-branch-road-name
street-name-pre-modifier <street-name-pre-modifier>
no street-name-pre-modifier
streetname-post-modifier <streetname-post-modifier>
no streetname-post-modifier
```

Parameter	Description
<country>	Upper-case two-letter country code, as specified in *ISO 3166*.
<state>	State (Civic Address (CA) Type 1): national subdivisions (state, canton, region).
<county>	County (CA Type 2): County, parish, gun (JP), district (IN).

Parameter(cont.)	Description(cont.)
<city>	City (CA Type 3): city, township, shi (JP).
<division>	City division (CA Type 4): City division, borough, city district, ward, chou (JP).
<neighborhood>	Neighborhood (CA Type 5): neighborhood, block.
<street-group>	Street group (CA Type 6): group of streets below the neighborhood level.
<leading-street-direction>	Leading street direction (CA Type 16).
<trailing-street-suffix>	Trailing street suffix (CA Type 17).
<street-suffix>	Street suffix (CA Type 18): street suffix or type.
<house-number>	House number (CA Type 19).
<house-number-suffix>	House number suffix (CA Type 20).
<landmark>	Landmark or vanity address (CA Type 21).
<additional-information>	Additional location information (CA Type 22).
<name>	Name (CA Type 23): residence and office occupant.
<postal-code>	Postal/zip code (CA Type 24).
<building>	Building (CA Type 25): structure.
<unit>	Unit (CA Type 26): apartment, suite.
<floor>	Floor (CA Type 27).
<room>	Room (CA Type 28).
<place-type>	Type of place (CA Type 29).
<postal-community-name>	Postal community name (CA Type 30).
<post-office-box>	Post office box (P.O. Box) (CA Type 31).
<additional-code>	Additional code (CA Type 32).
<seat>	Seat (CA Type 33): seat (desk, cubicle, workstation).
<primary-road-name>	Primary road name (CA Type 34).
<road-section>	Road section (CA Type 35).
<branch-road-name>	Branch road name (CA Type 36).
<sub-branch-road-name>	Sub-branch road name (CA Type 37).
<street-name-pre-modifier>	Street name pre-modifier (CA Type 38).
<street-name-post-modifier>	Street name post-modifier (CA Type 39).

Default By default no civic address location information is configured.

Mode Civic Address Location Configuration

Usage The country parameter must be configured before any other parameters can be configured; this creates the location. The country parameter cannot be deleted. One or more of the other parameters must be configured before the location can be assigned to a port. The country parameter must be entered as an upper-case two-letter country code, as specified in *ISO 3166*. All other parameters are entered as alpha-numeric strings. Do not configure all the civic address parameters (this would generate TLVs that are too long). Configure a subset of these parameters—enough to consistently and precisely identify the location of the device. If the location is to be used for Emergency Call Service (ECS), the particular ECS application may have guidelines for configuring the civic address location. For more information about civic address format, see "LLDP-MED: Location Identification TLV" on page 90.7.

To specify the civic address location, use the location civic-location identifier command. To delete the civic address location, use the no variant of the location civic-location identifier command. To assign the civic address location to particular ports, so that it can be advertised in TLVs from those ports, use the command location civic-location-id command.

Examples To configure civic address location 1 with location "27 Nazareth Avenue, Christchurch, New Zealand" in civic-address format, use the commands:

```
awplus# configure terminal
awplus(config)# location civic-location identifier 1
awplus(config-civic)# country NZ
awplus(config-civic)# city Christchurch
awplus(config-civic)# primary-road-name Nazareth
awplus(config-civic)# street-suffix Avenue
awplus(config-civic)# house-number 27
```

Related Commands
location civic-location-id
location civic-location identifier
show lldp local-info
show location

location civic-location identifier

Use this command to enter the Civic Address Location Configuration mode to configure the specified location.

Use the no variant of this command to delete a civic address location. This also removes the location from any ports it has been assigned to.

Syntax

```
location civic-location identifier <civic-loc-id>
no location civic-location identifier <civic-loc-id>
```

Parameter	Description
<civic-loc-id>	A unique civic address location ID, in the range 1 to 4095.

Default By default there are no civic address locations.

Mode Global Configuration

Usage To configure the location information for this civic address location identifier, use the location civic-location configuration command. To associate this civic location identifier with particular ports, use the location elin-location-id command.

Up to 400 locations can be configured on the switch for each type of location information, up to a total of 1200 locations.

Examples To enter Civic Address Location Configuration mode for the civic address location with ID 1, use the commands:

```
awplus# configure terminal
awplus(config)# location civic-location identifier 1
awplus(config-civic)#
```

To delete the civic address location with ID 1, use the commands:

```
awplus# configure terminal
awplus(config)# no location civic-location identifier 1
```

Related Commands
location civic-location-id
location civic-location configuration
show location
show running-config lldp

location civic-location-id

Use this command to assign a civic address location to the ports. The civic address location must already exist. This replaces any previous assignment of civic address location for the ports. Up to one location of each type can be assigned to a port.

Use the no variant of this command to remove a location identifier from the ports.

Syntax

```
location civic-location-id <civic-loc-id>
no location civic-location-id [<civic-loc-id>]
```

Parameter	Description
<civic-loc-id>	Civic address location ID, in the range 1 to 4095.

Default By default no civic address location is assigned to ports.

Mode Interface Configuration

Usage The civic address location associated with a port can be transmitted in Location Identification TLVs via the port.

Before using this command, create the location using the following commands:

- location civic-location identifier command
- location civic-location configuration command

If a civic-address location is deleted using the no variant of the location civic-location identifier command, it is automatically removed from all ports.

Examples To assign the civic address location 1 to port1.0.1, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# location civic-location-id 1
```

To remove a civic address location from port1.0.1, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# no location civic-location-id
```

Related Commands

lldp med-tlv-select
location civic-location identifier
location civic-location configuration
show location

location coord-location configuration

Use this command to configure a coordinate-based location. All parameters must be configured before assigning this location identifier to a port.

Syntax

```
latitude <latitude>
lat-resolution <lat-resolution>
longitude <longitude>
long-resolution <long-resolution>
altitude <altitude> {meters|floor}
alt-resolution <alt-resolution>
datum {wgs84|nad83-navd|nad83-mllw}
```

Parameter	Description
<lat-resolution>	Latitude resolution, as a number of valid bits, in the range 0 to 34.
<latitude>	Latitude value in degrees in the range -90.0 to 90.0
<long-resolution>	Longitude resolution, as a number of valid bits, in the range 0 to 34.
<longitude>	Longitude value in degrees, in the range -180.0 to 180.0.
<alt-resolution>	Altitude resolution, as a number of valid bits, in the range 0 to 30. A resolution of 0 can be used to indicate an unknown value.
<altitude>	Altitude value, in meters or floors.
`meters`	The altitude value is in meters.
`floors`	The altitude value is in floors.
`datum`	The geodetic system (or datum) that the specified coordinate values are based on.
`wgs84`	World Geodetic System 1984.
`nad83-navd`	North American Datum 1983 - North American Vertical Datum.
`nad83-mllw`	North American Datum 1983 - Mean Lower Low Water vertical datum.

Default By default no coordinate location information is configured.

Mode Coordinate Configuration

Usage Latitude and longitude values are always stored internally, and advertised in the Location Identification TLV, as 34-bit fixed-point binary numbers, with a 25-bit fractional part, irrespective of the number of digits entered by the user. Likewise altitude is stored as a 30-bit fixed point binary number, with an 8-bit fractional part. Because the user-entered decimal values are stored as fixed point binary numbers, they cannot always be represented exactly—the stored binary number is converted to a decimal number for display in the output of the show location command. For example, a user-entered latitude value of “2.77” degrees is displayed as “2.769999980926513671875000”.

The lat-resolution, long-resolution, and alt-resolution parameters allow the user to specify the resolution of each coordinate element as the number of valid bits in the internally-stored binary representation of the value. These resolution values can be used by emergency services to define a search area.

To specify the coordinate identifier, use the location coord-location identifier command. To remove coordinate information, delete the coordinate location by using the no variant of that command. To associate the coordinate location with particular ports, so that it can be advertised in TLVs from those ports, use the location elin-location-id command.

Example To configure the location for the White House in Washington DC, which has the coordinates based on the WGS84 datum of 38.89868 degrees North (with 22 bit resolution), 77.03723 degrees West (with 22 bit resolution), and 15 meters height (with 9 bit resolution), use the commands:

```
awplus# configure terminal
awplus(config)# location coord-location identifier 1
awplus(config-coord)# la-resolution 22
awplus(config-coord)# latitude 38.89868
awplus(config-coord)# lo-resolution 22
awplus(config-coord)# longitude -77.03723
awplus(config-coord)# alt-resolution 9
awplus(config-coord)# altitude 15 meters
awplus(config-coord)# datum wgs84
```

Related Commands
location coord-location-id
location coord-location identifier
show lldp local-info
show location

location coord-location identifier

Use this command to enter Coordinate Location Configuration mode for this coordinate location.

Use the no variant of this command to delete a coordinate location. This also removes the location from any ports it has been assigned to.

Syntax

```
location coord-location identifier <coord-loc-id>
no location coord-location identifier <coord-loc-id>
```

Parameter	Description
<coord-loc-id>	A unique coordinate location identifier, in the range 1 to 4095.

Default By default there are no coordinate locations.

Mode Global Configuration

Usage Up to 400 locations can be configured on the switch for each type of location information, up to a total of 1200 locations.

To configure this coordinate location, use the location coord-location configuration command. To associate this coordinate location with particular ports, so that it can be advertised in TLVs from those ports, use the location coord-location-id command.

Examples To enter Coordinate Location Configuration mode to configure the coordinate location with ID 1, use the commands:

```
awplus# configure terminal
awplus(config)# location coord-location identifier 1
awplus(config-coord)#
```

To delete coordinate location 1, use the commands:

```
awplus# configure terminal
awplus(config)# no location coord-location identifier 1
```

Related Commands

location coord-location-id
location coord-location configuration
show lldp local-info
show location

location coord-location-id

Use this command to assign a coordinate location to the ports. The coordinate location must already exist. This replaces any previous assignment of coordinate location for the ports. Up to one location of each type can be assigned to a port.

Use the no variant of this command to remove a location from the ports.

Syntax

```
location coord-location-id <coord-loc-id>
no location coord-location-id [<coord-loc-id>]
```

Parameter	Description
<coord-loc-id>	Coordinate location ID, in the range 1 to 4095.

Default By default no coordinate location is assigned to ports.

Mode Interface Configuration

Usage The coordinate location associated with a port can be transmitted in Location Identification TLVs via the port.

Before using this command, configure the location using the following commands:

- location coord-location identifier command
- location coord-location configuration command

If a coordinate location is deleted using the no variant of the location coord-location identifier command, it is automatically removed from all ports.

Examples To assign coordinate location 1 to port1.0.1, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# location coord-location-id 1
```

To remove a coordinate location from port1.0.1, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# no location coord-location-id
```

Related Commands

lldp med-tlv-select
location coord-location identifier
location coord-location configuration
show location

location elin-location

Use this command to create or modify an ELIN location.

Use the no variant of this command to delete an ELIN location, and remove it from any ports it has been assigned to.

Syntax

```
location elin-location <elin> identifier <elin-loc-id>
no location elin-location identifier <elin-loc-id>
```

Parameter	Description
<elin>	Emergency Location Identification Number (ELIN) for Emergency Call Service (ECS), in the range 10 to 25 digits long. In North America, ELINs are typically 10 digits long.
<elin-loc-id>	A unique ELIN location identifier, in the range 1 to 4095.

Default By default there are no ELIN location identifiers.

Mode Global Configuration

Usage Up to 400 locations can be configured on the switch for each type of location information, up to a total of 1200 locations.

To assign this ELIN location to particular ports, so that it can be advertised in TLVs from those ports, use the location elin-location-id command.

Examples To create a new ELIN location with ID 1, and configure it with ELIN "1234567890", use the commands:

```
awplus# configure terminal
awplus(config)# location elin-location 1234567890 identifier 1
```

To delete existing ELIN location with ID 1, use the commands:

```
awplus# configure terminal
awplus(config)# no location elin-location identifier 1
```

Related Commands

location elin-location-id
show lldp local-info
show location

location elin-location-id

Use this command to assign an ELIN location to the ports. The ELIN location must already exist. This replaces any previous assignment of ELIN location for the ports. Up to one location of each type can be assigned to a port.

Use the no variant of this command to remove a location identifier from the ports.

Syntax

```
location elin-location-id <elin-loc-id>
no location elin-location-id [<elin-loc-id>]
```

Parameter	Description
<elin-loc-id>	ELIN location identifier, in the range 1 to 4095.

Default By default no ELIN location is assigned to ports.

Mode Interface Configuration

Usage An ELIN location associated with a port can be transmitted in Location Identification TLVs via the port.

Before using this command, configure the location using the location elin-location command.

If an ELIN location is deleted using the no variant of one of the location elin-location command, it is automatically removed from all ports.

Examples To assign ELIN location 1 to port 1.0.1, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# location elin-location-id 1
```

To remove an ELIN location from port 1.0.1, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# no location elin-location-id
```

Related Commands

lldp med-tlv-select
location elin-location
show location

show debugging lldp

This command displays LLDP debug settings for specified ports. If no port list is supplied, LLDP debug settings for all ports are displayed.

Syntax `show debugging lldp [interface <port-list>]`

Parameter	Description
`<port-list>`	The ports for which the LLDP debug settings are shown.

Mode User Exec and Privileged Exec

Examples To display LLDP debug settings for all ports, use the command:

```
awplus# show debugging lldp
```

To display LLDP debug settings for ports 1.0.1 to 1.0.9, use the command:

```
awplus# show debugging lldp interface port1.0.1-1.0.9
```

Output Figure 91-1: Example output from the **show debugging lldp** command

```
LLDP Debug settings:
Debugging for LLDP internal operation is on
Port        Rx     RxPkt    Tx     TxPkt
-------------------------------------
1.0.1       Yes    Yes      No     No
1.0.2       Yes    No       No     No
1.0.3       No     No       No     No
1.0.4       Yes    Yes      Yes    No
1.0.5       Yes    No       Yes    No
1.0.6       No     No       Yes    No
1.0.7       Yes    Yes      Yes    Yes
1.0.8       Yes    No       Yes    Yes
1.0.9       No     No       Yes    Yes
```

Table 91-1: Parameters in the output of the **show debugging lldp** command

Parameter	Description
`Port`	Port name.
`Rx`	Whether debugging of LLDP receive is enabled on the port.
`RxPkt`	Whether debugging of LLDP receive packet dump is enabled on the port.
`Rx`	Whether debugging of LLDP transmit is enabled on the port.
`RxPkt`	Whether debugging of LLDP transmit packet dump is enabled on the port.

Related Commands debug lldp

show lldp

This command displays LLDP status and global configuration settings.

Syntax `show lldp`

Mode User Exec and Privileged Exec

Example To display LLDP status and global configuration settings, use the command:

```
awplus# show lldp
```

Output

Figure 91-2: Example output from the **show lldp** command

```
awplus# show lldp

LLDP Global Configuration:              [Default Values]
LLDP Status ............... Enabled     [Disabled]
Notification Interval ..... 5 secs      [5]
Tx Timer Interval ......... 30 secs     [30]
Hold-time Multiplier ...... 4           [4]
(Computed TTL value ....... 120 secs)
Reinitialization Delay .... 2 secs      [2]
Tx Delay .................. 2 secs      [2]
Port Number Type........... Ifindex     [Port-Number]
Fast Start Count .......... 5           [3]

LLDP Global Status:
Total Neighbor Count ...... 47
Neighbors table last updated 0 hrs 0 mins 43 secs ago
```

Table 91-2: Parameters in the output of the **show lldp** command

Parameter	Description
`LLDP Status`	Whether LLDP is enabled. Default is disabled.
`Notification Interval`	Minimum interval between LLDP notifications.
`Tx Timer Interval`	Transmit interval between regular transmissions of LLDP advertisements.
`Hold-time Multiplier`	The holdtime multiplier. The transmit interval is multiplied by the holdtime multiplier to give the Time To Live (TTL) value that is advertised to neighbors.
`Reinitialization Delay`	The reinitialization delay. This is the minimum time after disabling LLDP transmit on a port before it can reinitialize again.
`Tx Delay`	The transmission delay. This is the minimum time interval between transmitting advertisements due to a change in LLDP local information.
`Port Number Type`	The type of port identifier used to enumerate LLDP MIB local port entries, as set by the lldp port-number-type command.
`Fast Start Count`	The number of times fast start advertisements are sent for LLDP-MED.

Table 91-2: Parameters in the output of the **show lldp** command(cont.)

Parameter	Description
`Total Neighbor Count`	Number of LLDP neighbors discovered on all ports.
`Neighbors table last updated`	The time since the LLDP neighbor table was last updated.

Related Commands

show lldp interface
show running-config lldp

show lldp interface

This command displays LLDP configuration settings for specified ports. If no port list is specified, LLDP configuration for all ports is displayed.

Syntax `show lldp interface [<port-list>]`

Parameter	Description
<port-list>	The ports for which the LLDP configuration settings are to be shown.

Mode User Exec and Privileged Exec

Examples To display LLDP configuration settings for ports 1.0.1 to 1.0.8, use the command:

```
awplus# show lldp interface port1.0.1-1.0.8
```

To display LLDP configuration settings for all ports, use the command:

```
awplus# show lldp interface
```

Output

Figure 91-3: Example output from the **show lldp interface** command

```
awplus# show lldp interface port1.0.1-1.0.8
LLDP Port Status and Configuration:

  * = LLDP is inactive on this port because it is a mirror analyser port
  Notification Abbreviations:
    RC = LLDP Remote Tables Change       TC = LLDP-MED Topology Change
  TLV Abbreviations:
    Base:  Pd = Port Description         Sn = System Name
           Sd = System Description       Sc = System Capabilities
           Ma = Management Address
    802.1: Pv = Port VLAN ID             Pp = Port And Protocol VLAN ID
           Vn = VLAN Name                Pi = Protocol Identity
    802.3: Mp = MAC/PHY Config/Status    Po = Power Via MDI (PoE)
           La = Link Aggregation         Mf = Maximum Frame Size
    MED:   Mc = LLDP-MED Capabilities    Np = Network Policy
           Lo = Location Identification  Pe = Extended PoE    In = Inventory

                                          Optional TLVs Enabled for Tx
 Port     Rx/Tx  Notif  Management Addr  Base       802.1    802.3    MED
-------------------------------------------------------------------------------
 1.0.1    Rx Tx  RC --  192.168.100.123  PdSnSdScMa -------- -------- McNpLoPe--
*1.0.2    -- Tx  RC --  192.168.100.123  PdSnSdScMa -------- -------- McNpLoPe--
 1.0.3    Rx Tx  RC --  192.168.100.123  Pd--SdScMa PvPpVnPi -------- McNpLoPe--
 1.0.4    -- --  RC --  192.168.100.123  PdSnSd--Ma -------- -------- McNpLoPe--
 1.0.5    Rx Tx  RC TC  192.168.100.123  PdSnSdScMa PvPpVnPi -------- McNpLoPe--
 1.0.6    Rx Tx  RC TC  192.168.100.123  Pd----ScMa -------- -------- McNpLoPe--
 1.0.7    Rx Tx  -- TC  192.168.100.123  PdSnSdScMa PvPpVnPi MpPoLaMf McNpLoPeIn
 1.0.8    Rx Tx  -- TC  192.168.1.1      PdSn--ScMa PvPpVnPi -------- McNp------
```

Table 91-3: Parameters in the output of the **show lldp interface** command

Parameter	Description
`Port`	Port name.
`Rx`	Whether reception of LLDP advertisements is enabled on the port.
`Tx`	Whether transmission of LLDP advertisements is enabled on the port.
`Notif`	Whether sending SNMP notification for LLDP is enabled on the port: ■ RM = Remote Tables Change Notification ■ TP = LLDP-MED Topology Change Notification
`Management Addr`	Management address advertised to neighbors.
`Base TLVs Enabled for Tx`	List of optional Base TLVs enabled for transmission: ■ Pd = Port Description ■ Sn =System Name ■ Sd = System Description ■ Sc =System Capabilities ■ Ma = Management Address
`802.1 TLVs Enabled for Tx`	List of optional 802.1 TLVs enabled for transmission: ■ Pv = Port VLAN ID ■ Pp = Port And Protocol VLAN ID ■ Vn = VLAN Name ■ Pi =Protocol Identity
`802.3 TLVs Enabled for Tx`	List of optional 802.3 TLVs enabled for transmission: ■ Mp = MAC/PHY Configuration/Status ■ Po = Power Via MDI (PoE) ■ La = Link Aggregation ■ Mf = Maximum Frame Size
`MED TLVs Enabled for Tx`	List of optional LLDP-MED TLVs enabled for transmission: ■ Mc = LLDP-MED Capabilities ■ Np = Network Policy ■ Lo = Location Information, ■ Pe = Extended Power-Via-MDI ■ In = Inventory

Related Commands

show lldp
show running-config lldp

show lldp local-info

This command displays local LLDP information that can be transmitted through specified ports. If no port list is entered, local LLDP information for all ports is displayed.

Syntax

```
show lldp local-info [base] [dot1] [dot3] [med] [interface
   <port-list>]
```

Parameter	Description
`base`	Information for base TLVs.
`dot1`	Information for 802.1 TLVs.
`dot3`	Information for 802.3 TLVs.
`med`	Information for LLDP-MED TLVs.
<port-list>	The ports for which the local information is to be shown.

Mode User Exec and Privileged Exec

Usage Whether and which local information is transmitted in advertisements via a port depends on:

- whether the port is set to transmit LLDP advertisements (lldp transmit receive command)
- which TLVs it is configured to send (lldp tlv-select command, lldp med-tlv-select command)

Examples To display local information transmitted via port 1.0.1, use the command:

```
awplus# show lldp local-info interface port1.0.1
```

To display local information transmitted via all ports, use the command:

```
awplus# show lldp local-info
```

Output

Figure 91-4: Example output from the **show lldp local-info** command

```
LLDP Local Information:

Local port1.0.1:
  Chassis ID Type ................... MAC address
  Chassis ID ........................ 0015.77c9.7453
  Port ID Type ...................... Interface alias
  Port ID ........................... port1.0.1
  TTL ............................... 120
  Port Description .................. [not configured]
  System Name ....................... awplus
  System Description ................ Allied Telesis router/switch, AW+
                                      v5.3.3
  System Capabilities - Supported .. Bridge, Router
                      - Enabled .... Bridge, Router
  Management Address ................ 192.168.1.6
  Port VLAN ID (PVID) ............... 1
  Port & Protocol VLAN - Supported . Yes
                       - Enabled ... No
                       - VIDs ..... 0
  VLAN Names ........................ default
  Protocol IDs ...................... 9000, 0026424203000000, 888e01, aaaa03,
                                      88090101, 00540000e302, 0800, 0806, 86dd
  MAC/PHY Auto-negotiation ......... Supported, Enabled
       Advertised Capability ....... 1000BaseTFD, 100BaseTXFD, 100BaseTX,
                                      10BaseTFD, 10BaseT
       Operational MAU Type ........ 1000BaseTFD (30)
  Power Via MDI (PoE) ............... Supported, Enabled
       Port Class .................. PSE
       Pair Control Ability ........ Disabled
       Power Class ................. Unknown
  Link Aggregation .................. Supported, Disabled
  Maximum Frame Size ................ 1522
  LLDP-MED Device Type .............. Network Connectivity
  LLDP-MED Capabilities ............. LLDP-MED Capabilities, Network Policy,
                                      Location Identification,
                                      Extended Power - PSE, Inventory
  Network Policy .................... [not configured]
  Location Identification .......... Civic Address
       Country Code ................ NZ
       City ........................ Christchurch
       Street Suffix ............... Avenue
       House Number ................ 27
       Primary Road Name ........... Nazareth
  Location Identification .......... ELIN
       ELIN ........................ 123456789012
  Extended Power Via MDI (PoE) ..... PSE
       Power Source ................ Primary Power
       Power Priority .............. Low
       Power Value ................. 4.4 Watts
  Inventory Management:
       Hardware Revision ........... A-0
       Firmware Revision ........... 1.1.0
       Software Revision ........... v5.3.3
       Serial Number ............... G1Q78900B
       Manufacturer Name ........... Allied Telesis Inc.
       Model Name .................. x600-48Ts/XP
       Asset ID .................... [zero length]
```

Table 91-4: Parameters in the output of the **show lldp local-info** command

Parameter	Description
Chassis ID Type	Type of the Chassis ID.
Chassis ID	Chassis ID that uniquely identifies the local device.
Port ID Type	Type of the Port ID.
Port ID	Port ID of the local port through which advertisements are sent.
TTL	Number of seconds that the information advertised by the local port remains valid.
Port Description	Port description of the local port, as specified by the description (interface) command on page 11.2.
System Name	System name, as specified by the hostname command on page 8.18.
System Description	System description.
System Capabilities (Supported)	Capabilities that the local port supports.
System Capabilities (Enabled)	Enabled capabilities on the local port.
Management Addresses	Management address associated with the local port. To change this, use the lldp management-address command.
Port VLAN ID (PVID)	VLAN identifier associated with untagged or priority tagged frames received via the local port.
Port & Protocol VLAN (Supported)	Whether Port & Protocol VLANs (PPV) is supported on the local port.
Port & Protocol VLAN (Enabled)	Whether the port is in one or more Port & Protocol VLANs.
Port & Protocol VLAN (VIDs)	List of identifiers for Port & Protocol VLANs that the port is in.
VLAN Names	List of VLAN names for VLANs that the local port is assigned to.
Protocol IDs	List of protocols that are accessible through the local port.
MAC/PHY Auto-negotiation	Auto-negotiation support and current status of the 802.3 LAN on the local port.
Power Via MDI (PoE)	PoE-capability and current status on the local port.
Port Class	Whether the device is a PSE (Power Sourcing Entity) or a PD (Powered Device)
Pair Control Ability	Whether power pair selection can be controlled
Power Pairs	Which power pairs are selected for power ("Signal Pairs" or "Spare Pairs") if pair selection can be controlled

Table 91-4: Parameters in the output of the **show lldp local-info** command(cont.)

Parameter	Description
Power Class	The power class of the PD device on the port (class 0, 1, 2, 3 or 4)
Link Aggregation	Whether the link is capable of being aggregated and it is currently in an aggregation.
Aggregated Port-ID	Aggregated port identifier.
Maximum Frame Size	The maximum frame size capability of the implemented MAC and PHY.
LLDP-MED Device Type	LLDP-MED device type
LLDP-MED Capabilities	Capabilities LLDP-MED capabilities supported on the local port.
Network Policy	List of network policies configured on the local port.
VLAN ID	VLAN identifier for the port for the specified application type
Tagged Flag	Whether the VLAN ID is to be used as tagged or untagged
Layer-2 Priority:	Layer 2 User Priority (in the range 0 to 7)
DSCP Value	Diffserv codepoint (in the range 0 to 63)
Location Identification	Location configured on the local port.
Extended Power Via MDI (PoE)	PoE-capability and current status of the PoE parameters for Extended Power-Via-MDI TLV on the local port.
Power Source	The power source the switch currently uses; either primary power or backup power.
Power Priority	The power priority configured on the port; either critical, high or low.
Power Value	The total power the switch can source over a maximum length cable to a PD device on the port. The value shows the power value in Watts from the PD side.
Inventory Management	Inventory information for the device.

Related Commands

description (interface)
hostname
lldp transmit receive

show lldp neighbors

This command displays a summary of information received from neighbors via specified ports. If no port list is supplied, neighbor information for all ports is displayed.

Syntax `show lldp neighbors [interface <port-list>]`

Parameter	Description
<port-list>	The ports for which the neighbor information is to be shown.

Mode User Exec and Privileged Exec

Examples To display neighbor information received via all ports, use the command:

```
awplus# show lldp neighbors
```

To display neighbor information received via ports 1.0.1 and 1.0.7 with LLDP-MED configuration, use the command:

```
awplus# show lldp neighbors interface port1.0.1,port1.0.7
```

Output

Figure 91-5: Example output from the **show lldp neighbors** command

```
LLDP Neighbor Information:

Total number of neighbors on these ports .... 4

  System Capability Codes:
    O = Other    P = Repeater    B = Bridge                 W = WLAN Access Point
    R = Router   T = Telephone   C = DOCSIS Cable Device    S = Station Only
  LLDP-MED Device Type and Power Source Codes:
    1 = Class I    3 = Class III     PSE  = PoE     Both = PoE&Local    Prim = Primary
    2 = Class II   N = Network Con.  Locl = Local   Unkn = Unknown      Back = Backup

Local    Neighbor         Neighbor         Neighbor                 System       MED
Port     Chassis ID       Port ID          Sys Name                 Cap.         Ty Pwr
-------------------------------------------------------------------------------------
1.0.1    002d.3044.7ba6   port1.0.2        awplus                   OPBWRTCS
1.0.1    0011.3109.e5c6   port1.0.3        AT-9924 switch/route...  --B-R---
1.0.7    0000.10cf.8590   port3            AR-442S                  --B-R---
1.0.7    00ee.4352.df51   192.168.1.2      Jim's desk phone         --B--T--     3  PSE
```

Table 91-5: Parameters in the output of the **show lldp neighbors** command

Parameter	Description
`Local Port`	Local port on which the neighbor information was received.
`Neighbor Chassis ID`	Chassis ID that uniquely identifies the neighbor.
`Neighbor Port Name`	Port ID of the neighbor.
`Neighbor Sys Name`	System name of the LLDP neighbor.

Table 91-5: Parameters in the output of the **show lldp neighbors** command(cont.)

Parameter	Description
`Neighbor Capability`	Capabilities that are supported and enabled on the neighbor.
`System Capability`	System Capabilities of the LLDP neighbor.
`MED Device Type`	LLDP-MED Device class (Class I, II, III or Network Connectivity)
`MED Power Source`	LLDP-MED Power Source

Related Commands show lldp neighbors detail

show lldp neighbors detail

This command displays in detail the information received from neighbors via specified ports. If no port list is supplied, detailed neighbor information for all ports is displayed.

Syntax `show lldp neighbors detail [base] [dot1] [dot3] [med] [interface <port-list>]`

Parameter	Description
`base`	Information for base TLVs.
`dot1`	Information for 802.1 TLVs.
`dot3`	Information for 803.1 TLVs.
`med`	Information for LLDP-MED TLVs.
<port-list>	The ports for which the neighbor information is to be shown.

Mode User Exec and Privileged Exec

Examples To display detailed neighbor information received via all ports, use the command:

```
awplus# show lldp neighbors detail
```

To display detailed neighbor information received via ports 1.0.1, use the command:

```
awplus# show lldp neighbors detail interface port1.0.1
```

Output

Figure 91-6: Example output from the **show lldp neighbors detail** command

```
awplus# show lldp neighbors detail interface port1.0.1
LLDP Detailed Neighbor Information:

Local port1.0.1:
  Neighbors table last updated 0 hrs 0 mins 40 secs ago

  Chassis ID Type ................... MAC address
  Chassis ID ........................ 0004.cd28.8754
  Port ID Type ...................... Interface alias
  Port ID ........................... port1.0.8
  TTL ............................... 120 (secs)
  Port Description .................. [zero length]
  System Name ....................... awplus
  System Description ................ Allied Telesis router/switch, AW+ v5.3.3
  System Capabilities - Supported .. Bridge, Router
                      - Enabled .... Bridge, Router
  Management Addresses .............. 0004.cd28.8754
  Port VLAN ID (PVID) ............... 1
  Port & Protocol VLAN - Supported . Yes
                       - Enabled ... Yes
                       - VIDs ...... 5
  VLAN Names ........................ default, vlan5
  Protocol IDs ...................... 9000, 0026424203000000, 888e01, 8100,
                                      88090101, 00540000e302, 0800, 0806, 86dd
  MAC/PHY Auto-negotiation ......... Supported, Enabled
       Advertised Capability ....... 1000BaseTFD, 100BaseTXFD, 100BaseTX,
                                      10BaseTFD, 10BaseT
       Operational MAU Type ........ 1000BaseTFD (30)
  Power Via MDI (PoE) ............... [not advertised]
  Link Aggregation .................. Supported, Disabled
  Maximum Frame Size ................ 1522 (Octets)
  LLDP-MED Device Type .............. Network Connectivity
  LLDP-MED Capabilities ............. LLDP-MED Capabilities, Network Policy,
                                      Location Identification,
                                      Extended Power - PSE, Inventory
  Network Policy .................... [not advertised]
  Location Identification ........... [not advertised]
  Extended Power Via MDI (PoE) ..... PD
           Power Source ............. PSE
           Power Priority ........... High
           Power Value .............. 4.4 Watts
  Inventory Management:
           Hardware Revision ....... X1-0
           Firmware Revision ....... 1.1.0
           Software Revision ....... 5.3.3
           Serial Number ........... M1NB73008
           Manufacturer Name ....... Allied Telesis Inc.
           Model Name .............. x900-12XT/S
           Asset ID ................ [zero length]
```

Table 91-6: Parameters in the output of the **show lldp neighbors detail** command

Parameter	Description
`Chassis ID Type`	Type of the Chassis ID.
`Chassis ID`	Chassis ID that uniquely identifies the neighbor.
`Port ID Type`	Type of the Port ID.
`Port ID`	Port ID of the neighbor.
`TTL`	Number of seconds that the information advertised by the neighbor remains valid.
`Port Description`	Port description of the neighbor's port.
`System Name`	Neighbor's system name.

Table 91-6: Parameters in the output of the **show lldp neighbors detail** command(cont.)

Parameter	Description
System Description	Neighbor's system description.
System Capabilities (Supported)	Capabilities that the neighbor supports.
System Capabilities (Enabled)	Capabilities that are enabled on the neighbor.
Management Addresses	List of neighbor's management addresses.
Port VLAN ID (PVID)	VLAN identifier associated with untagged or priority tagged frames for the neighbor port.
Port & Protocol VLAN (Supported)	Whether Port & Protocol VLAN is supported on the LLDP neighbor.
Port & Protocol VLAN (Enabled)	Whether Port & Protocol VLAN is enabled on the LLDP neighbor.
Port & Protocol VLAN (VIDs)	List of Port & Protocol VLAN identifiers.
VLAN Names	List of names of VLANs that the neighbor's port belongs to.
Protocol IDs	List of protocols that are accessible through the neighbor's port.
MAC/PHY Auto-negotiation	Auto-negotiation configuration and status
Power Via MDI (PoE)	PoE configuration and status of 802.3 Power-Via-MDI TLV
Link Aggregation	Link aggregation information
Maximum Frame Size	The maximum frame size capability
LLDP-MED Device Type	LLDP-MED Device type
LLDP-MED Capabilities	LLDP-MED capabilities supported
Network Policy	List of network policies
Location Identification	Location information
Extended Power Via MDI (PoE)	PoE-capability and current status
Inventory Management	Inventory information

Related Commands show lldp neighbors

show lldp statistics

This command displays the global LLDP statistics (packet and event counters).

Syntax `show lldp statistics`

Mode User Exec and Privileged Exec

Example To display global LLDP statistics information, use the command:

```
awplus# show lldp statistics
```

Output

Figure 91-7: Example output from the **show lldp statistics** command

```
awplus# show lldp statistics

Global LLDP Packet and Event counters:

  Frames:     Out ................... 345
              In .................... 423
              In Errored ............ 0
              In Dropped ............ 0
  TLVs:       Unrecognized .......... 0
              Discarded ............. 0
  Neighbors:  New Entries ........... 20
              Deleted Entries ....... 20
              Dropped Entries ....... 0
              Entry Age-outs ........ 20
```

Table 91-7: Parameters in the output of the **show lldp statistics** command

Parameter	Description
`Frames Out`	Number of LLDPDU frames transmitted.
`Frames In`	Number of LLDPDU frames received.
`Frames In Errored`	Number of invalid LLDPDU frames received.
`Frames In Dropped`	Number of LLDPDU frames received and discarded for any reason.
`TLVs Unrecognized`	Number of LLDP TLVs received that are not recognized but the TLV type is in the range of reserved TLV types.
`TLVs Discarded`	Number of LLDP TLVs discarded for any reason.
`Neighbors New Entries`	Number of times the information advertised by neighbors has been inserted into the neighbor table.
`Neighbors Deleted Entries`	Number of times the information advertised by neighbors has been removed from the neighbor table.
`Neighbors Dropped Entries`	Number of times the information advertised by neighbors could not be entered into the neighbor table because of insufficient resources.
`Neighbors Entry Age-outs Entries`	Number of times the information advertised by neighbors has been removed from the neighbor table because the information TTL interval has expired.

Related Commands clear lldp statistics
show lldp statistics interface

show lldp statistics interface

This command displays the LLDP statistics (packet and event counters) for specified ports. If no port list is supplied, LLDP statistics for all ports are displayed.

Syntax

```
show lldp statistics interface [<port-list>]
```

Parameter	Description
<port-list>	The ports for which the statistics are to be shown.

Mode User Exec and Privileged Exec

Examples To display LLDP statistics information for all ports, use the command:

```
awplus# show lldp statistics interface
```

To display LLDP statistics information for ports 1.0.1 and 1.0.7, use the command:

```
awplus# show lldp statistics interface port1.0.1,port1.0.7
```

Output

Figure 91-8: Example output from the **show lldp statistics interface** command

```
awplus# show lldp statistics interface port1.0.1,port1.0.7

LLDP Packet and Event Counters:

port1.0.1
  Frames:     Out ..................... 27
              In ...................... 22
              In Errored .............. 0
              In Dropped .............. 0
  TLVs:       Unrecognized ............ 0
              Discarded ............... 0
  Neighbors:  New Entries ............. 3
              Deleted Entries ......... 0
              Dropped Entries ......... 0
              Entry Age-outs .......... 0

port1.0.7
  Frames:     Out ..................... 15
              In ...................... 18
              In Errored .............. 0
              In Dropped .............. 0
  TLVs:       Unrecognized ............ 0
              Discarded ............... 0
  Neighbors:  New Entries ............. 1
              Deleted Entries ......... 0
              Dropped Entries ......... 0
              Entry Age-outs .......... 0
```

Table 91-8: Parameters in the output of the **show lldp statistics interface** command

Parameter	Description
`Frames Out`	Number of LLDPDU frames transmitted.
`Frames In`	Number of LLDPDU frames received.
`Frames In Errored`	Number of invalid LLDPDU frames received.

Table 91-8: Parameters in the output of the **show lldp statistics interface**

Parameter	Description
`Frames In Dropped`	Number of LLDPDU frames received and discarded for any reason.
`TLVs Unrecognized`	Number of LLDP TLVs received that are not recognized but the TLV type is in the range of reserved TLV types.
`TLVs Discarded`	Number of LLDP TLVs discarded for any reason.
`Neighbors New Entries`	Number of times the information advertised by neighbors has been inserted into the neighbor table.
`Neighbors Deleted Entries`	Number of times the information advertised by neighbors has been removed from the neighbor table.
`Neighbors Dropped Entries`	Number of times the information advertised by neighbors could not be entered into the neighbor table because of insufficient resources.
`Neighbors Entry Age-outs Entries`	Number of times the information advertised by neighbors has been removed from the neighbor table because the information TTL interval has expired.

Related Commands

clear lldp statistics
show lldp statistics

show location

Use this command to display selected location information configured on the switch.

Syntax

```
show location {civic-location|coord-location|elin-location}

show location {civic-location|coord-location|elin-location}
   identifier {<civic-loc-id>|<coord-loc-id>|<elin-loc-id>}

show location {civic-location|coord-location|elin-location} interface
   <port-list>
```

Parameter	Description
`civic-location`	Display civic location information.
`coord-location`	Display coordinate location information.
`elin-location`	Display ELIN location information.
<civic-loc-id>	Civic address location identifier, in the range 1 to 4095.
<coord-loc-id>	Coordinate location identifier, in the range 1 to 4095.
<elin-loc-id>	ELIN location identifier, in the range 1 to 4095.
<port-list>	Ports to display information about.

Mode User Exec and Privileged Exec

Examples To display a civic address location configured on port1.0.1, use the command:

```
awplus# show location civic-location interface port1.0.1
```

Figure 91-9: Example output from the **show location** command

```
awplus# show location civic-location interface port1.0.1
Port     ID   Element Type          Element Value
-------------------------------------------------------------
1.0.1    1    Country               NZ
              City                  Christchurch
              Street-suffix         Avenue
              House-number          27
              Primary-road-name     Nazareth
```

To display coordinate location information configured on the identifier 1, use the command:

```
awplus# show location coord-location identifier 1
```

Figure 91-10: Example output from the **show location** command

```
awplus# show location coord-location identifier 1
  ID  Element Type             Element Value
------------------------------------------------------------------
  1   Latitude Resolution      15 bits
      Latitude                 38.898648113012313842773437 5 degrees
      Longitude Resolution     15 bits
      Longitude                130.232323229312896728515625 0 degrees
      Altitude Resolution      10 bits
      Altitude                 2.50000000 meters
      Map Datum                WGS 84
```

The coordinate location information displayed may differ from the information entered because it is stored in binary format. For more information, see the location coord-location configuration command.

To display all ELIN location information configured on the switch, use the command:

```
awplus# show location elin-location
```

Figure 91-11: Example output from the show location command

```
awplus# show location elin-location
  ID  ELIN
-----------------------------------
  1   1234567890
  2   5432154321
```

Related Commands

location elin-location-id
location civic-location identifier
location civic-location configuration
location coord-location identifier
location coord-location configuration
location elin-location

Chapter 92: SMTP Commands

Command List 92.2
debug mail 92.2
delete mail 92.3
mail 92.4
mail from 92.5
mail smtpserver 92.6
show counter mail 92.7
show mail 92.8
undebug mail 92.8

Command List

This chapter provides an alphabetical reference for commands used to configure SMTP.

For information about modifying or redirecting the output from show commands to a file, see "Controlling "show" Command Output" on page 1.41.

debug mail

This command turns on debugging for sending emails.

The no variant of this command turns off debugging for sending emails.

Syntax

```
debug mail
no debug mail
```

Mode Privileged Exec

Examples To turn on debugging for sending emails, use the command:

```
awplus# debug mail
```

To turn off debugging for sending emails, use the command:

```
awplus# no debug mail
```

Related Commands

delete mail
mail
mail from
mail smtpserver
show mail
show counter mail
undebug mail

delete mail

This command deletes mail from the queue.

Syntax `delete mail [mail-id <mail-id>|all]`

Parameter	Description	
`mail-id`	Deletes a single mail from the mail queue.	
	<mail-id>	An unique mail ID number. Use the show mail command to display this for an item of mail.
`all`	Delete all the mail in the queue.	

Mode Privileged Exec

Examples To delete a unique mail item `20060912142356.1234` from the queue, use the command:

```
awplus# delete mail 20060912142356.1234
```

To delete all mail from the queue, use the command:

```
awplus# delete mail all
```

Related Commands
debug mail
mail
mail from
mail smtpserver
show mail

mail

This command sends an email using the SMTP protocol. If you specify a file the text inside the file is sent in the message body.

If you do not specify the to, file, or subject parameters, the CLI prompts you for the missing information.

Before you can send mail using this command, you must specify the sending email address using the mail from command and a mail server using the mail smtpserver command.

Syntax `mail [{to <to>|subject <subject>|file <filename>}]`

Parameter	Description	
`to`	The email recipient.	
	<to>	Email address.
`subject`	Description of the subject of this email. Use quote marks when the subject text contains spaces.	
	<subject>	String.
`file`	File to insert as text into the message body.	
	<filename>	String.

Mode Privileged Exec

Example To send an email to `rei@nerv.com` with the subject `dummy plug configuration`, and with the message body inserted from the file `plug.conf` use the command:

```
awplus# mail rei@nerv.com subject dummy plug configuration
        filename plug.conf
```

Related Commands
debug mail
delete mail
mail from
mail smtpserver
show mail
show counter mail

mail from

This command sets an email address for the 'mail from' SMTP command. You must specify a sending email address with this command before you can send any email.

Syntax `mail from <from>`

Parameter	Description
<from>	The email address that the mail is sent from.

Mode Global Configuration

Example To set the email address you are sending mail from to "kaji@nerv.com, use the command:

```
awplus(config)# mail from kaji@nerv.com
```

Related Commands
delete mail
mail
mail smtpserver
show mail

mail smtpserver

This command sets the IP address of the SMTP server that your device sends email to. You must specify a mail server with this command before you can send any email.

Syntax `mail smtpserver <ip-address>`

Parameter	Description
<ip-address>	Internet Protocol (IP) Address for the mail server specified.

Mode Global Configuration

Example To specify a mail server at 192.168.0.1, use the command:

```
awplus# mail smtpserver 192.168.0.1
```

Related Commands
debug mail
delete mail
mail
mail from
show mail
show counter mail

show counter mail

This command displays the mail counters.

Syntax `show counter mail`

Mode User Exec and Privileged Exec

Output Figure 92-1: Example output from the **show counter mail** command

```
Mail Client (SMTP) counters
Mails Sent            ......... 0
Mails Sent Fails      ......... 1
```

Table 92-1: Parameters in the output of the **show counter mail** command

Parameter	Description
`Mails Sent`	The number of emails sent successfully since the last device restart.
`Mails Sent Fails`	The number of emails the device failed to send since the last device restart.

Example To show the emails in the queue use the command:

```
awplus# show counter mail
```

Related Commands
debug mail
delete mail
mail
mail from
show mail

show mail

This command displays the emails in the queue.

Syntax `show mail`

Mode Privileged Exec

Example To display the emails in the queue use the command:

```
awplus# show mail
```

Related Commands delete mail
mail
show counter mail

undebug mail

This command applies the functionality of the no debug mail command on page 92.2.

Chapter 93: RMON Introduction and Configuration

Introduction 93.2
Overview 93.2
RMON Configuration Example 93.3

Introduction

The chapter describes the Remote Network MONitoring (RMON) service on the switch, and describes a configuration example showing how to set up an RMON alarm.

This RMON alarm configuration example described creates SNMP traps and log messages when the rate of receipt of Broadcast packets on a switch port exceeds a threshold, and creates SNMP traps and log messages when the rate of receipt of Broadcast packets on a switch drops below a lower threshold.

For detailed information about the commands used to configure RMON, see Chapter 94, RMON Commands

RMON is disabled by default in AlliedWare Plus™. No RMON alarms or events are configured.

Overview

The Remote Network MONitoring (RMON) MIB (RFC2819) was developed by the IETF to support monitoring and protocol analysis of LANs with a focus on Layer 1 and 2 information in networks. RMON is an industry standard that provides the functionality in network analyzers.

An RMON implementation operates in a client/server model. Monitoring devices (or 'probes') contain RMON agents that collect information and analyze packets. The probes are servers and the Network Management applications that communicate with them are clients. While agent configuration and data collection uses SNMP, RMON operates differently than SNMP systems:

- Probes have responsibility for data collection and processing, reducing SNMP traffic and reducing processing load for clients.
- Information is only transmitted to the management application when required, not polled.

RMON is mainly used for 'flow-based' monitoring, while SNMP is mainly used for 'device-based' management. RMON data collected deals mainly with traffic patterns on the network, and SNMP data collected usually deals with the status of individual devices on the network.

One disadvantage of flow based monitoring is that remote devices have much more of the management burden, and require more resources. AlliedWare Plus minimizes the management and resources burden by implementing a subset of the RMON MIB group to provide a minimal RMON agent implementation supporting statistics, history, alarms, and events.

The RMON groups supported in AlliedWare Plus™ are:

- Statistics - collects ethernet statistics on a switch port, such as utilization and collisions.
- History - collects a history of ethernet statistics on a switch port.
- Alarms - monitor a MIB object for a specified interval, trigger an alarm at a specified value (the 'rising threshold'), and resets the alarm at another value (the 'falling threshold'). Alarms are used with events to trigger alarms, which generate logs or SNMP traps.
- Events - specify the action to take when an event is triggered by an alarm. The action of an event can generate a log or an SNMP trap.

RMON Configuration Example

This configuration example sets up an RMON alarm to create SNMP traps and log messages. This RMON alarm creates SNMP traps and log messages when the rate of receipt of Broadcast packets on a switch port exceeds a threshold, and creates SNMP traps and log messages when the rate of receipt of Broadcast packets on a switch port drops below a lower threshold.

Step 1: Set up an RMON collection on the switch port that is being monitored.

Use the following commands to configure this functionality:

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# rmon collection stats 4
```

This will cause the software to build a table in which it stores statistics relating to the switch port.

Step 2: Define an RMON event that will be called by the Alarm when the thresholds are passed.

Create this as a 'trap and log' event, so that both an SNMP trap and a log message will be generated. The trap will be sent to the SNMP community named 'public'.

Use the following command to configure this functionality:

```
awplus(config-if)# rmon event 10 log trap public
```

Step 3: Create the RMON alarm.

Every 5 seconds, the alarm checks the broadcast packet counter in RMON collection stats 4. If the change in the value of that counter over the 5 second interval exceeds 5000 (1000 broadcasts per second), the alarm will trigger the event defined in step 2 above.

Additionally, when the rate broadcast falls below 500 broadcasts per 5 seconds, then the alarm will trigger the event defined in step 2 above again.

Use the below command to configure this functionality:

```
awplus(config-if)# rmon alarm 5 etherStatsBroadcastPkts.4
                   interval 5 delta rising-threshold 5000
                   event 10 falling-threshold 500 event 10
```

For the variable '`etherStatsBroadcastPkts.4`' in this command, note that '`.4`' refers to the index number of the RMON collection stats 4 as defined on `port1.0.4`.

So, '`etherStatsBroadcastPkts.4`' refers to 'Received broadcasts' in RMON collection stats 4. Further counters for RMON are defined in section 5 of RFC 1757.

Step 4: Enable RMON traps.

To ensure that the SNMP trap is sent, you need to enabled RMON traps, and you need to define a trap host in SNMP. Use the below commands to configure this functionality:

```
awplus# configure terminal
awplus(config)# snmp-server
awplus(config)# snmp-server enable trap rmon
awplus(config)# snmp-server community public
awplus(config)# snmp-server host 192.168.2.254 version 2c
public
```

Note that the resulting log message will be of the form listed below:

```
RMON [1024]: Alarm Index 5 alarm Rising Threshold 5000 alarm
Value 5117 alarm Rising event Index 10 event description
RMON_SNMP
```

Chapter 94: RMON Commands

Command List 94.2
rmon alarm 94.2
rmon collection history 94.4
rmon collection stats 94.5
rmon event 94.6
show rmon alarm 94.7
show rmon event 94.8
show rmon history 94.10
show rmon statistics 94.12

Command List

This chapter provides an alphabetical reference for commands used to configure Remote Monitoring (RMON).

For an introduction to RMON and an RMON configuration example, see Chapter 93, RMON Introduction and Configuration

RMON is disabled by default in AlliedWare Plus™. No RMON alarms or events are configured.

For information about modifying or redirecting the output from show commands to a file, see "Controlling "show" Command Output" on page 1.41.

rmon alarm

Use this command to configure an RMON alarm to monitor the value of an SNMP object, and to trigger specified events when the monitored object crosses specified thresholds.

To specify the action taken when the alarm is triggered, use the event index of an event defined by the rmon event command.

Use the no variant of this command to remove the alarm configuration.

Note Only alarms for switch port interfaces, not for VLAN interfaces, can be configured.

Syntax

```
rmon alarm <alarm-index> <oid> interval <1-4294967295> {delta|
   absolute} rising-threshold <1-2147483647> event <rising-event-
   index> falling-threshold <1-2147483647> event <falling-event-
   index> [owner <owner>]

no rmon alarm <alarm-index>
```

Parameter	Description
<alarm-index>	*<1-65535>* Alarm entry index value.
<oid>	The variable SNMP MIB Object Identifier (OID) name to be monitored, in the format etherStatsEntry.field.<*stats-index*>. For example, etherStatsEntry.5.22 is the OID for the etherStatsPkts field in the etherStatsEntry table for the interface defined by the <*stats-index*> 22 in the rmon collection stats command.
`interval <1-4294967295>`	Polling interval in seconds.
`delta`	The RMON MIB alarmSampleType: the change in the monitored MIB object value between the beginning and end of the polling interval.
`absolute`	The RMON MIB alarmSampleType: the value of the monitored MIB object.

Parameter(cont.)	Description(cont.)
`rising-threshold <1-2147483647>`	Rising threshold value of the alarm entry in seconds.
`<rising-event-index>`	`<1-65535>` The event to be triggered when the monitored object value reaches the rising threshold value. This is an event index of an event specified by the rmon event command.
`falling-threshold <1-2147483647>`	Falling threshold value of the alarm entry in seconds.
`<falling-event-index>`	`<1-65535>` The event to be triggered when the monitored object value reaches the falling threshold value. This is an event index of an event specified by the rmon event command.
`owner <owner>`	Arbitrary owner name to identify the alarm entry.

Default By default, there are no alarms.

Mode Global Configuration

Usage Note that the SNMP MIB Object Identifier (OID) indicated in the command syntax with <*oid*> must be specified as a dotted decimal value with the form etherStatsEntry.field.<*stats-index*>.

Example To configure an alarm to monitor the change per minute in the etherStatsPkt value for interface 22 (defined by stats-index 22 in the rmon collection stats command), to trigger event 2 (defined by the rmon event command) when it reaches the rising threshold 400, and to trigger event 3 when it reaches the falling threshold 200, and identify this alarm as belonging to Maria, use the commands:

```
awplus# configure terminal

awplus(config)# rmon alarm 229 etherStatsEntry.22.5 interval 60
                delta rising-threshold 400 event 2 falling-
                threshold 200 event 3 owner maria
```

Related Commands rmon collection stats
rmon event

rmon collection history

Use this command to create a history statistics control group to store a specified number of snapshots (buckets) of the standard RMON statistics for the switch port, and to collect these statistics at specified intervals. If there is sufficient memory available, then the device will allocate memory for storing the set of buckets that comprise this history control.

Use the no variant of this command to remove the specified history control configuration.

Note Only a history for switch port interfaces, not for VLAN interfaces, can be collected.

Syntax

```
rmon collection history <history-index> [buckets <1-65535>]
   [interval <1-3600>] [owner <owner>]

no rmon collection history <history-index>
```

Parameter	Description
<history-index>	*<1-65535>* A unique RMON history control entry index value.
buckets *<1-65535>*	Number of requested buckets to store snapshots. Default 50 buckets.
interval *<1-3600>*	Polling interval in seconds. Default 1800 second polling interval.
owner *<owner>*	Owner name to identify the entry.

Default The default interval is 1800 seconds and the default buckets is 50 buckets.

Mode Interface Configuration

Example

```
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# rmon collection history 200 buckets 500
                   interval 600 owner herbert

awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no rmon collection history 200
```

rmon collection stats

Use this command to enable the collection of RMON statistics on a switch port, and assign an index number by which to access these collected statistics.

Use the no variant of this command to stop collecting RMON statistics on this switch port.

Note Only statistics for switch port interfaces, not for VLAN interfaces, can be collected.

Syntax

```
rmon collection stats <collection-index> [owner <owner>]
no rmon collection stats <collection-index>
```

Parameter	Description
<collection-index>	*<1-65535>* Give this collection of statistics an index number to uniquely identify it. This is the index to use to access the statistics collected for this switch port.
owner *<owner>*	An arbitrary owner name to identify this statistics collection entry.

Default RMON statistics are not enabled by default.

Mode Interface Configuration

Example

```
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# rmon collection stats 200 owner myrtle

awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# no rmon collection stats 200
```

rmon event

Use this command to create an event definition for a log or a trap or both. The event index for this event can then be referred to by the rmon alarm command.

Use the no variant of this command to remove the event definition.

Note Only the events for switch port interfaces, not for VLAN interfaces, can be collected.

Syntax

```
rmon event <event-index> [description <description>|owner <owner>|
   trap <trap>]

rmon event <event-index> [log [description <description>|
   owner <owner>|trap <trap>] ]

rmon event <event-index> [log trap [description <description>|
   owner <owner>] ]

no rmon event <event-index>
```

Parameter	Description
<event-index>	*<1-65535>* Unique event entry index value.
log	Log event type.
trap	Trap event type.
log trap	Log and trap event type.
description *<description>*	Event entry description.
owner *<owner>*	Owner name to identify the entry.

Default No event is configured by default.

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# rmon event 299 log description cond3 owner
alfred

awplus# configure terminal
awplus(config)# no rmon event 299
```

Related Commands rmon alarm

show rmon alarm

Use this command to display the alarms and threshold configured for the RMON probe.

Note Only the alarms for switch port interfaces, not for VLAN interfaces, can be shown.

Syntax

```
show rmon alarm
```

Mode User Exec and Privileged Exec

Example

```
awplus# show rmon alarm
```

Related Commands rmon alarm

show rmon event

Use this command to display the events configured for the RMON probe.

Note Only the events for switch port interfaces, not for VLAN interfaces, can be shown.

Syntax

```
show rmon event
```

Mode User Exec and Privileged Exec

Output Figure 94-1: Example output from the **show rmon event** command

```
awplus#sh rmon event
 event Index = 787
       Description TRAP
        Event type log & trap
         Event community name gopher
       Last Time Sent = 0
       Owner  RMON_SNMP

 event Index = 990
       Description TRAP
        Event type trap
         Event community name teabo
       Last Time Sent = 0
       Owner  RMON_SNMP
```

Note The following etherStats counters are not currently available for Layer 3 interfaces:

- etherStatsBroadcastPkts
- etherStatsCRCAlignErrors
- etherStatsUndersizePkts
- etherStatsOversizePkts
- etherStatsFragments
- etherStatsJabbers
- etherStatsCollisions
- etherStatsPkts64Octets
- etherStatsPkts65to127Octets
- etherStatsPkts128to255Octets
- etherStatsPkts256to511Octets
- etherStatsPkts512to1023Octets
- etherStatsPkts1024to1518Octets

Example

```
awplus# show rmon event
```

Related Commands rmon event

show rmon history

Use this command to display the parameters specified on all the currently defined RMON history collections on the device.

Note Only the history for switch port interfaces, not for VLAN interfaces, can be shown.

Syntax `show rmon history`

Mode User Exec and Privileged Exec

Output Figure 94-2: Example output from the **show rmon history** command

```
awplus#sh rmon history
 history index = 56
         data source ifindex = 4501
         buckets requested = 34
        buckets granted = 34
        Interval = 2000
        Owner Andrew

 history index = 458
         data source ifindex = 5004
         buckets requested = 400
        buckets granted = 400
        Interval = 1500
        Owner trev
=======================================================
```

Note The following etherStats counters are not currently available for Layer 3 interfaces:

- etherStatsBroadcastPkts
- etherStatsCRCAlignErrors
- etherStatsUndersizePkts
- etherStatsOversizePkts
- etherStatsFragments
- etherStatsJabbers
- etherStatsCollisions
- etherStatsPkts64Octets
- etherStatsPkts65to127Octets
- etherStatsPkts128to255Octets
- etherStatsPkts256to511Octets
- etherStatsPkts512to1023Octets
- etherStatsPkts1024to1518Octets

Example

```
awplus# show rmon history
```

Related Commands rmon collection history

show rmon statistics

Use this command to display the current values of the statistics for all the RMON statistics collections currently defined on the device.

Note Only statistics for switch port interfaces, not for VLAN interfaces, can be shown.

Syntax `show rmon statistics`

Mode User Exec and Privileged Exec

Example

```
awplus# show rmon statistics
```

Output Figure 94-3: Example output from the **show rmon statistics** command

```
awplus#show rmon statistics
    rmon collection index 45
    stats->ifindex = 4501
    input packets 1279340, bytes 85858960, dropped 00, multicast packets 1272100
    output packets 7306090, bytes 268724, multicast packets 7305660 broadcast
packets 290
    rmon collection index 679
    stats->ifindex = 5013
    input packets 00, bytes 00, dropped 00, multicast packets 00
    output packets 8554550, bytes 26777324, multicast packets 8546690 broadcast
packets 7720
```

Note The following etherStats counters are not currently available for Layer 3 interfaces:

- etherStatsBroadcastPkts
- etherStatsCRCAlignErrors
- etherStatsUndersizePkts
- etherStatsOversizePkts
- etherStatsFragments
- etherStatsJabbers
- etherStatsCollisions
- etherStatsPkts64Octets
- etherStatsPkts65to127Octets
- etherStatsPkts128to255Octets
- etherStatsPkts256to511Octets
- etherStatsPkts512to1023Octets
- etherStatsPkts1024to1518Octets

Related Commands rmon collection stats

Chapter 95: Triggers Introduction

Introduction 95.2
Trigger Facility 95.2
Configuring a Trigger 95.2
Troubleshooting Triggers 95.5

Introduction

This chapter provides information about the Trigger facility on this switch. For specific configuration examples, see Chapter 96, Triggers Configuration. For detailed descriptions of the commands used to configure triggers, see Chapter 97, Trigger Commands.

Trigger Facility

The Trigger facility provides a powerful mechanism for automatic and timed management of your device by automating the execution of commands in response to certain events. For example, you can use triggers to deactivate a service during the weekends, or to collect diagnostic information when the CPU usage is high.

A trigger is an ordered sequence of scripts that is executed when a certain event occurs. A script is a sequence of commands stored as a plaintext file on a file subsystem accessible to the device, such as Flash memory. Each trigger may reference multiple scripts and any script may be used by any trigger. When an event activates a trigger, the trigger executes the scripts associated with it in sequence. One script is executed completely before the next script begins. Various types of triggers are supported, each activated in a different way.

Configuring a Trigger

The following describes the general steps to configure a trigger. For specific configuration examples, see Chapter 96, Triggers Configuration.

Step 1: Create a configuration script

Create a configuration script with the commands you would like executed when the trigger conditions are met. To create the configuration script using the CLI, use the command:

```
awplus# edit [<filename>]
```

Alternatively, you can create a script on a PC then load it onto your device using the copy (URL) command.

Step 2: Enter the trigger configuration mode

You must be in the Global Configuration mode to reach the Trigger Configuration mode. Use the command:

```
awplus# configure terminal
```

To create a trigger, and enter its configuration mode, use the command:

```
awplus(config)# trigger <1-250>
```

Step 3: Set the trigger type

The trigger type determines how the trigger is activated. To set the trigger to activate:

« when a Secure Digital (SD) or Secure Digital High Capacity (SDHC) card is either inserted or removed, use the command:

```
awplus(config-trigger)# type card {in|out}
```

« when CPU usage reaches a certain level, use the command:

```
awplus(config-trigger)# type cpu <1-100> [up|down|any]
```

« when the link status of a particular interface changes, use the command:

```
awplus(config-trigger)# type interface <interface>
                        [up|down|any]
```

« when the RAM usage reaches a certain level, use the command:

```
awplus(config-trigger)# type memory <1-100> [up|down|any]
```

« periodically after a set number of minutes, use the command:

```
awplus(config-trigger)# type periodic <1-1440>
```

« when a ping poll identifies that a target device's status has changed, use the command:

```
awplus(config-trigger)# type ping-poll <1-100> {up|down}
```

« if your device reboots, use the command:

```
awplus(config-trigger)# type reboot
```

« when a stacking link goes up or down, use the command:

```
awplus(config-trigger)# type stack link {up|down}
```

« at a specific time of the day, use the command:

```
awplus(config-trigger)# type time <hh:mm>
```

Note that a combined limit of 10 triggers of the type periodic and type time can be configured. If you attempt to add more than 10 triggers the following error message is displayed:

```
% Cannot configure more than 10 triggers with the type time or
periodic
```

Step 4: Set the time and days that the trigger can activate on

By default triggers can activate at any time of the day, on all days. If you want your trigger to activate only during a specific time of the day, use the command:

```
awplus(config-trigger)# time {[after <hh:mm:ss>]
                        [before <hh:mm:ss>]}
```

If you want your trigger to activate only on a specific date, use the command:

```
awplus(config-trigger)# day <1-31> <month> <2000-2035>
```

If you want the trigger to activate only on specific days of the week, use the command:

```
awplus(config-trigger)# day <weekday>
```

Note that you can set either a specific date, or specific weekdays, but not both.

Step 5: Specify how often the trigger can activate

By default, triggers can activate an unlimited number of times, as long as the trigger conditions are met. To set a limit on the number of times a trigger can activate, use the command:

```
awplus(config-trigger)# repeat {forever|no|once|yes|
                        <1-4294967294>}
```

You device maintains two counters that track the number of times a trigger has activated. One counts the total number of times the trigger is activated and is only reset if the device restarts, or when the trigger is destroyed. The other counter tracks the permitted number of repetitions. To reset this counter, use the repeat command on page 97.6.

Step 6: Add the script to the trigger

You can add up to five scripts to the trigger. When a trigger is activated, it executes the scripts in sequence, with the lowest numbered script activated first. The first script runs to completion before the next script begins. To add a script, use the command:

```
awplus(config-trigger)# script <1-5> {<filename>}
```

Note that a script activated from a SD card trigger cannot be located on the SD or SDHC card. It must be located in Flash memory.

Step 7: Specify a description for the trigger

Specify a description for the trigger, so that you can easily identify the trigger in show commands and log output. Use the command:

```
awplus(config-trigger)# description <description>
```

Step 8: Verify the trigger's configuration

To check the configuration of the trigger, use the command:

```
awplus(config-trigger)# show trigger [<1-250>|counter|
                        full]
```

Troubleshooting Triggers

You can use the trigger diagnostic mode and trigger debugging to test your triggers and troubleshoot any issues.

Diagnostic mode is set per trigger. In this mode the trigger activates if its trigger conditions are met, but does not run any of its scripts. Your device generates a log message to indicate that the trigger was activated. To place a trigger in diagnostic mode, enter the trigger's configuration mode and use the command:

```
awplus(config-trigger)# test
```

To start debugging for triggers, use the command:

```
awplus(config-trigger)# debug trigger
```

This generates detailed messages about how your device is processing the trigger commands and activating the triggers.

Enabling and Disabling

Triggers are enabled by default. This allows the trigger to activate as soon as its trigger conditions are met. If you need to disable a trigger but do not want to delete the trigger, use the command:

```
awplus(config-trigger)# no active
```

To enable the trigger again, use the command:

```
awplus(config-trigger)# active
```

To delete the trigger, use the command:

```
awplus(config-trigger)# no trigger <1-250>
```

Chapter 96: Triggers Configuration

Introduction 96.2
Restrict Internet Access 96.2
Capture Unusual CPU and RAM Activity 96.4
See Daily Statistics 96.6
Turn Off Power to Port LEDs 96.7
Capture Show Output and Save to a SD Card 96.9
Load a Release File From a SD Card 96.10

Introduction

The chapter describes how to configure triggers to:

- Restrict Internet Access
- Capture Unusual CPU and RAM Activity
- See Daily Statistics
- Turn Off Power to Port LEDs
- Capture Show Output and Save to a SD Card

For more information about triggers, see Chapter 95, Triggers Introduction. For detailed descriptions of the commands used to configure triggers, see Chapter 97, Trigger Commands.

Restrict Internet Access

In the following configuration the ACME company wants to restrict its employees from accessing popular video sharing websites as this is causing bandwidth problems during work hours. The ACME company is happy for workers to access the site after work hours.

Employee PCs at ACME are on vlan2. Two triggers with associated scripts are needed:

- Trigger 1 activates at 8.30am and runs a script called shutdown.scp. This script adds commands to restrict access to the specified sites
- Trigger 2 activates at 5.30pm and runs the script called open.scp. This script removes the configuration specified by shutdown.scp

1. Create the shutdown.scp script

   Create a configuration script using Access Control List commands to restrict users on vlan2 from accessing the specific sites.

2. Create the open.scp script

   Create a script to remove the ACL configuration specified in the shutdown.scp file.

3. Configure trigger 1

   To create trigger 1, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 1
```

   Set the trigger to activate at 8:30am, by using the command:

```
awplus(config-trigger)# type time 08:30
```

   Set the trigger to activate on Monday, Tuesday, Wednesday, Thursday and Friday:

```
awplus(config-trigger)# day mon tue wed thur fri
```

   Add the script shutdown.scp to the trigger:

```
awplus(config-trigger)# script 1 shutdown.scp
```

Specify a helpful description, such as Stops access to video sharing sites. Use the command:

```
awplus(config-trigger)# description Stops access to video
                        sharing sites
```

Change to Global Configuration mode:

```
awplus(config-trigger)# exit
```

4. Configure trigger 2

   To create trigger 2, use the command:

   ```
   awplus(config)# trigger 2
   ```

   Set the trigger to activate at 5.30pm:

   ```
   awplus(config-trigger)# type time 17:30
   ```

   Set the trigger to activate on Monday, Tuesday, Wednesday, Thursday and Friday:

   ```
   awplus(config-trigger)# day mon tue wed thur fri
   ```

   Add the script open.scp to the trigger:

   ```
   awplus(config-trigger)# script 1 open.scp
   ```

   Specify a helpful description, such as Access allowed to video sharing sites. Use the command:

   ```
   awplus(config-trigger)# description Access allowed to video
                           sharing sites
   ```

5. Verify the configuration

   To check the configuration of the triggers, use the commands:

   ```
   awplus# show trigger 1

   awplus# show trigger 2
   ```

Capture Unusual CPU and RAM Activity

The following configuration allows you to troubleshoot high CPU or RAM usage by the device. It uses two triggers to capture show output, and places this output in a file.

- Trigger 3 activates the script cpu-usage.scp when CPU usage is over 90% and can activate up to 5 times
- Trigger 4 activates the script ram-usage.scp when RAM usage is over 95%, and can activate up to 10 times

1. Create the cpu-usage.scp configuration script

   Create a script with the appropriate show command:

   ```
   awplus# show cpu | redirect showcpu.txt
   ```

   The output of the show cpu command has been redirected into a file. It is not possible to display trigger script output on the terminal. Redirecting the command output to a file means it is available for later inspection.

   If the trigger activates on more than one occasion the contents of showcpu.txt will be overwritten with the latest output. To keep a full record for all activations of this trigger an ASH shell script can be added to the trigger to manage the output of the configuration script. For example:

   ```
   #!/bin/ash
   date >> showcpu_bkup.txt
   cat showcpu.txt >> showcpu_bkup.txt
   ```

   This script concatenates that date and time of activation and the contents of showcpu.txt onto the end of the backup file showcpu_bkup.txt in flash memory.

   Note that the files may grow large accumulating data and consume available flash memory.

2. Create the ram-usage.scp configuration script

   Create a script with the appropriate show command:

   ```
   awplus# show memory | redirect showmem.txt
   ```

   The output of the show memory command has been redirected into a file. It is not possible to display trigger script output on the terminal. Redirecting the command output to a file means it is available for later inspection.

   If the trigger activates on more than one occasion the contents of showcpu.txt will be overwritten with the latest output. To keep a full record for all activations of this trigger an ASH shell script can be added to the trigger to manage the output of the configuration script. For example:

   ```
   #!/bin/ash
   date >> showmem_bkup.txt
   cat showmem.txt >> showmem_bkup.txt
   ```

   This script concatenates that date and time of activation and the contents of showmem.scp onto the end of the backup file showmem_bkup.scp in flash memory.

   Note that the files may grow large accumulating data and consume available flash memory.

3. Configure trigger 3

   To create trigger 3, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 3
```

   Set the trigger to activate when CPU usage exceeds 80%:

```
awplus(config-trigger)# type cpu 90 up
```

   Add the script cpu-usage.scp to the trigger:

```
awplus(config-trigger)# script 1 cpu-usage.scp
```

   Return to Global Configuration mode:

```
awplus(config-trigger)# exit
```

4. Configure trigger 4

   To create trigger 4, use the command:

```
awplus(config)# trigger 4
```

   Set the trigger to activate when RAM usage exceeds 95%:

```
awplus(config-trigger)# type cpu 95 up
```

   Add the script cpu-usage.scp to the trigger:

```
awplus(config-trigger)# script 1 ram-usage.scp
```

5. Verify the configuration

   To check the configuration of the triggers, use the command:

```
awplus# show trigger 3
awplus# show trigger 4
```

See Daily Statistics

The ACME company has recently set up QoS on its traffic to give traffic different priorities to the ISP. ACME wants to assess how much traffic is dropped with the QoS bandwidths set over the next week. To do this, they want to generate an hourly report on QoS traffic on the first day that this is implemented.

- Trigger 5 activates the script qos-stats.scp every 60 minutes.
  The trigger is set to only activate during work hours.

1. Create the qos-stats.scp script

   Create a configuration script with the appropriate show commands. You can either create the configuration script using the CLI with the edit command or create a script on a PC then load it onto your device using the copy (URL) command.

2. Configure trigger 5

   To create trigger 5, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 5
```

   Set the trigger to activate periodically every 60 minutes:

```
awplus(config-trigger)# type periodic 60
```

   Set the trigger to activate only during the hours of 8:00am and 6:00pm:

```
awplus(config-trigger)# time after 8:00 before 18:00
```

   Add the script qos-stats.scp to the trigger:

```
awplus(config-trigger)# script 1 qos-stats.scp
```

3. Verify the configuration

   To check the configuration of the trigger, use the command:

```
awplus# show trigger 5
```

Turn Off Power to Port LEDs

The following configuration allows you to conserve power by using the eco-friendly feature to turn off power to the port LEDs during non-work hours.

- Trigger 6 activates at 5.30pm and runs a script called LEDoff.scp. This script adds commands to turn off power to all the port LEDs
- Trigger 7 activates at 8.30am and runs the script called LEDon.scp. This script removes the configuration specified by LEDoff.scp

1. Create the LEDoff.scp script

   Create a configuration script with the commands that are executed when the trigger conditions are met. You can either create the configuration script using the CLI with the edit command or create a script on a PC then load it onto your device using the copy (URL) command. The configuration script for this example is:

```
!
enable
configure terminal
ecofriendly led
exit
exit
!
```

2. Create the LEDon.scp script

   Create a script to remove the configuration specified in the LEDoff.scp file. The configuration script for this example is:

```
!
enable
configure terminal
no ecofriendly led
exit
exit
!
```

3. Configure trigger 6

   To create trigger 6, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 6
```

   Set the trigger to activate at 5:30pm, by using the command:

```
awplus(config-trigger)# type time 17:30
```

   Set the trigger to activate on Monday, Tuesday, Wednesday, Thursday and Friday:

```
awplus(config-trigger)# day mon tue wed thur fri
```

   Add the script LEDoff.scp to the trigger:

```
awplus(config-trigger)# script 1 powershutdown.scp
```

Specify a helpful description, such as Shutdown power to LEDs. Use the command:

```
awplus(config-trigger)# description Shutdown power to LEDs
```

Change to Global Configuration mode:

```
awplus(config-trigger)# exit
```

4. Configure trigger 7

   To create trigger 7, use the command:

   ```
   awplus(config)# trigger 9
   ```

   Set the trigger to activate at 8.30am:

   ```
   awplus(config-trigger)# type time 08:30
   ```

   Set the trigger to activate on Monday, Tuesday, Wednesday, Thursday and Friday:

   ```
   awplus(config-trigger)# day mon tue wed thur fri
   ```

   Add the script LEDon.scp to the trigger:

   ```
   awplus(config-trigger)# script 1 poweropen.scp
   ```

   Specify a helpful description, such as Turn on power to LEDs. Use the command:

   ```
   awplus(config-trigger)# description Turn on power to LEDs
   ```

5. Verify the configuration

   To check the configuration of the triggers, use the commands:

   ```
   awplus# show trigger 6
   awplus# show trigger 7
   ```

Capture Show Output and Save to a SD Card

The following configuration allows you to automatically capture output from the show tech-support command when a SD (or SDHC) card is inserted into the switch. It uses a script called by the SD card trigger to capture the show tech-support output and places this output in a file on the SD card.

- Trigger 8 activates the script shtech-sup.scp when an SD card is inserted in the switch

1. Create the shtech-sup.scp script

   Create a configuration script with the commands that are executed when the trigger conditions are met. You can either create the configuration script using the CLI with the edit command or create a script on a PC then load it onto your device using the copy (URL) command. The configuration script for this example is:

```
!
enable
show tech-support outfile card:support.txt.gz
exit
end
!
```

2. Configure trigger 8

   To create trigger 8, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 8
```

   Set the trigger to activate on the insertion of a SD card:

```
awplus(config-trigger)# type card in
```

   Add the script shtech-sup.scp to the trigger:

```
awplus(config-trigger)# script 1 shtech-sup.scp
```

3. Verify the configuration

   To check the configuration of the triggers, use the command:

```
awplus# show trigger 8
```

Load a Release File From a SD Card

The following configuration allows you to automatically load a release file from a SD (or SDHC) card into Flash memory when a card is inserted into the switch. It uses a script called by the SD card trigger to load the release file from the SD card.

Note that you can only specify that the release file is on a SD card if there is a backup release file already specified in Flash. See the boot system command for further information.

Caution Anyone with physical access to the switch and who knows the name of the release file loaded by the trigger could insert an SD card and overwrite the boot configuration in flash memory.

- Trigger 10 activates the script copy.scp when an SD card is inserted in the switch

1. Create the copy.scp script

   Create a configuration script with the commands that are executed when the trigger conditions are met. You can either create the configuration script using the CLI with the edit command or create a script on a PC then load it onto your device using the copy (URL) command. The configuration script for this example is:

```
!
enable
copy card flash x900-5.4.2.rel
wait 5
configure terminal
boot system x900-5.4.2.rel
exit
end
!
```

2. Configure trigger 10

   To create trigger 10, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 10
```

   Set the trigger to activate on the insertion of a SD card:

```
awplus(config-trigger)# type card in
```

   Add the script copy.scp to the trigger:

```
awplus(config-trigger)# script 1 copy.scp
```

   Specify a helpful description, such as Load a release file. Use the command:

```
awplus(config-trigger)# description Load a release file
```

After a SD card has been inserted in the switch, use the following two steps to check the trigger and current boot configuration details.

1. Verify the trigger configuration

   To check the configuration of the trigger, use the command:

```
awplus# show trigger 10
```

   Example output from this command is shown below:

```
awplus#show trigger 10
Trigger Configuration Details
-------------------------------------------------------------
Trigger ..................... 10
Description ................. Load a release file
Type and details ............ Card (in)
Days ........................ smtwtfs
After ....................... 00:00:00
Before ...................... 23:59:59
Active ...................... Yes
Test ........................ No
Trap ........................ Yes
Repeat ...................... Continuous
Modified .................... Wed Sep 15 16:25:33 2010
Number of activations ....... 1
Last activation ............. Wed Sep 15 16:26:49 2010
Number of scripts ........... 1
  1. copy.scp
  2. <not configured>
  3. <not configured>
  4. <not configured>
  5. <not configured>
-------------------------------------------------------------
```

2. Display the current boot configuration

   To display the current boot configuration, use the command:

```
awplus# show boot
```

   Example output from this command is shown below:

```
awplus#show boot
Boot configuration
-------------------------------------------------------------
Current software   : x900-5.4.2.rel
Current boot image : flash:/x900-5.4.2.rel
Backup  boot image : flash:/x900-5.4.2.rel
Default boot config: flash:/default.cfg
Current boot config: flash:/atplab.cfg (file exists)
Backup  boot config: flash:/default.cfg (file exists)
```

Chapter 97: Trigger Commands

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show running-config trigger 97.8
show trigger 97.9
test 97.13
time (trigger) 97.14
trap 97.16
trigger 97.17
trigger activate 97.18
type card 97.19
type cpu 97.20
type interface 97.21
type memory 97.22
type periodic 97.23
type ping-poll 97.24
type reboot 97.25
type stack disabled-master 97.26
type stack master-fail 97.27
type stack member 97.27
type stack link 97.28
type time 97.29
undebug trigger 97.29

Command List

This chapter provides an alphabetical reference for commands used to configure Triggers. For more information, see Chapter 95, Triggers Introduction and Chapter 96, Triggers Configuration.

For information about modifying or redirecting the output from show commands to a file, see "Controlling "show" Command Output" on page 1.41.

active (trigger)

This command enables a trigger. This allows the trigger to activate when its trigger conditions are met.

The no variant of this command disables a trigger. While in this state the trigger cannot activate when its trigger conditions are met.

Syntax

```
active
no active
```

Mode Trigger Configuration

Examples To enable trigger 172, so that it can activate when its trigger conditions are met, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 172
awplus(config-trigger)# active
```

To disable trigger 182, preventing it from activating when its trigger conditions are met, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 182
awplus(config-trigger)# no active
```

Related Commands show trigger
trigger

day

This command specifies the days or date that the can trigger activate on. You can specify either:

- A specific date
- A specific day of the week
- A list of days of the week
- every day

By default, the trigger can activate on any day.

Syntax

```
day every-day
day <1-31> <month> <2000-2035>
day <weekday>
```

Parameter	Description
`every-day`	Sets the trigger so that it can activate on any day.
<1-31>	Day of the month the trigger is permitted to activate on.
<month>	Sets the month that the trigger is permitted to activate on. Valid keywords are: january, february, march, april, may, june, july, august, september, october, november, and december.
<2000-2035>	Sets the year that the trigger is permitted to activate in.
<weekday>	Sets the days of the week that the trigger can activate on. You can specify one or more week days in a space separated list. Valid keywords are: monday, tuesday, wednesday, thursday, friday, saturday, and sunday.

Mode Trigger Configuration

Usage For example trigger configurations that use the day command, see "Restrict Internet Access" on page 96.2 and "Turn Off Power to Port LEDs" on page 96.7.

Examples To permit trigger 55 to activate on the `1 Jun 2010`, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 55
awplus(config-trigger)# day 1 Jun 2010
```

To permit trigger 12 to activate on a Mondays, Wednesdays and Fridays, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 12
awplus(config-trigger)# day monday wednesday friday
```

Related Commands
show trigger
trigger

debug trigger

This command enables trigger debugging. This generates detailed messages about how your device is processing the trigger commands and activating the triggers.

The no variant of this command disables trigger debugging.

Syntax

```
debug trigger
```

```
no debug trigger
```

Mode

Privilege Exec

Examples

To start trigger debugging, use the command:

```
awplus# debug trigger
```

To stop trigger debugging, use the command:

```
awplus# no trigger
```

Related Commands

show trigger
test
trigger
undebug trigger

description (trigger)

This command adds an optional description to help you identify the trigger. This description is displayed in show command outputs and log messages.

The no variant of this command removes a trigger's description. The show command outputs and log messages stop displaying a description for this trigger.

Syntax

```
description <description>
no description
```

Parameter	Description
<description>	A word or phrase that uniquely identifies this trigger or its purpose. Valid characters are any printable character and spaces, up to a maximum of 40 characters.

Mode Trigger Configuration

Examples To give trigger 240 the description `daily status report`, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 240
awplus(config-trigger)# description daily status report
```

To remove the description from trigger `36`, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 36
awplus(config-trigger)# no description
```

Related Commands

show trigger
test
trigger

repeat

This command specifies the number of times that a trigger is permitted to activate. This allows you to specify whether you want the trigger to activate:

- only the first time that the trigger conditions are met
- a limited number of times that the trigger conditions are met
- an unlimited number of times

Once the trigger has reached the limit set with this command, the trigger remains in your configuration but cannot be activated. Use the repeat command again to reset the trigger so that it is activated when its trigger conditions are met.

By default, triggers can activate an unlimited number of times. To reset a trigger to this default, specify either yes or forever.

Syntax `repeat {forever|no|once|yes|<1-4294967294>}`

Parameter	Description
`yes|forever`	The trigger repeats indefinitely, or until disabled.
`no|once`	The trigger activates only once.
<1-4292967294>	The trigger repeats the set number of times.

Mode Trigger Configuration

Examples To allow trigger `21` to activate only once, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 21
awplus(config-trigger)# repeat no
```

To allow trigger `22` to activate an unlimited number of times whenever its trigger conditions are met, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 22
awplus(config-trigger)# repeat forever
```

To allow trigger `23` to activate only the first `10` times the conditions are met, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 23
awplus(config-trigger)# repeat 10
```

Related Commands show trigger
trigger

script

This command specifies one or more scripts that are to be run when the trigger activates. You can add up to five scripts to a single trigger.

The sequence in which the trigger runs the scripts is specified by the number you set before the name of the script file. One script is executed completely before the next script begins.

Scripts may be either ASH shell scripts, indicated by a .sh filename extension suffix, or AlliedWare Plus™ scripts, indicated by a .scp filename extension suffix. AlliedWare Plus™ scripts only need to be readable.

The no variant of this command removes one or more scripts from the trigger's script list. The scripts are identified by either their name, or by specifying their position in the script list. The all parameter removes all scripts from the trigger.

Syntax

```
script <1-5> {<filename>}
no script {<1-5>|<filename>|all}
```

Parameter	Description
<1-5>	The position of the script in execution sequence. The trigger runs the lowest numbered script first.
<filename>	The path to the script file.

Mode Trigger Configuration

Examples To configure trigger 71 to run the script flash:/cpu_trig.sh in position 3 when the trigger activates, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 71
awplus(config-trigger)# script 3 flash:/cpu_trig.sh
```

To configure trigger 99 to run the scripts flash:reconfig.scp, flash:cpu_trig.sh and flash:email.scp in positions 2, 3 and 5 when the trigger activates, use the following commands:

```
awplus# configure terminal
awplus(config)# trigger 99
awplus(config-trigger)# script 2 flash:/reconfig.scp 3 flash:/
cpu_trig.sh 5 flash:/email.scp
```

To remove the scripts 1, 3 and 4 from trigger 71's script list, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 71
awplus(config-trigger)# no script 1 3 4
```

To remove the script flash:/cpu_trig.sh from trigger 71's script list, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 71
awplus(config-trigger)# no script flash:/cpu_trig.sh
```

To remove all the scripts from trigger 71's script list, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 71
awplus(config-trigger)# no script all
```

Related Commands show trigger
trigger

show running-config trigger

This command displays the current running configuration of the trigger utility.

Syntax

```
show running-config trigger
```

Mode Privileged Exec

Example To display the current configuration of the trigger utility, use the command:

```
awplus# show running-config trigger
```

Output Figure 97-1: Example output from the **show running-config trigger** command

```
trigger 1
 type card in
trigger 2
 type card out
!
```

Related Commands show trigger

show trigger

This command displays configuration and diagnostic information about the triggers configured on the device. Specify the show trigger command without any options to display a summary of the configuration of all triggers.

Syntax `show trigger [<1-250>|counter|full]`

Parameter	Description
<1-250>	Displays detailed information about a specific trigger, identified by its trigger ID.
`counter`	Displays statistical information about all triggers.
`full`	Displays detailed information about all triggers.

Mode Privileged Exec

Example To get summary information about all triggers, use the following command:

```
awplus# show trigger
```

Figure 97-2: Example output from the **show trigger** command

```
awplus#show trigger
TR# Type & Details       Name                  Ac Te Tr Repeat     #Scr Days/Date
-------------------------------------------------------------------------------
001 Card (in)                                  Y  N  Y  Continuous  0   smtwtfs
002 Card (out)                                 Y  N  Y  Continuous  0   smtwtfs
003 CPU (80% any)        Busy CPU              Y  N  Y  5           1   smtwtfs
005 Periodic (30 min)    Regular status check  Y  N  N  Continuous  1   -mtwtf-
007 Memory (85% up)      High mem usage        Y  N  Y  8           1   smtwtfs
011 Time (00:01)         Weekend access        Y  N  Y  Continuous  1   ------s
013 Reboot                                     Y  N  Y  Continuous  2   smtwtfs
017 Interface (vlan1 ... Change config for...  Y  N  Y  Once        1   2-apr-2008
019 Ping-poll (5 up)     Connection to svr1    Y  N  Y  Continuous  1   smtwtfs
-------------------------------------------------------------------------------
```

Table 97-1: Parameters in the output of the **show trigger** command

Parameter	Description
`TR#`	Trigger identifier (ID).
`Type & Details`	The trigger type, followed by the trigger details in brackets.
`Name`	Descriptive name of the trigger configured with the description (trigger) command.
`Ac`	Whether the trigger is active (Y), or inactive (N).
`Te`	Whether the trigger is in test mode (Y) or not (N).
`Tr`	Whether or not the trigger is enabled to send SNMP traps. See the trap command.

Table 97-1: Parameters in the output of the **show trigger** command(cont.)

Parameter	Description
Repeat	Whether the trigger repeats continuously, and if not, the configured repeat count for the trigger. To see the number of times a trigger has activated, use the show trigger <1-250> command.
#Scr	Number of scripts associated with the trigger.
Days/Date	Days or date when the trigger may be activated. For the days options, the days are shown as a seven character string representing Sunday to Saturday. A hyphen indicates days when the trigger cannot be activated.

To display detailed information about trigger 3, use the command:

```
awplus# show trigger 3
```

Figure 97-3: Example output from the **show trigger** command for a specific trigger

```
awplus#show trigger 3
Trigger Configuration Details
-------------------------------------------------------------
Trigger ..................... 1
Description ................. display cpu usage when pass 80%
Type and details ............ CPU (80% up)
Days ........................ 26-nov-2007
After ....................... 00:00:00
Before ...................... 23:59:59
Active ...................... Yes
Test ........................ No
Trap ........................ Yes
Repeat ...................... 123 (0)
Modified .................... Tue Dec 20 02:26:03 1977
Number of activations ....... 0
Last activation ............. not activated
Number of scripts ........... 1
  1. shocpu.scp
  2. <not configured>
  3. <not configured>
  4. <not configured>
  5. <not configured>
-------------------------------------------------------------
```

To display detailed information about all triggers, use the command:

```
awplus# show trigger full
```

Figure 97-4: Example output from the **show trigger full** command

```
awplus#show trigger full
Trigger Configuration Details
-------------------------------------------------------------
 Trigger ..................... 1
 Description ................. <no description>
 Type and details ............ Card (in)
 Days ........................ smtwtfs
 After ....................... 00:00:00
 Before ...................... 23:59:59
 Active ...................... Yes
 Test ........................ No
 Trap ........................ Yes
 Repeat ...................... Continuous
 Modified .................... Fri Sep  3 14:45:56 2010
 Number of activations ....... 0
 Last activation ............. not activated
 Number of scripts ........... 0
   1. <not configured>
   2. <not configured>
   3. <not configured>
   4. <not configured>
   5. <not configured>

 Trigger ..................... 2
 Description ................. <no description>
 Type and details ............ Card (out)
 Days ........................ smtwtfs
 After ....................... 00:00:00
 Before ...................... 23:59:59
 Active ...................... Yes
 Test ........................ No
 Trap ........................ Yes
 Repeat ...................... Continuous
 Modified .................... Fri Sep  3 14:45:56 2010
 Number of activations ....... 0
 Last activation ............. not activated
 Number of scripts ........... 0
   1. <not configured>
   2. <not configured>
   3. <not configured>
   4. <not configured>
   5. <not configured>

Trigger ..................... 3
Description ................. Busy CPU
Type and details ............ CPU (80% up)
Days ........................ smtwtfs
Active ...................... Yes
Test ........................ No
Trap ........................ Yes
Repeat ...................... Continuous
Modified .................... Fri Feb 2 17:05:16 2007
Number of activations ....... 0
Last activation ............. not activated
Number of scripts ........... 2
  1. flash:/cpu_alert.sh
  2. flash:/reconfig.scp
  3. <not configured>
  4. <not configured>
  5. <not configured>
-------------------------------------------------------------
```

Table 97-2: Parameters in the output of the s**how trigger full** and **show trigger** commands for a specific trigger

Parameter	Description
Trigger	The ID of the trigger.
Description	Descriptive name of the trigger.
Type and details	The trigger type and its activation conditions.
Days	The days on which the trigger is permitted to activate.
Date	The date on which the trigger is permitted to activate. Only displayed if configured, in which case it replaces “Days”.
Active	Whether or not the trigger is permitted to activate.
Test	Whether or not the trigger is operating in diagnostic mode.
Trap	Whether or not the trigger is enabled to send SNMP traps.
Repeat	Whether the trigger repeats an unlimited number of times (Continuous) or for a set number of times. When the trigger can repeat only a set number of times, then the number of times the trigger has been activated is displayed in brackets.
Modified	The date and time of the last time that the trigger was modified.
Number of activations	Number of times the trigger has been activated since the last restart of the device.
Last activation	The date and time of the last time that the trigger was activated.
Number of scripts	How many scripts are associated with the trigger, followed by the names of the script files in the order in which they run.

To display counter information about all triggers use the command:

```
awplus# show trigger counter
```

Figure 97-5: Example output from the **show trigger counter** command

```
awplus#show trigger counter
Trigger Module Counters
-------------------------------------------------------
Trigger activations ............................ 0
Time triggers activated today .................. 0
Periodic triggers activated today .............. 0
Interface triggers activated today ............. 0
Resource triggers activated today .............. 0
Reboot triggers activated today ................ 0
Ping-poll triggers activated today ............. 0
Stack master fail triggers activated today .... 0
Stack member triggers activated today ......... 0
Stack xem-stk triggers activated today ........ 0
-------------------------------------------------------
```

Table 97-3: Parameters in the output of the **show trigger counter** command

Parameter	Description
`Trigger activations`	Number of times a trigger has been activated.
`Time triggers activated today`	Number of times a time trigger has been activated today.
`Periodic triggers activated today`	Number of times a periodic trigger has been activated today.
`Interface triggers activated today`	Number of times an interface trigger has been activated today.
`Resource triggers activated today`	Number of times a CPU or memory resource trigger has been activated today.
`Ping-poll triggers activated today`	Number of times a ping-poll trigger has been activated today.

Related Commands trigger

test

This command puts the trigger into a diagnostic mode. In this mode the trigger may activate but when it does it will not run any of the trigger's scripts. A log message will be generated to indicate when the trigger has been activated.

The no variant of this command takes the trigger out of diagnostic mode, restoring normal operation. When the trigger activates the scripts associated with the trigger will be run, as normal.

Syntax

```
test
no test
```

Mode Trigger Configuration

Examples To put trigger 5 into diagnostic mode, where no scripts will be run when the trigger activates, use the commands:

```
                awplus# configure terminal
        awplus(config)# trigger 5
awplus(config-trigger)# test
```

To take trigger 205 out of diagnostic mode, restoring normal operation, use the commands:

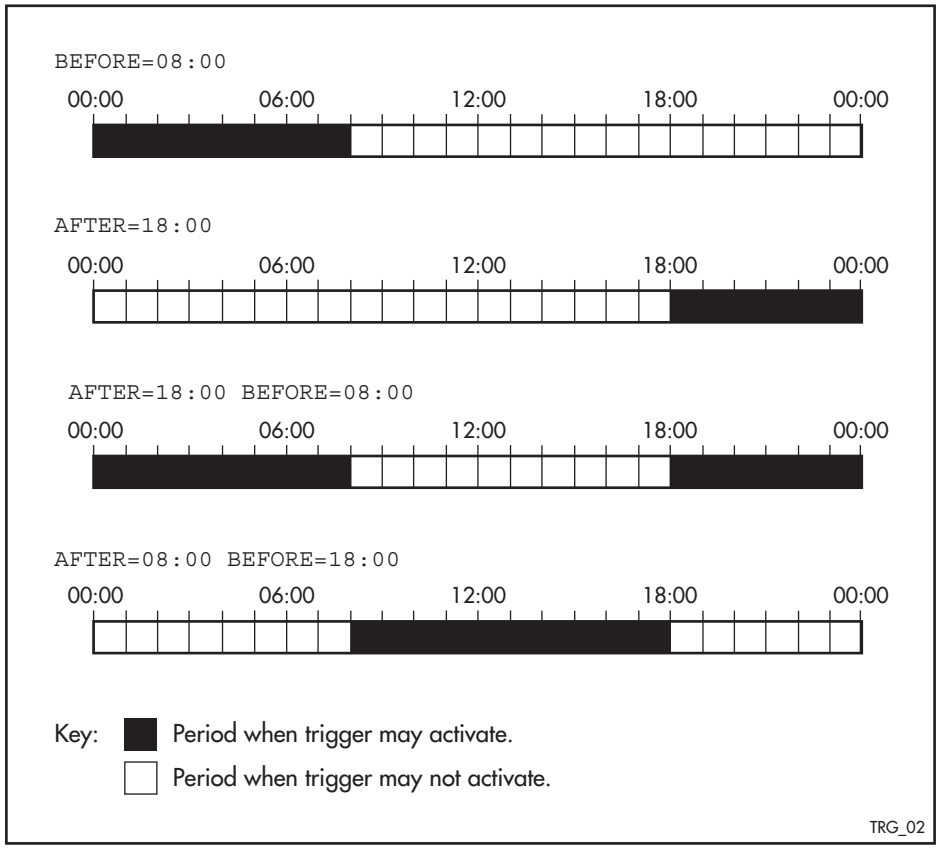
```
                awplus# configure terminal
        awplus(config)# trigger 205
awplus(config-trigger)# no test
```

Related Commands show trigger
trigger

time (trigger)

This command specifies the time of day when the trigger is permitted to activate. The after parameter specifies the start of a time period that extends to midnight during which trigger may activate. By default the value of this parameter is 00:00:00 (am); that is, the trigger may activate at any time. The before parameter specifies the end of a time period beginning at midnight during which the trigger may activate. By default the value of this parameter is 23:59:59; that is, the trigger may activate at any time. If the value specified for before is later than the value specified for after, a time period from "after" to "before" is defined, during which the trigger may activate. This command is not applicable to time triggers (type time).

The following figure illustrates how the before and after parameters operate.



Syntax `time {[after <hh:mm:ss>] [before <hh:mm:ss>]}`

Parameter	Description
`after` *<hh:mm:ss>*	The earliest time of day when the trigger may be activated.
`before` *<hh:mm:ss>*	The latest time of day when the trigger may be activated.

Mode Trigger Configuration

Usage For example trigger configurations that use the time (trigger) command, see "Restrict Internet Access" on page 96.2 and "Turn Off Power to Port LEDs" on page 96.7.

Examples To allow trigger `63` to activate between midnight and 10:30am, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 63
awplus(config-trigger)# time before 10:30:00
```

To allow trigger `64` to activate between 3:45pm and midnight, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 64
awplus(config-trigger)# time after 15:45:00
```

To allow trigger `65` to activate between 10:30am and 8:15pm, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 65
awplus(config-trigger)# time after 10:30:00 before 20:15:00
```

Related Commands show trigger
trigger

trap

This command enables the specified trigger to send SNMP traps.

Use the no variant of this command to disable the sending of SNMP traps from the specified trigger.

Syntax

```
trap
no trap
```

Default SNMP traps are enabled by default for all defined triggers.

Mode Trigger Configuration

Usage You must configure SNMP before using traps with triggers. See the following SNMP chapters:
Chapter 87, SNMP Introduction
Chapter 88, SNMP Commands
Chapter 89, SNMP MIBs

Since SNMP traps are enabled by default for all defined triggers, a common usage will be for the no variant of this command to disable SNMP traps from a specified trap if the trap is only periodic. Refer in particular to AT-TRIGGER-MIB for further information about the relevant SNMP MIB.

Examples To enable SNMP traps to be sent from trigger 5, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 5
awplus(config-trigger)# trap
```

To disable SNMP traps being sent from trigger 205, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 205
awplus(config-trigger)# no trap
```

Related Commands
trigger
show trigger

trigger

This command is used to access the Trigger Configuration mode for the specified trigger. Once Trigger Configuration mode has been entered the trigger type information can be configured and the trigger scripts and other operational parameters can be specified. At a minimum the trigger type information must be specified before the trigger can become active.

The no variant of this command removes a specified trigger and all configuration associated with it.

Syntax

```
trigger <1-250>
no trigger <1-250>
```

Parameter	Description
<*1-250*>	A trigger ID.

Mode Global Configuration

Examples To enter trigger configuration mode for trigger `12` use the command:

```
awplus# trigger 12
```

To completely remove all configuration associated with trigger `12`, use the command:

```
awplus# no trigger 12
```

Related Commands

show trigger
trigger activate

trigger activate

This command is used to manually activate a specified trigger from the Privileged Exec mode, which has been configured with the trigger command from the Global Configuration mode.

Syntax `trigger activate <1-250>`

Parameter	Description
<*1-250*>	A trigger ID.

Mode Privileged Exec

Usage This command manually activates a trigger without the normal trigger conditions being met.

The trigger is activated even if it is configured as inactive. The scripts associated with the trigger will be executed even if the trigger is in the diagnostic test mode.

Triggers activated manually do not have their repeat counts decremented or their 'last triggered' time updated, and do not result in updates to the '[type] triggers today' counters.

Example To manually activate trigger `12` use the command:

```
awplus# trigger activate 12
```

Related Commands show trigger
trigger

type card

Use this command to configure a trigger that activates on either the removal or the insertion of a Secure Digital (SD) or Secure Digital High Capacity (SDHC) card.

Syntax `type card {in|out}`

Parameter	Description
`in`	Trigger activates on insertion of a card.
`out`	Trigger activates on removal of a card.

Mode Trigger Configuration

Usage Card triggers cannot execute script files from a card.

In a VCStack configuration, card triggers are activated on the master for either the insertion or removal of a card on the master only.

For example trigger configurations that use the type card command, see "Capture Show Output and Save to a SD Card" on page 96.9 .

Examples To configure `trigger 1` to activate on the insertion of a card, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 1
awplus(config-trigger)# type card in
```

Related Commands
trigger
show running-config trigger
show trigger

type cpu

This command configures a trigger to activate based on CPU usage level. Selecting the up option causes the trigger to activate when the CPU usage exceeds the specified usage level. Selecting the down option causes the trigger to activate when CPU usage drops below the specified usage level. Selecting any causes the trigger to activate in both situations. The default is any.

Syntax `type cpu <1-100> [up|down|any]`

Parameter	Description
`<1-100>`	The percentage of CPU usage at which to trigger.
`up`	Activate when CPU usage exceeds the specified level.
`down`	Activate when CPU usage drops below the specified level
`any`	Activate when CPU usage passes the specified level in either direction

Mode Trigger Configuration

Usage For an example trigger configuration that uses the type cpu command, see "Capture Unusual CPU and RAM Activity" on page 96.4.

Examples To configure trigger `28` to be a CPU trigger that activates when CPU usage exceeds 80% use the following commands:

```
awplus# configure terminal
awplus(config)# trigger 28
awplus(config-trigger)# type cpu 80 up
```

To configure trigger `5` to be a CPU trigger that activates when CPU usage either rises above or drops below 65%, use the following commands:

```
awplus# configure terminal
awplus(config)# trigger 5
awplus(config-trigger)# type cpu 65
```

or

```
awplus# configure terminal
awplus(config)# trigger 5
awplus(config-trigger)# type cpu 65 any
```

Related Commands show trigger
trigger

type interface

This command configures a trigger to activate based on the link status of an interface. The trigger can be activated when the interface becomes operational by using the up option, or when the interface closes by using the down option. The trigger can also be configured to activate when either one of these events occurs by using the any option.

Syntax `type interface <interface> [up|down|any]`

Parameter	Description
`<interface>`	Interface name. This can be the name of a switch port, an eth-management port, or a VLAN.
`up`	Activate when interface becomes operational.
`down`	Activate when the interface closes.
`any`	Activate when any interface link status event occurs.

Mode Trigger Configuration

Example To configure trigger `19` to be an interface trigger that activates when `port1.0.2` becomes operational, use the following commands:

```
awplus# configure terminal
awplus(config)# trigger 19
awplus(config-trigger)# type interface port1.0.2 up
```

Related Commands
show trigger
trigger

type memory

This command configures a trigger to activate based on RAM usage level. Selecting the up option causes the trigger to activate when memory usage exceeds the specified level. Selecting the down option causes the trigger to activate when memory usage drops below the specified level. Selecting any causes the trigger to activate in both situations. The default is any.

Syntax

```
type memory <1-100> [up|down|any]
```

Parameter	Description
<1-100>	The percentage of memory usage at which to trigger.
up	Activate when memory usage exceeds the specified level.
down	Activate when memory usage drops below the specified level.
any	Activate when memory usage passes the specified level in either direction.

Mode

Trigger Configuration

Examples

To configure trigger `12` to be a memory trigger that activates when memory usage exceeds 50% use the following commands:

```
awplus# configure terminal
awplus(config)# trigger 12
awplus(config-trigger)# type memory 50 up
```

To configure trigger `40` to be a memory trigger that activates when memory usage either rises above or drops below 65%, use the following commands:

```
awplus# configure terminal
awplus(config)# trigger 40
awplus(config-trigger)# type memory 65
```

or

```
awplus# configure terminal
awplus(config)# trigger 40
awplus(config-trigger)# type memory 65 any
```

Related Commands

show trigger
trigger

type periodic

This command configures a trigger to be activated at regular intervals. The time period between activations is specified in minutes.

Syntax `type periodic <1-1440>`

Parameter	Description
<1-1440>	The number of minutes between activations.

Mode Trigger Configuration

Usage A combined limit of 10 triggers of the type periodic and time can be configured. If you attempt to add more than 10 triggers the following error message is displayed:

```
% Cannot configure more than 10 triggers with the type time or
periodic
```

For an example trigger configuration that uses the type periodic command, see "See Daily Statistics" on page 96.6.

Example To configure trigger `44` to activate periodically at `10` minute intervals use the following commands:

```
awplus# configure terminal
awplus(config)# trigger 44
awplus(config-trigger)# type periodic 10
```

Related Commands
show trigger
trigger

type ping-poll

This command configures a trigger that activates when Ping Polling identifies that a target device's status has changed. This allows you to run a configuration script when a device becomes reachable or unreachable.

Syntax `type ping-poll <1-100> {up|down}`

Parameter	Description
<1-100>	The ping poll ID.
`up`	The trigger activates when ping polling detects that the target is reachable.
`down`	The trigger activates when ping polling detects that the target is unreachable.

Mode Trigger Configuration

Example To configure trigger `106` to activate when ping poll `12` detects that its target device is now unreachable, use the following commands:

```
awplus# configure terminal
awplus(config)# trigger 106
awplus(config-trigger)# type ping-poll 12 down
```

Related Commands show trigger
trigger

type reboot

This command configures a trigger that activates when your device is rebooted.

Syntax `type reboot`

Mode Trigger Configuration

Example To configure trigger `32` to activate when your device reboots, use the following commands:

```
awplus# configure terminal
awplus(config)# trigger 32
awplus(config-trigger)# type reboot
```

Related Commands show trigger
trigger

type stack disabled-master

This command (configured to the stack) configures a trigger to activate on a stack member if it becomes the disabled master.

A disabled master has the same configuration as the active master, but has all its links shutdown.

Although this command could activate any trigger script, the intention here is that the script will reactivate the links from their previously shutdown state, to enable the user to manage the switch. An appropriate trigger script must already exist that will apply the no shutdown command on page 11.13 on the deactivated links.

Caution

It is important that any ports that are configured as trunked ports across master and stack members are disabled at their stack member termination when operating in the fallback configuration. Otherwise, the trunked ports will not function correctly on the switch that is connected downstream.

If the stack virtual-mac command on page 103.38 command is enabled, the stack uses a virtual MAC address. The stack will always use this MAC address and the new elected master will still retain the originally configured virtual MAC address. If the stack virtual-mac command is disabled, the stack will use the MAC address of the current master. If the stack master fails, the stack MAC address changes to reflect the new master's MAC address. See "Fixed or Virtual MAC Addressing" on page 102.13 for information on virtual MAC addresses.

Syntax

```
type stack disabled-master
```

Mode

Trigger Configuration

Examples

To configure trigger `82` to activate on a device if it becomes the disabled master, use the commands:

Command	Description
`awplus#` `configure terminal`	Enter the Global Configuration mode
`awplus(config)#` `trigger 82`	Enter the Trigger Configuration mode for trigger 82
`awplus(config-trigger)#` `type stack disabled master`	Sets the type of trigger
`awplus(config-trigger)#` `script 1 flash:/disabled.scp`	
`awplus(config-trigger)#` `exit`	

Related Commands

stack disabled-master-monitoring
trigger
type stack master-fail
type stack member
type stack link

type stack master-fail

This command (configured to the stack) initiates the action of a pre-configured trigger to occur when the stack enters the fail-over state.

Syntax `type stack master-fail`

Mode Trigger Configuration

Example To configure trigger `86` to activate when stack master fail-over event occurs, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 86
awplus(config-trigger)# type stack master-fail
```

Related Commands
stack disabled-master-monitoring
trigger
type stack disabled-master
type stack member
type stack link

type stack member

This command (configured to the stack) initiates the action of a pre-configured trigger to occur when a switch either joins or leaves the stack.

Syntax `type stack member {join|leave}`

Parameter	Description
`join`	Neighbor join event
`leave`	Neighbor leave event

Mode Trigger Configuration

Example To configure a pre-configured trigger number `86` to activate when a new switch joins the stack Note that the number `86` has no particular significance; you can assign any (previously created) numbered trigger

```
awplus# configure terminal
awplus(config)# trigger 86
awplus(config-trigger)# type stack member join
```

Related Commands
trigger
type stack master-fail
type stack link

type stack link

This command (configured to the stack) initiates the action of a pre-configured trigger to occur when a stacking link is either activated or deactivated.

Syntax

```
type stack link {up|down}
```

Parameter	Description
up	Stack link up event
down	Stack link down event

Mode Trigger Configuration

Example To configure trigger 86 to activate when the stack link down event occurs, use the commands:

```
awplus# configure terminal
awplus(config)# trigger 86
awplus(config-trigger)# type stack link down
```

Related Commands

show trigger
trigger
type stack master-fail

type time

This command configures a trigger that activates at a specified time of day.

Syntax `type time <hh:mm>`

Parameter	Description
<hh:mm>	The time to activate the trigger.

Mode Trigger Configuration

Usage A combined limit of 10 triggers of the type time and type periodic can be configured. If you attempt to add more than 10 triggers the following error message is displayed:

```
% Cannot configure more than 10 triggers with the type time or
periodic
```

Example To configure trigger `86` to activate at `15:53`, use the following commands:

```
awplus# configure terminal
awplus(config)# trigger 86
awplus(config-trigger)# type time 15:53
```

Related Commands show trigger
trigger

undebug trigger

This command applies the functionality of the no debug trigger command.

Chapter 98: Ping Polling Introduction and Configuration

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How Ping Polling Works 98.2
Configuring Ping Polling 98.4
- Creating a Polling Instance 98.4
- Customizing a Polling Instance 98.5
- Troubleshooting Ping Polling 98.6

Interaction with Other Protocols 98.7

Introduction

Ping polling lets your device regularly check whether it can reach other hosts on a network. It works by sending ICMP Echo Requests to a host and waiting for replies sent back. If ping polling indicates that a host's status has changed, then your device can respond to the new status. When a host is unreachable, ping polling continues monitoring the host's reachability.

You can configure triggers to activate when ping polling determines that the host's status has changed. For example, you could configure a trigger to run a script that opens and configures an alternative link if the host at the other end of a preferred link becomes unavailable. You could then configure a second trigger to run a script that automatically returns traffic to the preferred link as soon as it is available again.

How Ping Polling Works

To determine a host's reachability, your device regularly sends ICMP Echo Request packets ("pings") to the host. As long as your device receives ping responses from the host, it considers the host to be reachable. If your device does not receive a reply to a set number of ICMP Echo Requests, it considers that the host is unreachable. It continues to try to ping the device, at an increased rate. After it receives a set number of responses, it considers the device to be reachable again.

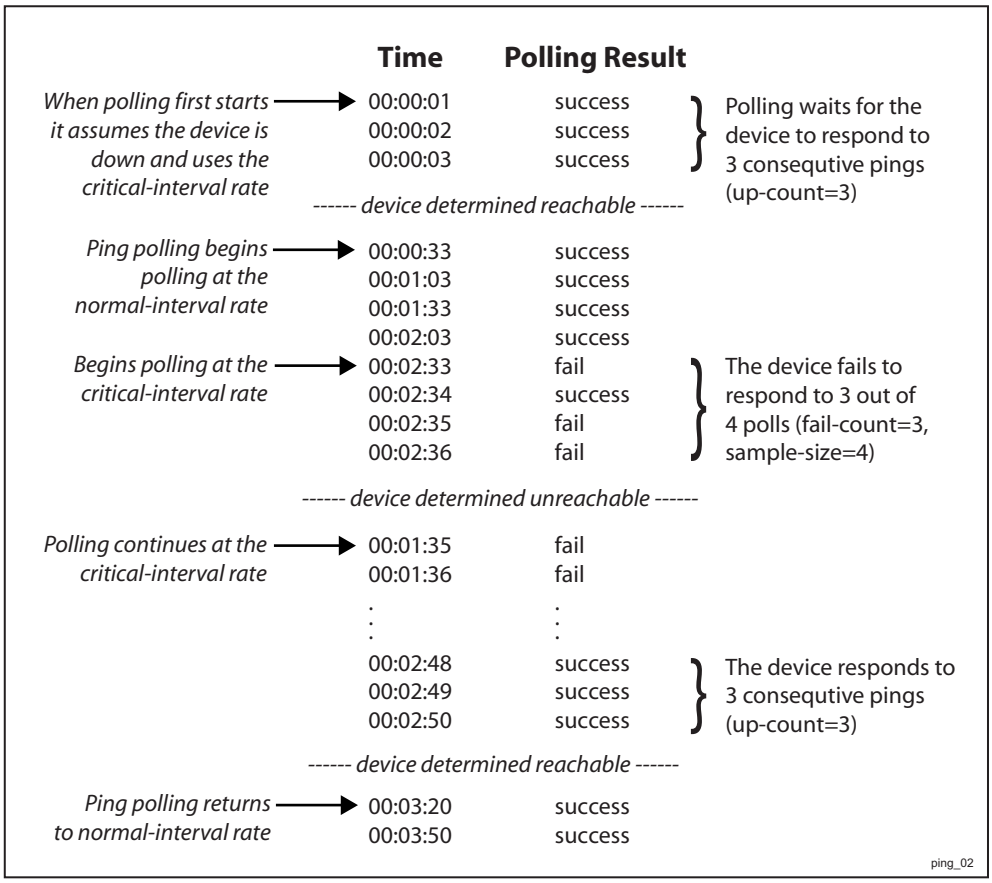
By default, a polling instance sends a ping every 30 seconds as long as it is receiving replies. The frequency of this polling is controlled by the normal-interval command. When a reply is not received, the polling instance increases the frequency at which it polls the device. This frequency is controlled by the critical-interval command, and by default, is set to send a packet every one second. It maintains this higher rate of polling until it has received sufficient consecutive replies.

The polling instance determines whether a device is reachable or unreachable based on the settings of the fail-count, sample-size, and up-count commands. To determine whether a device is reachable, the polling instance counts the number of failed pings within a set sample size. The sample size is set by the sample-size command, and by default is 5 ping responses. Within the sample size, the number of failed pings that means that the device is down is set by the fail-count command. By default this is set to 5. Once a polling instance has determined that a device is unreachable, it must receive a set number of consecutive replies before it changes the device's status back to reachable. This number is configured with the up-count command.

The following figure illustrates a polling instance where the device becomes unreachable, then reachable. It uses this configuration:

```
awplus(config-ping-poll)# fail-count 4
awplus(config-ping-poll)# sample-size 5
awplus(config-ping-poll)# up-count 3
awplus(config-ping-poll)# critical-interval 1
awplus(config-ping-poll)# normal-interval 30
```

Figure 98-1: Interaction between states and parameters for ping polling



On some operating systems, some servers may respond to a ping even if no other functionality is available, and therefore remain in an Up state while malfunctioning.

Responding to status changes

To configuring your device to determine and respond to changes in a device's reachability, you will need to:

- create a polling instance to periodically ping the device
- create scripts to run when the device becomes unreachable and when it becomes reachable again
- configure triggers to run these scripts

To set a trigger to activate when a device's status changes, its trigger type must be ping-poll. This is with the following command in the trigger's configuration mode:

```
awplus(config-trigger)# type ping-poll <1-100> {up|down}
```

where up activates the trigger when the device is reachable, and down activates the trigger when the device is unreachable.

If you use triggers to open a backup link to a remote device in the event of the primary link failing (rather than the remote device failing), the backup link and primary link must point to different IP addresses on the remote device. Otherwise, when the backup link points to the IP address that your device is polling, your device receives ping replies through the backup link, considers the device to be reachable again, and attempts to reopen the primary link instead of using the backup link. See Chapter 95, Triggers Introduction for more information about configuring Triggers with Ping Polling.

Configuring Ping Polling

This section contains:

- Creating a Polling Instance
  This explains how to quickly create a polling instance using the ping polling defaults.
- Customizing a Polling Instance
  This explains how to customize a ping poll and explains the other ping poll commands.
- Troubleshooting Ping Polling
  This explains how to use the debugging and monitoring commands for ping polling.

Creating a Polling Instance

The Ping Polling feature in the AlliedWare Plus™ OS allows you to easily configure polling instances with a minimum of commands. To configure a ping poll suitable for most network situations:

1. Create a polling instance by using the command:

```
awplus(config)# ping-poll <1-100>
```

   The range <1-100> identifies the polling instance in the trigger commands and in other ping poll commands. Your device can poll up to 100 IP addresses at once.

2. Set the IP address of the device you are polling by using the command:

```
awplus(config-ping-poll)# ip {<ip-address>|<ipv6-address>}
```

3. Enable the polling instance by using the command:

```
awplus(config-ping-poll)# active
```

4. If desired, set an optional description to identify the polling instance, by using the command:

```
awplus(config-ping-poll)# description <description>
```

You do not need to configure any other commands for most networks, because convenient defaults exist for all other ping poll settings. The following table summarizes the default configuration created.

Command	Default
Critical-interval	1 second
Fail-count	5
Length	32 bytes
Normal-interval	30 seconds
Sample-size	5

Command(cont.)	Default(cont.)
Source-ip	The IP address of the interface from which the ping packets are transmitted
Time-out	1 second
Up-count	30

Customizing a Polling Instance

Once you've created a polling instance using the ping-poll and ip (ping-polling) command, you may wish to customize the polling instance for your network.

Packet size

If you find that larger packet types in your network are not reaching the polled device while smaller ones such as ping do, you can increase the data bytes included in the ping packets sent by the polling instance. This encourages the polling instance to change the device's status to unreachable when packet of the size you are interested in are being dropped. To change the number of bytes sent in the data portion of the ping packets, use the command:

```
awplus(config-ping-poll)# length <4-1500>
```

Response timeout

The polling instance determines that a device hasn't responded to a ping if one second elapses without a response to the ping. In networks where ping packets have a low priority, you may need to set the allowed response time to a longer time period. To change this, use the command:

```
awplus(config-ping-poll)# timeout <1-30>
```

Polling frequency

By default, a polling instance polls a reachable device every 30 seconds. You can change this by using the command:

```
awplus(config-ping-poll)# normal-interval <1-65536>
```

Once the polling instance has determined that a ping has failed, it starts polling the device at the frequency set as the critical interval—by default, one second. To change the frequency set by the critical interval, use the command:

```
awplus(config-ping-poll)# critical-interval <1-65536>
```

The critical interval enables the polling instance to quickly observe changes in the state of the device, and should be set to a much lower value than the normal interval.

Configuring when the device's status changes

The number of pings that the polling instance examines to consider a change in state is controlled by the interaction of the sample-size, fail-count, and up-count commands. See "How Ping Polling Works" on page 98.2 for an example showing this interaction.

To determine whether a device is reachable, the polling instance counts the number of failed pings within a sample of a set size. The sample size is 5 pings by default. To change the sample size, use the command:

```
awplus(config-ping-poll)# sample-size <1-100>
```

To change the number of failed pings that the sample must have, use the command:

```
awplus(config-ping-poll)# fail-count <1-100>
```

If the sample size and fail count are the same, the unanswered pings must be consecutive. If the sample size is greater than the fail count, a device that does not always reply to pings may be declared unreachable.

The upcount is the number of consecutive pings that must be answered for the polling instance to consider the device reachable again. To change this from the default of 30, use the command:

```
awplus(config-ping-poll)# up-count <1-100>
```

Checking the configuration

To check the settings and status of the polling instance, use the command:

```
awplus(config-ping-poll)# show ping-poll [<1-100>|state {up|
                          down}] [brief]
```

Troubleshooting Ping Polling

To disable a polling instance, use the command:

```
awplus(config-ping-poll)# no active
```

The polling instance no longer sends ICMP echo requests to the polled device and the counters for this polling instance are reset.

To clear the counters and change the status of a device to unreachable, enter the Privileged Exec mode and use the command:

```
awplus# clear ping-poll {<1-100>|all}
```

The polling instance changes to the polling frequency specified with the critical-interval command. The device status changes to reachable once the device responses have reached the up-count.

To start debugging for ping polling, use the command:

```
awplus# debug ping-poll <1-100>
```

Interaction with Other Protocols

Ping polling does not work if the polled host, your device, or any intermediate routers or switches are configured to drop ICMP Echo Requests and Replies.

Ping and Traceroute

Ping and Traceroute are not affected by ping polling. You can enter ping and trace commands at any time and independent of the polling.

Chapter 99: Ping-Polling Commands

Command List 99.2
active (ping-polling) 99.3
clear ping-poll 99.4
critical-interval 99.5
debug ping-poll 99.6
description (ping-polling) 99.7
fail-count 99.8
ip (ping-polling) 99.9
length (ping-poll data) 99.10
normal-interval 99.11
ping-poll 99.12
sample-size 99.13
show counter ping-poll 99.14
show ping-poll 99.16
source-ip 99.20
timeout (ping polling) 99.21
up-count 99.22
undebug ping-poll 99.22

Command List

This chapter provides an alphabetical reference for commands used to configure Ping Polling. For more information, see Chapter 98, Ping Polling Introduction and Configuration.

For information about modifying or redirecting the output from show commands to a file, see "Controlling "show" Command Output" on page 1.41.

Table 99-1: The following table lists the default values when configuring a ping poll.

Default	Value
Critical-interval	1 second
Description	No description
Fail-count	5
Length	32 bytes
Normal-interval	30 seconds
Sample-size	5
Source-ip	The IP address of the interface from which the ping packets are transmitted
Time-out	1 second
Up-count	30

active (ping-polling)

This command enables a ping-poll instance. The polling instance sends ICMP echo requests to the device with the IP address specified by the ip (ping-polling) command.

By default, polling instances are disabled. When a polling instance is enabled, it assumes that the device it is polling is unreachable.

The no variant of this command disables a ping-poll instance. The polling instance no longer sends ICMP echo requests to the polled device. This also resets all counters for this polling instance.

Syntax

```
active
no active
```

Mode Ping-Polling Configuration

Examples To activate the ping-poll instance 43, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 43
awplus(config-ping-poll)# active
```

To disable the ping-poll instance 43 and reset its counters, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 43
awplus(config-ping-poll)# no active
```

Related Commands

debug ping-poll
ip (ping-polling)
ping-poll
show ping-poll

clear ping-poll

This command resets the specified ping poll, or all ping poll instances. This clears the ping counters, and changes the status of polled devices to unreachable. The polling instance changes to the polling frequency specified with the critical-interval command. The device status changes to reachable once the device responses have reached the up-count.

Syntax

```
clear ping-poll {<1-100>|all}
```

Parameter	Description
<1-100>	A ping poll ID number. The specified ping poll instance has its counters cleared, and the status of the device it polls is changed to unreachable.
`all`	Clears the counters and changes the device status of all polling instances.

Mode

Privileged Exec

Examples

To reset the ping poll instance 12, use the command:

```
awplus# clear ping-poll 12
```

To reset all ping poll instances, use the command:

```
awplus# clear ping-poll all
```

Related Commands

active (ping-polling)
ping-poll
show ping-poll

critical-interval

This command specifies the time period in seconds between pings when the polling instance has not received a reply to at least one ping, and when the device is unreachable.

This command enables the device to quickly observe changes in state, and should be set to a much lower value than the normal-interval command.

The no variant of this command sets the critical interval to the default of one second.

Syntax

```
critical-interval <1-65536>
no critical-interval
```

Parameter	Description
<1-65536>	Time in seconds between pings, when the device has failed to a ping, or the device is unreachable.

Default The default is 1 second.

Mode Ping-Polling Configuration

Examples To set the critical interval to 2 seconds for the ping-polling instance 99, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 99
awplus(config-ping-poll)# critical-interval 2
```

To reset the critical interval to the default of one second for the ping-polling instance 99, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 99
awplus(config-ping-poll)# no critical-interval
```

Related Commands

fail-count
normal-interval
sample-size
show ping-poll
timeout (ping polling)
up-count

debug ping-poll

This command enables ping poll debugging for the specified ping-poll instance. This generates detailed messages about ping execution.

The no variant of this command disables ping-poll debugging for the specified ping-poll.

Syntax

```
debug ping-poll <1-100>
no debug ping-poll {<1-100>|all}
```

Parameter	Description
<1-100>	A unique ping poll ID number.
`all`	Turn off all ping-poll debugging.

Mode Privileged Exec

Examples To enable debugging for ping-poll instance 88, use the command:

```
awplus# debug ping-poll 88
```

To disable all ping poll debugging, use the command:

```
awplus# no debug ping-poll all
```

To disable debugging for ping-poll instance 88, use the command:

```
awplus# no debug ping-poll 88
```

Related Commands

active (ping-polling)
clear ping-poll
ping-poll
show ping-poll
undebug ping-poll

description (ping-polling)

This command specifies a string to describe the ping-polling instance. This allows the ping-polling instance to be recognized easily in show commands. Setting this command is optional.

By default ping-poll instances do not have a description.

Use the no variant of this command to delete the description set.

Syntax

```
description <description>
no description
```

Parameter	Description
<description>	The description of the target. Valid characters are any printable character and spaces. There is no maximum character length.

Mode Ping-Polling Configuration

Examples To add the text “Primary Gateway” to describe the ping-poll instance 45, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 45
awplus(config-ping-poll)# description Primary Gateway
```

To delete the description set for the ping-poll instance 45, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 45
awplus(config-ping-poll)# no description
```

Related Commands

ping-poll
show ping-poll

fail-count

This command specifies the number of pings that must be unanswered, within the total number of pings specified by the sample-size command, for the ping-polling instance to consider the device unreachable.

If the number set by the sample-size command and the fail-count commands are the same, then the unanswered pings must be consecutive. If the number set by the sample-size command is greater than the number set by the fail-count command, then a device that does not always reply to pings may be declared unreachable.

The no variant of this command resets the fail count to the default.

Syntax

```
fail-count <1-100>
no fail-count
```

Parameter	Description
<1-100>	The number of pings within the sample size that a reachable device must fail to respond to before it is classified as unreachable.

Default The default is 5.

Mode Ping-Polling Configuration

Examples To specify the number of pings that must fail within the sample size to determine that a device is unreachable for ping-polling instance 45, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 45
awplus(config-ping-poll)# fail-count 5
```

To reset the fail-count to its default of 5 for ping-polling instance 45, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 45
awplus(config-ping-poll)# no fail-count
```

Related Commands

critical-interval
normal-interval
ping-poll
sample-size
show ping-poll
timeout (ping polling)
up-count

ip (ping-polling)

This command specifies the IPv4 address of the device you are polling.

Syntax `ip {<ip-address>|<ipv6-address>}`

Parameter	Description
<ip-address>	An IPv4 address in dotted decimal notation `A.B.C.D`
<ipv6-address>	An IPv6 address in hexadecimal notation `X:X::X:X`

Mode Ping-Polling Configuration

Examples To set ping-poll instance 5 to poll the device with the IP address `192.168.0.1`, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 5
awplus(config-ping-poll)# ip 192.168.0.1
```

To set ping-poll instance 10 to poll the device with the IPv6 address `2001:db8::`, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 10
awplus(config-ping-poll)# ip 2001:db8::
```

Related Commands
ping-poll
source-ip
show ping-poll

length (ping-poll data)

This command specifies the number of data bytes to include in the data portion of the ping packet. This allows you to set the ping packets to a larger size if you find that larger packet types in your network are not reaching the polled device, while smaller packets are getting through. This encourages the polling instance to change the device's status to unreachable when the network is dropping packets of the size you are interested in.

The no variant of this command resets the data bytes to the default of 32 bytes.

Syntax

```
length <4-1500>
no length
```

Parameter	Description
<4-1500>	The number of data bytes to include in the data portion of the ping packet.

Default The default is 32.

Mode Ping-Polling Configuration

Examples To specify that ping-poll instance 12 sends ping packet with a data portion of 56 bytes, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 12
awplus(config-ping-poll)# length 56
```

To reset the number of data bytes in the ping packet to the default of 32 bytes for ping-poll instance 3, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 3
awplus(config-ping-poll)# ping-poll 3
```

Related Commands

ping-poll
show ping-poll

normal-interval

This command specifies the time period between pings when the device is reachable.

The no variant of this command resets the time period to the default of 30 seconds.

Syntax

```
normal-interval <1-65536>
no normal-interval
```

Parameter	Description
<1-65536>	Time in seconds between pings when the target is reachable.

Default The default is 30 seconds.

Mode Ping-Polling Configuration

Examples To specify a time period of 60 seconds between pings when the device is reachable for ping-poll instance 45, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 45
awplus(config-ping-poll)# normal-interval 60
```

To reset the interval to the default of 30 seconds for ping-poll instance 45, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 45
awplus(config-ping-poll)# no normal-interval
```

Related Commands

critical-interval
fail-count
ping-poll
sample-size
show ping-poll
timeout (ping polling)
up-count

ping-poll

This command enters the ping-poll configuration mode. If a ping-poll exists with the specified number, then this command enters its configuration mode. If no-ping poll exists with the specified number, then this command creates a new ping poll with this ID number.

To configure a ping-poll, create a ping poll using this command, and use the ip (ping-polling) command to specify the device you want the polling instance to poll. It is not necessary to specify any further commands unless you want to change a command's default.

The no variant of this command deletes the specified ping poll.

Syntax

```
ping-poll <1-100>
no ping-poll <1-100>
```

Parameter	Description
<1-100>	A unique ping poll ID number.

Mode Global Configuration

Examples To create ping-poll instance 3 and enter ping-poll configuration mode, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 3
awplus(config-ping-poll)#
```

To delete ping-poll instance 3, use the commands:

```
awplus# configure terminal
awplus(config)# no ping-poll 3
```

Related Commands

active (ping-polling)
clear ping-poll
debug ping-poll
description (ping-polling)
ip (ping-polling)
length (ping-poll data)
show ping-poll
source-ip

sample-size

This command sets the total number of pings that the polling instance inspects when determining whether a device is unreachable. If the number of pings specified by the fail-count command go unanswered within the inspected sample, then the device is declared unreachable.

If the numbers set in this command and fail-count command are the same, the unanswered pings must be consecutive. If the number set by this command is greater than that set with the fail-count command, a device that does not always reply to pings may be declared unreachable.

You cannot set this command's value lower than the fail-count value.

The polling instance uses the number of pings specified by the up-count command to determine when a device is reachable.

The no variant of this command resets this command to the default.

Syntax

```
sample-size <1-100>
no sample size
```

Parameter	Description
<1-100>	Number of pings that determines critical and up counts.

Default The default is 5.

Mode Ping-Polling Configuration

Examples To set the sample-size to 50 for ping-poll instance 43, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 43
awplus(config-ping-poll)# sample-size 50
```

To reset sample-size to the default of 5 for ping-poll instance 43, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 43
awplus(config-ping-poll)# no sample-size
```

Related Commands

critical-interval
fail-count
normal-interval
ping-poll
show ping-poll
timeout (ping polling)
up-count

show counter ping-poll

This command displays the counters for ping polling.

Syntax `show counter ping-poll [<1-100>]`

Parameter	Description
<1-100>	A unique ping poll ID number. This displays the counters for the specified ping poll only. If you do not specify a ping poll, then this command displays counters for all ping polls.

Mode User Exec and Privileged Exec

Output Figure 99-1: Example output from the **show counter ping-poll** command

```
Ping-polling counters
Ping-poll: 1
PingsSent               ......... 15
PingsFailedUpState      ......... 0
PingsFailedDownState    ......... 0
ErrorSendingPing        ......... 2
CurrentUpCount          ......... 13
CurrentFailCount        ......... 0
UpStateEntered          ......... 0
DownStateEntered        ......... 0

Ping-poll: 2
PingsSent               ......... 15
PingsFailedUpState      ......... 0
PingsFailedDownState    ......... 0
ErrorSendingPing        ......... 2
CurrentUpCount          ......... 13
CurrentFailCount        ......... 0
UpStateEntered          ......... 0
DownStateEntered        ......... 0

Ping-poll: 5
PingsSent               ......... 13
PingsFailedUpState      ......... 0
PingsFailedDownState    ......... 2
ErrorSendingPing        ......... 2
CurrentUpCount          ......... 9
CurrentFailCount        ......... 0
UpStateEntered          ......... 0
DownStateEntered        ......... 0
```

Table 99-2: Parameters in output of the **show counter ping-poll** command

Parameter	Description
`Ping-poll`	The ID number of the polling instance.
`PingsSent`	The total number of pings generated by the polling instance.
`PingsFailedUpState`	The number of unanswered pings while the target device is in the Up state. This is a cumulative counter for multiple occurrences of the Up state.
`PingsFailedDownState`	Number of unanswered pings while the target device is in the Down state. This is a cumulative counter for multiple occurrences of the Down state.

Table 99-2: Parameters in output of the **show counter ping-poll** command(cont.)

Parameter	Description
ErrorSendingPing	The number of pings that were not successfully sent to the target device. This error can occur when your device does not have a route to the destination.
CurrentUpCount	The current number of sequential ping replies.
CurrentFailCount	The number of ping requests that have not received a ping reply in the current sample-size window.
UpStateEntered	Number of times the target device has entered the Up state.
DownStateEntered	Number of times the target device has entered the Down state.

Example To display counters for the polling instances, use the command:

```
awplus# show counter ping-poll
```

Related Commands
debug ping-poll
ping-poll
show ping-poll

show ping-poll

This command displays the settings and status of ping polls.

Syntax `show ping-poll [<1-100>|state {up|down}] [brief]`

Parameter	Description	
<1-100>	Displays settings and status for the specified polling instance.	
`state`	Displays polling instances based on whether the device they are polling is currently reachable or unreachable.	
	`up`	Displays polling instance where the device state is reachable.
	`down`	Displays polling instances where the device state is unreachable.
`brief`	Displays a summary of the state of ping polls, and the devices they are polling.	

Mode User Exec and Privileged Exec

Output Figure 99-2: Example output from the **show ping-poll brief** command

```
Ping Poll Configuration
-------------------------------------------------------------
Id Enabled State Destination
-------------------------------------------------------------
1  Yes     Down  192.168.0.1
2  Yes     Up    192.168.0.100
```

Table 99-3: Parameters in output of the show ping-poll brief command

Parameter	Meaning	
Id	The ID number of the polling instance, set when creating the polling instance with the ping-poll command.	
Enabled	Whether the polling instance is enabled or disabled.	
`State`	The current status of the device being polled:	
	`Up`	The device is reachable.
	`Down`	The device is unreachable.
	`Critical Up`	The device is reachable but recently the polling instance has not received some ping replies, so the polled device may be going down.
	`Critical Down`	The device is unreachable but the polling instance received a reply to the last ping packet, so the polled device may be coming back up.

Table 99-3: Parameters in output of the show ping-poll brief command(cont.)

Parameter	Meaning
Destination	The IP address of the polled device, set with the ip (ping-polling) command.

Figure 99-3: Example output from the show ping-poll command

```
Ping Poll Configuration
-------------------------------------------------------

Poll 1:
Description                          : Primary Gateway
Destination IP address               : 192.168.0.1
Status                               : Down
Enabled                              : Yes
Source IP address                    : 192.168.0.10
Critical interval                    : 1
Normal interval                      : 30
Fail count                           : 10
Up count                             : 5
Sample size                          : 50
Length                               : 32
Timeout                              : 1
Debugging                            : Enabled


Poll 2:
Description                          : Secondary Gateway
Destination IP address               : 192.168.0.100
Status                               : Up
Enabled                              : Yes
Source IP address                    : Default
Critical interval                    : 5
Normal interval                      : 60
Fail count                           : 20
Up count                             : 30
Sample size                          : 100
Length                               : 56
Timeout                              : 2
Debugging                            : Enabled
```

Table 99-4: Parameters in output of the show ping-poll command

Parameter	Description
Description	Optional description set for the polling instance with the description (ping-polling) command.
Destination IP address	The IP address of the polled device, set with the ip (ping-polling) command.

Table 99-4: Parameters in output of the show ping-poll command(cont.)

Parameter	Description	
Status	The current status of the device being polled:	
	Up	The device is reachable.
	Down	The device is unreachable.
	Critical Up	The device is reachable but recently the polling instance has not received some ping replies, so the polled device may be going down.
	Critical Down	The device is unreachable but the polling instance received a reply to the last ping packet, so the polled device may be coming back up.
Enabled	Whether the polling instance is enabled or disabled. The active (ping-polling) and no active commands enable and disable a polling instance.	
Source IP address	The source IP address sent in the ping packets. This is set using the source-ip command.	
Critical interval	The time period in seconds between pings when the polling instance has not received a reply to at least one ping, and when the device is unreachable. This is set with the critical-interval command.	
Normal interval	The time period between pings when the device is reachable. This is set with the normal-interval command.	
Fail count	The number of pings that must be unanswered, within the total number of pings specified by the sample-size command, for the polling instance to consider the device unreachable. This is set using the fail-count command.	
Up count	The number of consecutive pings that the polling instance must receive a reply to before classifying the device reachable again. This is set using the up-count command.	
Sample size	The total number of pings that the polling instance inspects when determining whether a device is unreachable. This is set using the sample-size command.	
Length	The number of data bytes to include in the data portion of the ping packet. This is set using the length (ping-poll data) command.	
Timeout	The time in seconds that the polling instance waits for a response to a ping packet. This is set using the timeout (ping polling) command.	
Debugging	Indicates whether ping polling debugging is Enabled or Disabled. This is set using the debug ping-poll command.	

Examples To display the ping poll settings and the status of all the polls, use the command:

```
awplus# show ping-poll
```

To display a summary of the ping poll settings, use the command:

```
awplus# show ping-poll brief
```

To display the settings for ping poll 6, use the command:

```
awplus# show ping-poll 6
```

To display a summary of the state of ping poll 6, use the command:

```
awplus# show ping-poll 6 brief
```

To display the settings of ping polls that have reachable devices, use the command:

```
awplus# show ping-poll state up
```

To display a summary of ping polls that have unreachable devices, use the command:

```
awplus# show ping-poll 6 state down brief
```

Related Commands debug ping-poll
ping-poll

source-ip

This command specifies the source IP address to use in ping packets.

By default, the polling instance uses the address of the interface through which it transmits the ping packets. It uses the device's local interface IP address when it is set. Otherwise, the IP address of the interface through which it transmits the ping packets is used.

The no variant of this command resets the source IP in the packets to the device's local interface IP address.

Syntax

```
source-ip {<ip-address>|<ip-address>}

no source-ip
```

Parameter	Description
<ip-address>	An IPv4 address in dotted decimal notation `A.B.C.D`
<ipv6-address>	An IPv6 address in hexadecimal notation `X:X::X:X`

Mode Ping-Polling Configuration

Examples To configure the ping-polling instance 43 to use the source IP address `192.168.0.1` in ping packets, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 43
awplus(config-ping-poll)# source-ip 192.168.0.1
```

To configure the ping-polling instance 43 to use the source IPv6 address `2001:db8::` in ping packets, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 43
awplus(config-ping-poll)# source-ip 2001:db8::
```

To reset the source IP address to the device's local interface IP address for ping-poll instance 43, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 43
awplus(config-ping-poll)# no source-ip
```

Related Commands

description (ping-polling)
ip (ping-polling)
length (ping-poll data)
ping-poll
show ping-poll

timeout (ping polling)

This command specifies the time in seconds that the polling instance waits for a response to a ping packet. You may find a higher time-out useful in networks where ping packets have a low priority.

The no variant of this command resets the set time out to the default of one second.

Syntax

```
timeout <1-30>
no timeout
```

Parameter	Description
<*1-30*>	Length of time, in seconds, that the polling instance waits for a response from the polled device.

Default The default is 1 second.

Mode Ping-Polling Configuration

Examples To specify the timeout as 5 seconds for ping-poll instance 43, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 43
awplus(config-ping-poll)# timeout 5
```

To reset the timeout to its default of 1 second for ping-poll instance 43, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 43
awplus(config-ping-poll)# no timeout
```

Related Commands

critical-interval
fail-count
normal-interval
ping-poll
sample-size
show ping-poll
up-count

up-count

This command sets the number of consecutive pings that the polling instance must receive a reply to before classifying the device reachable again.

The no variant of this command resets the up count to the default of 30.

Syntax

```
up-count <1-100>
no up-count
```

Parameter	Description
<1-100>	Number of replied pings before an unreachable device is classified as reachable.

Default The default is 30.

Mode Ping-Polling Configuration

Examples To set the upcount to 5 consecutive pings for ping-polling instance 45, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 45
awplus(config-ping-poll)# up-count 5
```

To reset the upcount to the default value of 30 consecutive pings for ping-polling instance 45, use the commands:

```
awplus# configure terminal
awplus(config)# ping-poll 45
awplus(config-ping-poll)# no up-count
```

Related Commands

critical-interval
fail-count
normal-interval
ping-poll
sample-size
show ping-poll
timeout (ping polling)

undebug ping-poll

This command applies the functionality of the no debug ping-poll command on page 99.6.

Chapter 100: sFlow Introduction and Configuration

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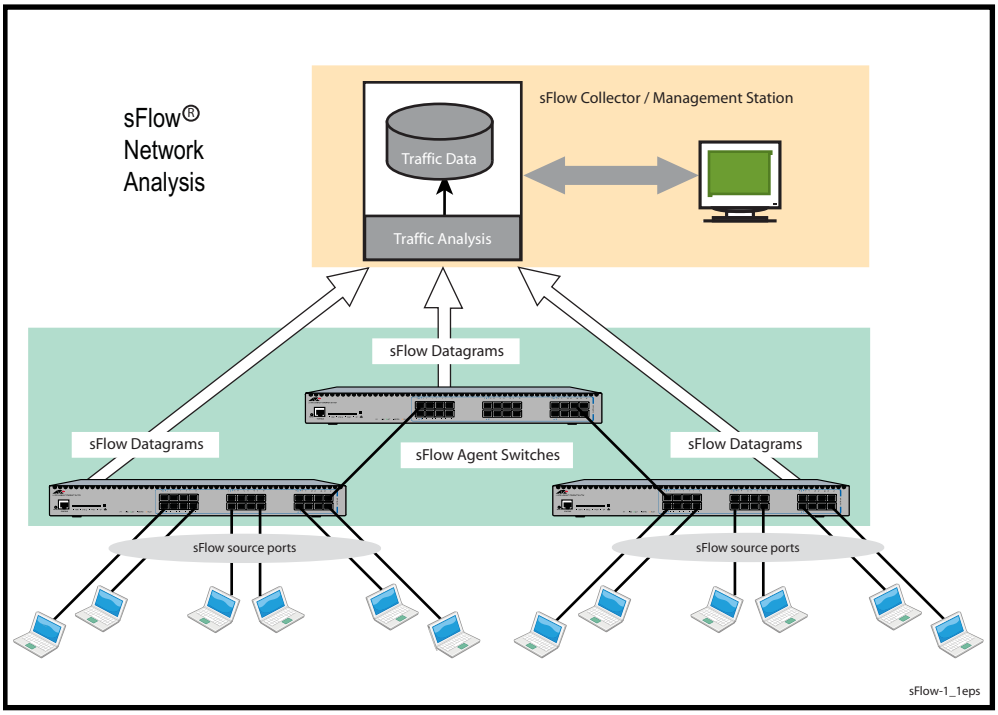
sFlow Introduction

sFlow®[1] provides the ability to monitor traffic in data networks containing switches and routers. A network employing sFlow typically comprises a number of network (sFlow) agents that accumulate sampled data and traffic counter information. The agents then forward this data to a collector. The collector then analyses the information supplied by its agents in order to compile and display statistical profiles of the network and its traffic. The sFlow feature on your switch provides the sFlow Agent capability.

1. sFlow® is a registered trademark belonging to InMon Corp, San Francisco, CA.

Figure 100-1 on page 100.2 shows a basic sFlow network structure. The three network switches also function as sFlow agents. Each agent switch captures samples of the traffic passing through its monitored ports, and sends these samples together with counter information back to the sFlow collector. The agents sample data from a number of switch ports, each acting as an sFlow data source.

Figure 100-1: Basic sFlow Network



The sFlow Agent

Your switch can act as an sFlow agent. The key capabilities of the agent are to:

- sample frames as they pass through selected ports on the switch, and provide sampled extracts of the network traffic.
- periodically capture interface counter data.
- package together the sampled frame and counter information that can be sent to the collector for analysis and display.
- be configurable via SNMP MIB objects.
- communicate to heterogeneous collector devices by means of standard protocols.

Agent components and functionality

sFlow functionality on your switch is based on the requirements defined in of RFC 3176 and its updates defined in the sFlow version 5 memo dated July 2004. This memo can be found at the web site, www.sflow.org/sflow_version_5.txt.

The terms defined in Table 100-1 are used to describe the agent and its functionality on your switch:

Table 100-1: sFlow Terminology

sFlow® Component	Definition
Network Device	Typically either a network switch or router that has the ability to forward frames across an Ethernet network; or between Ethernet networks, in the case of a router.
Data Source (sFlow Source Port)	The location of a sampling point within the switch. This is typically a switch port.
Packet Flow	The path taken by the data (frames) as they traverse a network device.
Sampling Rate	The ratio of frames passing through the data source, to those captured and forwarded as sFlow data. See sflow sampling-rate command on page 101.12.
Counter Sampling	The periodic polling of counters taken at the data source.
sFlow Datagram	A UDP datagram that contains details of sFlow captured data, and counters sent by the sFlow Agent to its Collector.

The sFlow agent (switch) uses sampling technology to derive traffic statistics from its monitored ports. Samples are taken at the sFlow source ports. After collecting its information, the switch then packetizes its samples and statistical data, and sends both to a remote sFlow collector.

Sampling Methods

Two sampling methods are employed within the sFlow agent, frame sampling, and counter sampling. Both sample types are combined within the datagrams sent to the collector. The frame sample data will result in a relatively constant traffic stream, but the counter information is sent where it can fill available space within each datagram. Datagrams are normally sent to the collector at the rate of one each second. However, several datagrams can be sent in rapid succession, where more information exists than can be sent in a single datagram.

Frame Sampling

As frames enter or leave an sFlow source port, they are sampled at a rate determined by the sflow sampling-rate command on page 101.12for that particular port.

Sampling occurs every N frames (on average), where N is the rate value set via sflow sampling-rate command. The sampling rate applies to ingress and egress frames independently. For example, a value of 1000, will sample one frame in every 1000 frames received, one in every 1000 frames sent from the specified port.

Caution

Setting the sFlow sampling rate to a very low value (frequent sampling) can place a heavy load on the switch's CPU. The severity of this loading will increase with the number of ports configured for sampling, the port speeds, and their data sampling rates.

Data Confidentiality

Sampling operates by capturing the initial portion of frames (statistically) selected. The portion sampled is set by the sflow max-header-size command on page 101.9, or SNMP. If the maximum header size is greater than the actual headers in the sampled frames, then portions of the user data (payload) will also be captured and encapsulated in the datagrams sent to the collector. The amount of user data captured can be minimized by careful selection of the maximum header size.

Counter Polling

The function of counter polling is to provide snapshots of various system counters. This produces a series of data counter sets for each port, which can be independently polled at user defined rates, and sent (once a second or less) to the collector. Allied Telesis switches running AlliedWare Plus software support generic interface counters only. For more information on the data types included in the sampling count, see "sFlow Datagrams" on page 100.13.

The sFlow Collector

The sFlow collector receives traffic samples and counter information from a number of sFlow agents. These samples are received as a series of UDP datagrams. From the data contained within these datagrams, the collector is able to provide statistical and or graphical information of network traffic.

The sFlow agent application on your switch supports only a single collector configuration.

sFlow collectors are proprietary third party products. Your switch, running as an sFlow agent has been designed for interoperability with any sFlow collector that supports the sFlow Version 5 specification, including the inMon sFlow collector.

The sFlow Collector may also contain an SNMP Manager that is able to configure sFlow on its agent switches.

Configuring sFlow on your Switch

This section provides some guidelines for setting up the sFlow® agent on your switch. sFlow can be configured directly on your switch - using the CLI, or it can be configured via an SNMP manager. The SNMP management function can be carried out either by a the sFlow collector, or a separate SNMP manager. The configuration examples in this section are shown using the CLI.

Caution

On an x908 with a XEM-2XP module fitted, sFlow sampling does not operate for this XEM when the XEM-2XP is installed in the lowest numbered x908 bay. Ensure that any XEM-2XP modules are not fitted in the lowest bay in an x908.

If a XEM module that is installed in a lower numbered x908 bay is hot swapped then a XEM-2XP module installed in a higher numbered x908 bay may become the XEM in the lowest numbered bay, resulting in sFlow sampling not operating. Ensure that any XEM-2XP modules will not become the XEM in the lowest numbered bay in an x908 by fitting the XEM-2XP in the highest numbered bay.

Caution

The sFlow configurations set either by the switch's CLI, or the sFlow collector. Sometimes the collector will overide the sFlow settings that were initially configured by the CLI, in order to apply "its" own default settings.

If you want to apply the sFlow settings set by the CLI, or by an external network management system, then turn off network management at the collector.

We also advise that as part of your sFlow commissioning process, you review your security access procedures relating to sFlow access and its data traffic management.

sFlow configuration can vary greatly with your overall configuration, data profile, and monitoring intensity. Also, many interdependencies existing between parameter settings. For this reason, few firm configuration settings are recommended in this software reference, but instead these parameter relationships are explained and some typical configuration examples are shown.

The default settings on your switch have sFlow turned off for all ports.
The following commands are used to setup and configure sFlow on your switch. These are introduced in the order in which you would logically need to use them.

sFlow Command	Functionality
sflow enable	enables sFlow on your switch (or stack).
sflow max-header-size	sets the maximum sFlow data capture size.
sflow collector max-datagram-size	sets the maximum size for the agent to collector datagrams.
sflow agent (address)	sets the sFlow agent IP address on the switch.
sflow polling-interval	sets the counter polling interval for specified ports.
sflow sampling-rate	sets the mean sampling rate for specified ports.
sflow collector (address)	the sFlow agent's collector IP address and/or UDP port.

Configuration Procedure

The following process sets out a systematic procedure to configure sFlow on your switch:

Information Gathering

sFlow configuration is dependant on your network structure and its data. Start by gathering together the following information.

- Obtain (or determine) the sFlow collector IP address.
- Select an appropriate UDP port for your sFlow datagrams. The recommended value is 6343, and is the default value preconfigured on your switch.
- Select an appropriate IP address for your sFlow agent. We recommend that you use the local IP address of your switch. For more information on local addresses and how to set them up, see the interface (to configure) command on page 11.3.
- Assess the sensitivity of the data that your sFlow agent will be sampling.
- Obtain details of the protocols that your sFlow agent will be sampling. If you intend sampling unusual or proprietary protocols, obtain details of their header lengths.
- Calculate the most appropriate max-header-size for your sFlow sampling.
- Select the ports that you want to sample, and their sample rate.
  These two factors vary (not quite) proportionally; so if you double the number of ports and double your sampling rate (i.e. sample half as many frames) then you will “almost” return to your earlier situation. Also note the speeds of the ports you have selected, because - for the same port utilization - the faster the port speed, the greater the load on the CPU.
- Review the speed of the port used to transport the sFlow datagrams to the collector. Unless configured to a specific port, the collector traffic will share the same network port with other traffic.

  The capacity of the collector port should be sufficient to carry the volume of sFlow traffic. This topic is expanded on in the Configuration Examples later in this chapter.

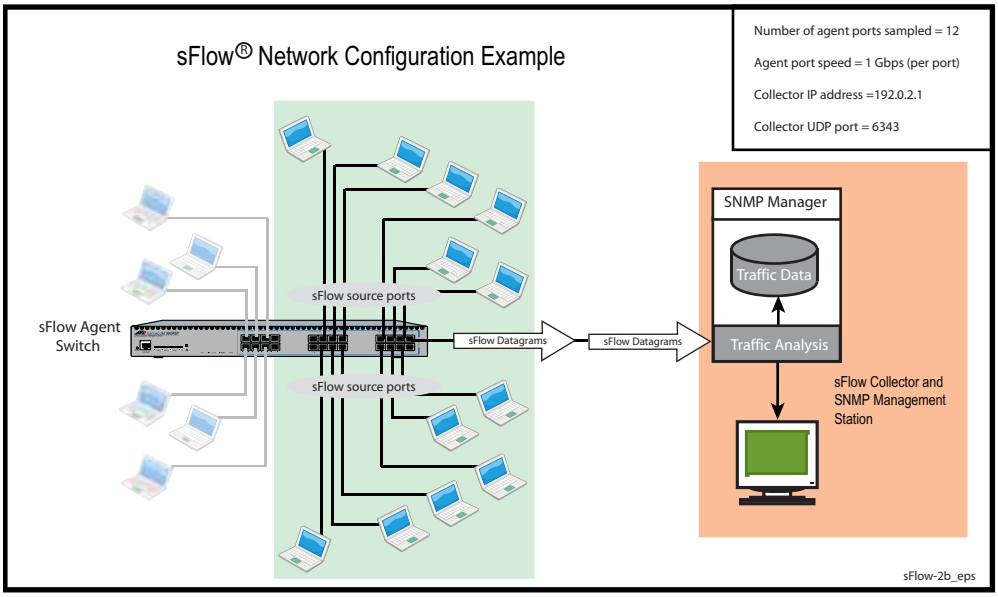
Managing the sFlow processing overhead

The sFlow data sampled on the ports converges into the CPU for processing and UDP packetizing. Therefore one of the major factors when configuring sFlow is to prevent the sFlow data volumes from placing a significant overhead on the CPU processing. The two most significant factors here are, the number of ports sampled, and the sampling rate. The other (and lessor) factors in this equation are the frame size distribution and the maximum header size. The shorter the frames are on the network, the heavier the sFlow processing load will be (for the same number of frames per second). Conversely the shorter the maximum header size selected, the lighter the sFlow processing load will be (because less data per frame is sent to the CPU).

Configuration Examples

This section provides a configuration example based on the network shown below:

Figure 100-2: sFlow Configuration Example



Step 1: Determine the IP addresses and UDP ports.

Collector IP address is 192.0.2.65

sFlow UDP port uses the default of 6343

Agent (local) IP address 192.0.2.33. This is the address that the collector may use to configure the agent via SNMP.

Step 2: Determine the maximum sFlow Datagram size.

Datagrams will be sent at one second intervals regardless of the amount of data they contain. If the amount of data to be sent is greater than the maximum datagram size, then several datagrams will be sent in quick succession - within the 1 second interval. The objective is to contain the sFlow information in a the minimum number of datagrams. That is. to fragment datagrams when necessary, but do it as little as possible.

Find the maximum datagram size that will pass through all network components without fragmenting. Then set the sFlow datagram size a little less than this value.

The maximum datagram size should be less than the MTU size.

For this example, the MTU is assumed to be set to its default of 1500 bytes. In this situation we could leave the maximum Datagram size at its default of 1400 bytes; but in order to show this as a configuration step, we will change it to 1200 bytes.

Note

sFlow datagrams are generally transmitted at 1 second intervals. However, where there is more information than can fit into one datagram, several datagrams are sent sequentially, within the 1 second time frame.

Step 3: Determine the max-header-size for the sampled data.

The maximum header size for the sampled data is set by the sflow max-header-size command. The optimum setting is to capture only the header portion of the frame and discard the user-data portion. This is especially important where the user data contains sensitive information.

Keeping the max-header-size as small as possible has the additional benefit of lightening the CPU load.

First, inspect the nature of the data to be sampled and the protocols used to carry it.

For this example we will assume that the network contains Ethernet II frames with the 4 byte 802.1Q header component, IP, TCP protocols. In this situation the following rules can be applied:

For an environment using standard TCP\IPv4 over Ethernet frames, consider the following protocol basics.

Ethernet header (including the 4 byte 802.1Q header component) = 18 bytes

IPv4 header = 24 bytes

TCP header = 24 bytes

Total = 66 bytes

A similar calculation can be made for an environment using IPv6 over Ethernet.

Ethernet header (including the 4 byte 802.1Q component) = 18 bytes

IPv6 header = 40 bytes

TCP header = 24 bytes

Total = 82 bytes

Caution In the above network scenarios:

- For IPv4 - any data existing between 66 bytes and the value set by this command will be included in the sFlow packet samples. For example, with the default of 128 applied, up to 128-66=62 bytes of user data could be included in the sFlow datagram samples sent between the Agent and the Collector.
- For IPv6 - any data existing between 82 bytes and the value set by this command will be included in the sFlow packet samples. For example, with the default of 128 applied, up to 128-82=46 bytes of user data could be included in the sFlow datagram samples sent between the Agent and the Collector.

For this example the sflow max-header-size will be set to 68 bytes (assuming an Ethernet - IPv4 - TCP environment).

Step 4: Select ports to sample

Each sampled sFlow port speed is 1 Gbps

12 ports have been selected for sampling

Check that none of the ports selected have mirroring configured. sFlow will not operate if any port on the switch is configured for mirroring.

Note When sampling is across ports that form an aggregated link, statistics will be extracted on traffic across all links, but their display is shown as if all traffic is flowing through the first physical link created.

Step 5: Determine the sampling rate

Selecting the sampling rate involves a trade-off between sFlow requirements, and system loading. The greater the sampling rate, the more samples will be taken, and the more accurate their results will be. Unfortunately, taking more samples increases the load on the switch CPU and on the network connection to the collector.

For this particular configuration, the value of the sampling rate was set to 512 so as to present a light load on the CPU.

Step 6: Review and adjust settings

Because sFlow traffic loading will vary with the traffic profile, the following general assumptions are made. The following traffic profile is assumed.

- 50 % of frames are <200 bytes long
- 40 % of frames are >1400 bytes long

The following settings are:

- 12 x 1 Gbps ports are being sampled
- sFlow max-header size = 68 bytes
- sampling rate (N = 512)
- average port utilization is assumed to be approximately 60 %
- average data rate to the collector is assumed to be approximately 1.5 Mbps

When setting the sampling rate, consider the following factors that will affect the CPU load. This load will increase (not necessarily linearly) as you:

- increase the number of ports configured
- increase the port speeds
- decrease the sampling rate
- increase the max-header-size

For this configuration the average sFlow collector traffic is expected to be approximately 1.5 Mbps. In this example the agent-to-collector traffic will be shared with non-sFlow traffic. Although not described in this example, you can specifically configure the collector port to route only sFlow traffic. To do this you would need to assign a separate VLAN (and IP address) to the agent-to collector interface and direct your sFlow traffic to this interface.

We advise that you ensure adequate bandwidth is provided for both the sFlow and general traffic that could share its network connection.

We will now use these settings to configure the network.

Configuration Procedure

The following steps apply the settings obtained in the previous section.

Step 1: Configure sFlow

Enable sFlow on the switch

`awplus#`	
`configure terminal`	Enter Global Configuration Mode.
`awplus(config)#`	
`sflow enable`	Enable the sFlow agent globally on the switch.

Step 2: Configure the sFlow Collector Settings

Set the sFlow collector max-datagram size

`awplus(config)#`	
`sflow collector max-datagram-size 1200`	Set the maximum size of the sFlow datagrams to 1200 bytes.

Set the sFlow collector (address)

`awplus(config)#`	
`sflow collector ip 192.0.2.65`	Set the sFlow collector address to 192.0.2.65.

Step 3: Configure the sFlow Agent Settings

Set the sFlow agent (address)

`awplus(config)#`	
`sflow agent ip 192.0.2.33`	Set the sFlow agent address to 192.0.2.33.

Set the sFlow sampling rate on sFlow Source Ports

`awplus(config)#`	
`interface port1.0.11-port1.0.22`	Select the port range to configure (ports 1.0.11 to 1.0.22).
`awplus(config-if)#`	
`sflow sampling-rate 512`	Set the sampling rate on the selected ports.

Step 4: Check the Configuration

View the sFlow Configuration	
awplus(config-if)#	
do sh running-config sflow	Validate that sFlow is enabled Note that the prefix “do” enables you to run an Exec Mode command from an Interface Mode prompt.

Figure 100-3: Output from the **show running-config sFlow** command

```
awplus#sh run sflow
!
sflow agent ip 192.0.2.33
sflow collector ip 192.0.2.65
sflow collector max-datagram-size 1200
sflow enable
!
interface port1.0.11-port1.0.22
 sflow sampling-rate 512
```

sFlow Datagrams

After data sampling and counter information has been gathered, each sFlow agent packetizes the data and sends it to an sFlow collector where it can be analyzed and displayed in charts and tables etc.

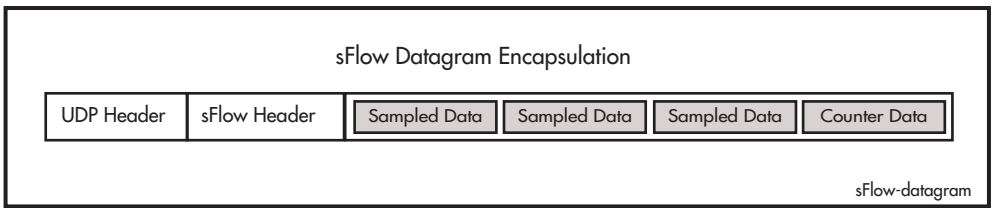
This packetized data is sent to the collector in UDP datagrams. These datagrams bear the IP address of the collector and the port number 6343. Using a standardized port helps to avoid configuration problems between the sFlow agents and collectors.

Although an analysis of the sFlow datagrams is outside the scope of this document, some basic information is provided here for those interested in knowing the basic components of the sFlow datagrams. The full specification of the sFlow protocol can be found at www.sflow.org/sflow_version_5.txt.

sFlow datagrams comprise three basic components:

- Datagram header information
- Flow sample information - may contain several samples
- Counter statistical information - fitted in where space permits

Figure 100-4: sFlow Datagram Encapsulation



The content of these datagram components is listed below:

sFlow Header Fields

- Version (The sFlow version being used)
- IP Address Type (Can be either an IPv4 or IPv6 address type)
- Source IP Address (The IP address of the sFlow agent)
- Sequence Number (The datagram sequence number)
- System Up-time
- Sample Count (The number of samples in the datagram)
- Sample Dataset

sFlow Flow Sample Fields

- Flow Sample 1 (The first sample)
- Sample Type (Flow Sample, 0x0001)
- Sample Sequence Number (of flow samples)
- Sampler ID
- Sampling Rate (as set by the "sflow sampling-rate" on page 101.12 or SNMP)
- Sample Pool (the total number of packets that could have been sampled)
- Packets Dropped (the number of packets dropped, due to a lack of resources)
- Input (the interface that the packet was received on - not supported)
- Output (the index number of the interface that the packet was sent from) (Note that your collector should have the ability via SNMP to resolve index numbers to physical port numbers)
- Packet Type
- Header Protocol - Ethernet ISO 88023(1)
- Packet Size (Frame Length including the FCS)
- Header Length - The sampled portion of the frame as set by the "sflow max-header-size" on page 101.9. May be shorter for small frames.
- Header Bytes

- Extended Elements Number
- Extended Elements

Note that in practice the Ethernet header is usually followed by components for the IP, TCP, and user data.

sFlow Flow Sample Fields

- Counter Sample
- Sample Type (Counter Sample, 0x0002)
- 'Sample Sequence Number
- Sample ID (source ID index value)
- Sample Interval (as set by the "sflow polling-interval" on page 101.11)
- Counter Type (1=generic, 2=Ethernet)

Generic Interface Counters

- ifIndex
- ifType
- ifSpeed
- ifDirection (0=unknown, 1=full-duplex, 2=half-duplex, 3=in, 4=out
- ifStatus
- InOctets
- InUcastpackets
- InMulticast packets
- InBroadcast packets
- InDiscarded packets (= 0)
- InPackets containing errors
- InPackets containing unknown protocols (= 0)
- OutOctets
- OutUcast packets
- OutMulticast packets
- OutBroadcast packets
- OutDiscarded packets
- OutPackets containing errors
- ifPromiscuous Mode

Ethernet Interface Counters

- dot3Stats Alignment Errors (= 0)
- dot3Stats FCS Errors
- dot3Stats Single Collision Frames (= 0)
- dot3Stats Multiple Collision Frames
- dot3Stats SQE Test Errors
- dot3Stats Deferred Transmissions (= 0)
- dot3Stats Late Collisions
- dot3Stats Excessive Collisions
- dot3Stats Internal Mac Transmit Errors
- dot3Stats Carrier Sense Errors (= 0)
- dot3Stats Frame Too Longs
- dot3Stats Internal Mac Receive Errors
- dot3Stats Symbol Errors (= 0)

The sFlow MIB

Your switch fully supports inMon's sFlow MIB. For more information, see "Private MIBs" on page 89.70, and the website www.sflow.org/SFLOW-MIB5.txt.

Chapter 101: sFlow Commands

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Command List

This chapter provides an alphabetical reference for sFlow commands.

debug sflow

This command enables sFlow® debug message logging, for sFlow sampling and polling activity on the specified ports. If no ports are specified, sampling and/or polling debug messages are enabled for all ports.

The no variant of this command disables sFlow sampling and or polling debug message logging on the ports selected. If no ports are specified, sampling and/or polling debug messages are disabled on all ports.

Syntax

```
debug sflow [interface <port-list>] [sampling][polling]
no debug sflow [interface <port-list>] [sampling][polling]
```

Parameter	Description
`interface`	Interface information.
`<port-list>`	The ports for which sFlow debug is to be enabled. The ports to display information about. The port list can be: ■ a switch port (e.g. `port1.2.12`) ■ a continuous range of ports separated by a hyphen, e.g. `port1.0.1-1.0.24` ■ a comma-separated list of ports and port ranges, e.g. `port1.0.1,port1.1.1-1.2.24`.
`sampling`	Debug sFlow sampling for the specified port(s).
`polling`	Debug sFlow polling for the specified port(s).

Default The sFlow sampling and or polling debug is disabled.

Mode Privileged Exec

Examples To enable sFlow debug message logging for polling and sampling on `port1.0.1` and `port1.0.7`, use the commands:

```
awplus# debug sflow interface port1.0.1,port1.0.7 sampling
       polling
```

To enable logging and polling of sFlow debug messages for polling and sampling on all ports, use the command:

```
awplus# debug sflow sampling polling
```

Related Commands show debugging sflow
no debug all

debug sflow agent

This command enables sFlow® debug message logging that is not specific to particular ports. For example, sending an sFlow datagram to the collector.

The no variant of this command applies the command default.

Syntax

```
debug sflow agent
no debug sflow agent
```

Default The sFlow agent debug message logging (that is not port specific) is disabled.

Mode Privileged Exec

Example To enable logging of sFlow agent debug messages, use the following command:

```
awplus# debug sflow agent
```

Related Commands show debugging sflow
debug sflow

sflow agent (address)

This command sets the sFlow® agent IP address on the switch. This address is inserted into every sFlow datagram sent from the sFlow agent switch to the sFlow collector device. The sFlow collector can then uses this address to uniquely identify and to access the switch, such as for SNMP. We therefore recommend that you change this address as little as possible.

Although the agent address can be set to any valid IPv4 or IPv6 address; we recommended that you set the sFlow® agent IP address to be the local address[1] that is configured on the switch. This ensures that the sFlow collector can maintain connectivity to the switch irrespective of the addition or deletion of VLAN interfaces (each of which will have its own specific IP address). Note that sFlow is rendered inactive whenever the agent address is not set.

1. For information on local addresses and how to set them up, see the interface (to configure) command on page 11.3.

The no variant of this command applies its default setting to remove a configured address.

Syntax

```
sflow agent {ip <ip-address>|ipv6 <ipv6-address>}
no sflow agent {ip|ipv6}
```

Parameter	Description
<ip-address>	The IPv4 address of the switch that is acting as the sFlow agent.
<ipv6-address>	The IPv6 address of the switch that is acting as the sFlow agent. The IPv6 address uses the format X:X::X:X.

Default The sFlow agent address is unset.

Mode Global Configuration

Examples To set the sFlow agent (IPv4) address to `192.0.2.23`, use the command:

```
awplus# configure terminal
awplus(config)# sflow agent ip 192.0.2.23
```

To remove the sFlow agent (IPv4) address, use the command:

```
awplus# configure terminal
awplus(config)# no sflow agent ip
```

To set the sFlow agent (IPv6) address to `2001:0db8::1`, use the command:

```
awplus# configure terminal
awplus(config)# sflow agent ipv6 2001:0db8::1
```

To remove the sFlow agent (IPv6) address, use the command:

```
awplus# configure terminal
awplus(config)# no sflow agent ipv6
```

Related Commands show running-config sflow
show sflow

sflow collector (address)

This command sets the sFlow® agent's collector IP address and/or UDP port. This is the destination IP address and UDP port, for sFlow datagrams sent from the sFlow agent. The IP address can be any valid IPv4 or IPv6 address. Note that sFlow is rendered inactive whenever the collector address is set to 0.0.0.0 (for IPv4) or `::` (for IPv6).

The no variant of this command returns the IP address and UDP port values to their defaults, which will result in sFlow being deactivated.

Syntax

```
sflow collector {[ip <ip-address>|ipv6 <ipv6-address>]|
   [port <1-65535>]}

no sflow collector {[ip|ipv6]|[port]}
```

Parameter	Description
<ip-address>	IPv4 address of the remote sFlow collector.
<ipv6-address>	IPv6 address of remote sFlow collector. The IPv6 address uses the format X:X::X:X.
`port`	Destination UDP port for sFlow datagrams sent to the collector.
<1-65535>	UDP port number (default: 6343).

Default The collector address is `0.0.0.0` (which renders sFlow inactive), and the UDP port is `6343`.

Mode Global Configuration

Examples To set the sFlow collector address to `1920.2.25` and UDP port to `9000`, use the command:

```
awplus# configure terminal
awplus(config)# sflow collector ip 192.0.2.25 port 9000
```

To remove the sFlow collector IPv4 address and leave the UDP port unchanged, use the command:

```
awplus# configure terminal
awplus(config)# no sflow collector ip
```

To remove the sFlow collector IPv4 address and to remove the UDP port, use the command:

```
awplus# configure terminal
awplus(config)# no sflow collector ip port
```

To set the sFlow collector address to `2001:0db8::1` and leave the UDP port unchanged, use the command:

```
awplus# configure terminal
awplus(config)# sflow collector ipv6 2001:0db8::1
```

To remove the sFlow collector IPv6 address and leave the UDP port unchanged, use the command:

```
awplus# configure terminal
awplus(config)# no sflow collector ipv6
```

To remove the sFlow collector IPv6 address and to remove the UDP port, use the command:

```
awplus# configure terminal
awplus(config)# no sflow collector ipv6 port
```

Related Commands show running-config sflow
show sflow

sflow collector max-datagram-size

This command sets the maximum size of the sFlow® datagrams sent to the collector.

The no variant of this command resets the maximum-datagram-size to the default.

Syntax

```
sflow collector max-datagram-size <200-1500>
no sflow collector max-datagram-size
```

Parameter	Description
<200-1500>	The maximum number of bytes that can be sent in an sFlow datagram sent from the agent to the collector.

Default 1400 bytes

Mode Global Configuration

Example To set the maximum datagram size to 1200, use the command:

```
awplus# configure terminal
awplus(config)# sflow collector max-datagram-size 1200
```

Related Commands show running-config sflow
show sflow

sflow enable

This command enables sFlow® globally on the switch. Note that sFlow cannot be enabled if Tx port mirroring is enabled on any port on the device.

The no variant of this command disables sFlow globally on the switch.

Note that enabling sFlow does not automatically set its operational status to active. To activate sFlow the following conditions need to be met:

- sFlow is enabled.
- The sFlow agent address is set.
- The sFlow collector address is set to a valid (non zero) IPv4 or IPv6 address.
- Polling or sampling is enabled on the ports to be sampled or polled.

Syntax

```
sflow enable
no sflow enable
```

Default sFlow is disabled globally on the switch.

Mode Global Configuration

Example To enable sFlow operation, use the command:

```
awplus# configure terminal
awplus(config)# sflow enable
```

Related Commands

show running-config sflow
show sflow

sflow max-header-size

This command sets the maximum header size of the ethernet frames sampled on a specified port. The maximum header size is measured in bytes, referenced from the first byte of the ethernet destination address and excludes the ethernet FCS fields.

If a sampled ethernet frame is longer than the maximum header size set by this command, then the frame will be truncated to the first N bytes before being placed in the sFlow datagram, where N is the maximum header size set by this command.

The no variant of this command resets the max-header-size to its default.

Syntax

```
sflow max-header-size <14-200>

no sflow max-header-size
```

Parameter	Description
<14-200>	The maximum number of header bytes to be sampled.

Default The max-header-size is 128 bytes.

Mode Interface Configuration

Usage The header size is measured from the first byte of the Ethernet frame MAC Destination Address.

For an environment using standard TCP IPv4 over Ethernet frames, consider the following basic protocol structure:

Ethernet header (including the 4 byte 802.1Q header component) = 18 bytes

IPv4 header = 24 bytes

TCP header = 24 bytes

Total = 66 bytes

See “Determine the max-header-size for the sampled data.” on page 100.9 for more information on configuring this command

A similar consideration can be made for an environment using TCP IPv6 over Ethernet:

Ethernet header (including the 4 byte 802.1Q header component) = 18 bytes

IPv6 header = 40 bytes

TCP header = 24 bytes

Total = 82 bytes

Caution

In the above network scenarios:

- For IPv4 - any data existing between 66 bytes and the value set by this command will be included in the sFlow packet samples. For example, with the default of 128 applied, up to 128-66=62 bytes of user data could be included in the sFlow datagram samples sent between the Agent and the Collector.
- For IPv6 - any data existing between 82 bytes and the value set by this command will be included in the sFlow packet samples. For example, with the default of 128 applied, up to 128-82=46 bytes of user data could be included in the sFlow datagram samples sent between the Agent and the Collector.

Note that the agent-to-collector datagrams contain their own UDP headers, which are outside this calculation.

Example To set the maximum header size to 160 bytes for ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# sflow max-header-size 160
```

Related Commands

show running-config sflow
show sflow interface
sflow max-header-size

sflow polling-interval

This command sets the sFlow® counter polling interval (in seconds) for the specified ports. A value of 0 disables polling. A counter sample is taken every N seconds where N is the value set by this command.

The no variant of this command applies the default.

Syntax

```
sflow polling-interval {0|<1-16777215>}
no sflow polling-interval
```

Parameter	Description
0	Disable polling (the default).
<1-16777215>	The polling interval in seconds.

Default The polling-interval is 0 (polling disabled).

Mode Interface Configuration

Example To set the polling interval to 60 seconds for ports 1.0.1 and 1.0.7, use the following commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# sflow polling-interval 60
```

Related Commands

show running-config sflow
show sflow interface

sflow sampling-rate

This command sets the mean sFlow® sampling rate for the specified ports. Sampling occurs every N frames (on average), where N is the rate value set via this command. The sampling rate applies to ingress and egress frames independently. For example, a value of 1000 will sample one frame in every 1000 frames received. One in every 1000 frames sent from the specified port. A value of 0 disables sampling on the specified ports.

The no variant of this command applies the default.

Syntax

```
sflow sampling-rate {0|<50-2147483647>}
no sflow sampling-rate
```

Parameter	Description
0	Sets the default.
<50-2147483647>	The sampling rate N, measured in ethernet frames.

Default The sampling-rate is 0 (sampling disabled).

Mode Interface Configuration

Example To set the sampling rate to 500 for ports 1.0.1 and 1.0.7, use the commands:

```
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.7
awplus(config-if)# sflow sampling-rate 500
```

Related Commands

show running-config sflow
show sflow interface

show debugging sflow

This command displays sFlow® debug settings for agent operation, and for sampling and polling on specific interface ports. If no interface ports are specified, sampling and polling will be applied to all ports.

Syntax

```
show debugging sflow [interface <port-list>]
```

Parameter	Description
`interface`	The interface information.
`<port-list>`	The ports for which the sFlow debug settings are to be shown. The ports to display information about. The port list can be: ■ a switch port (e.g. `port1.2.12`) ■ a continuous range of ports separated by a hyphen, e.g. `port1.0.1-1.0.24` ■ a comma-separated list of ports and port ranges, e.g. `port1.0.1,port1.1.1-1.2.24`.

Mode User Exec and Privileged Exec

Example To display sFlow debug settings on the agent, and for sampling and polling on ports 1.0.1 to 1.0.9, use the command:

```
awplus# show debugging sflow interface port1.0.1-1.0.9
```

Output

Figure 101-1: Sample obtained for an sFlow agent

```
awplus# show debugging sflow interface port1.0.1-1.0.9

sFlow Agent Debug:    Enabled

          Sampling      Polling
Port       Debug         Debug
-------------------------------
1.0.1     Enabled       Enabled
1.0.2     Enabled          -
1.0.3        -             -
1.0.4        -             -
1.0.5        -             -
1.0.6        -          Enabled
1.0.7        -             -
1.0.8        -          Enabled
1.0.9        -          Enabled
```

To display sFlow debug settings for all ports, use the command:

```
awplus# show debugging sflow
```

Related Commands

show running-config sflow
show sflow interface

show running-config sflow

This command displays the running system information specific to the sFlow feature.

Syntax `show running-config sflow`

Mode Privileged Exec and Global Configuration

Example To display the sFlow running configuration information, use the command:

```
awplus# show running-config sflow
```

Output Figure 101-2: Example output from the **show running-config sflow** command

```
awplus#sh run sflow
!
sflow agent ip 192.0.2.33
sflow collector ip 192.0.2.65
sflow collector max-datagram-size 1200
sflow enable
!
interface port1.0.11-port1.0.22
 sflow sampling-rate 512
```

Related Commands show running-config

show sflow

This command displays non-port-specific sFlow agent configuration and operational status.

Syntax `show sflow`

Mode Privileged Exec

Example To display sFlow configuration and operational status, use the command:

```
awplus#  show sflow
```

Output

Figure 101-3: Example output from the **show sflow** command

```
sFlow Agent Configuration:                    Default Values
  sFlow Admin Status ........ Disabled        [Disabled]
  sFlow Agent Address ....... [not set]       [not set]
  Collector Address ......... 0.0.0.0         [0.0.0.0]
  Collector UDP Port ........ 6343            [6343]
  Tx Max Datagram Size ...... 1200            [1400]

sFlow Agent Status:
  Polling/sampling/Tx ....... Inactive because:
                                - sFlow is disabled
                                - Agent Addr is not set
                                - Collector Addr is 0.0.0.0
                                - Polling & sampling disabled
                                  on all ports
```

Table 101-1: Parameters in the output of the **show sflow** command

Output Parameter	Description
`sFlow Admin Status`	Whether sFlow agent operation is administratively enabled.
`sFlow Agent Address`	The sFlow agent IPv4 or IPv6 address for the device. sFlow is rendered inactive whenever the agent address is not set.
`Collector Address`	The IPv4 or IPv6 collector address to which sFlow datagrams are sent. sFlow is rendered inactive whenever the collector address is set to 0.0.0.0 or 0:0::0.0.
`Collector UDP Port`	The UDP port on the collector to which sFlow datagrams are sent.
`Tx Max Datagram Size`	The maximum size of the sFlow datagrams sent to the collector.
`Polling/sampling/Tx`	Whether sFlow sampling and/or polling (and hence sFlow datagram transmission) are active. If inactive the reasons are listed.

Related Commands show running-config sflow
show sflow interface

show sflow interface

This command displays sFlow agent sampling and polling configuration for specified ports.

Syntax `show sflow interface <ifrange>`

Parameter	Description
<ifrange>	The interface range.

Mode Privileged Exec

undebug sflow

This command applies the functionality of the no debug sflow command.

Part 8: Virtual Chassis Stacking

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- Chapter 103 Stacking Commands

Chapter 102: Stacking Introduction

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VCStack Introduction

This chapter describes Virtual Chassis Stacking (VCStack), its features, and basic connection examples. For detailed descriptions of the commands used to configure VCStack, see Chapter 103, Stacking Commands.

A Virtual Chassis Stack (VCStack) is a group of physically separate switches that are connected so as to function as a single logical switch. In order to function as a VCStack, its component switches are connected using high-speed stacking links.

Features of Virtual Chassis Stacking

Creating a VCStack greatly eases network management, because you can configure all the stacked devices via a single IP address. Creating a VCStack will often eliminate your need to configure protocols such as VRRP and Spanning Tree. VCStack also enables you to create highly resilient networks. This resiliency can be applied in several ways.

Within the stack itself, switch interconnection is via two links. The second link is able to provide an alternative data path, thus the stack will continue to function if a single switch fails. Degraded performance might occur however, due to the reduced VCStack bandwidth.

User ports can also be made extremely resilient by utilizing link aggregation. Aggregated links can span ports, modules, and even switches within the stack. Creating aggregated links that span multiple switches within a stack creates an extremely resilient configuration. Communication will still exist even if a switch and its aggregated ports fail. Refer to Figure 102-4 on page 102.6.

VCStack Supported Platforms

VCStack is supported on the following switch types:

- x900-24XT, x900-24XS, x900-24XT-N
- x900-12XT/s
- SwitchBlade® x908

VCStack supports a maximum of two devices per stack on the x900 and SwitchBlade x908 series switches. Switches must be of the same product type to exist within the same stack. The principles of product / stack compatibility are shown in the following table.

Table 102-1: Stacking compatibility by product type

Product Types	x900-24XS, x900-24XT, x900-24XT-N	Via XEM-STK ports.
Product Type	x900-12XT/s	Via XEM-STK ports.
Product Type	SwitchBlade® x908	Via either XEM-STK ports, or high speed rear chassis ports.

The Physical Stack

A stack comprises two individual stack members interconnected via a high-speed stacking link. A stack always has a primary stack member called the stack master, and a secondary stack member called the backup member.

The basic stack configurations are:

- Two stack members connected in a ring topology via their stack XEM modules. All models.
- On SwitchBlade® x908 two stack members can connected via their back-plane chassis connections—a variation of the ring topology.

XEM module - cables and connections

The XEMStack ports use special cables to construct the physical stack; these are:

- AT-XEM-STK-CBL0.5 (0.5 metres long)
- AT-XEM-STK-CBL2.0 (2 metres long)

Chassis rear - cables and connections

The chassis rear stacking ports use special cables to construct the physical stack; these are:

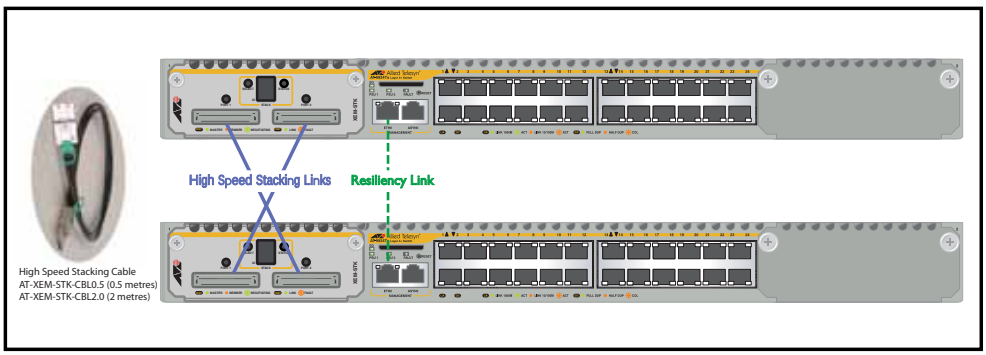
For the back panel chassis connections on the SwitchBlade x908, use the cable type AT-HS-STK-CBL1.0 (1 metre long).

Note Port 1 on one switch must connect to port 2 on the other (or next) switch.

Two Switch Stack Configuration

This configuration, shown in Figure 102-1 on page 102.3, uses two switches that are connected via their high-speed stacking links and an optional resiliency link. Note that stacking ports labeled 1 must connect to stacking ports labeled 2. In this configuration the stack can still function using only a single high speed link.

Figure 102-1: Two Switch Stack Configuration



On the SwitchBlade® x908, the two switch configuration can use either the connections on a XEM stacking module, or use stacking ports 1 and 2 located on the chassis rear panel. The chassis rear panel connections have a faster data rate, but do require a special cable.

Resiliency link

The resiliency link carries no network data. Its function is to provide additional stack status information to enable the stack members to more accurately decide whether it is appropriate for one of them to take over the role of stack master if the existing master fails. See "Stack Resiliency Link" on page 102.14.

A resiliency link can be created using a single physical connection between two eth0 ports, or it can use a VLAN (resiliency link VLAN) to which the switch ports can be attached.

To create a resiliency link using eth0 ports, connect a standard twisted pair LAN cable (either straight through, or crossover—MDI-MDIX negotiation is supported on these ports) between the two eth0 ports on both devices. Once you have connected the cable you can run the stack resiliencylink command on page 103.34 to create the resiliency link.

Resiliency link configurations via switch ports

Two resiliency-link configurations that use switch ports are shown below. Figure 102-2 shows the resiliency link connecting in a ring topology, whilst Figure 102-3 shows the resiliency link connecting to the switch ports via a network hub. In both configurations, the resiliency link connections are made using a designated VLAN running over switch-port connections between each stack member. For more information on using the resiliency link commands see: stack resiliencylink command on page 103.34 and switchport resiliencylink command on page 103.40.

Figure 102-2: Resiliency link connecting to switch ports over the ResiliencyLink VLAN

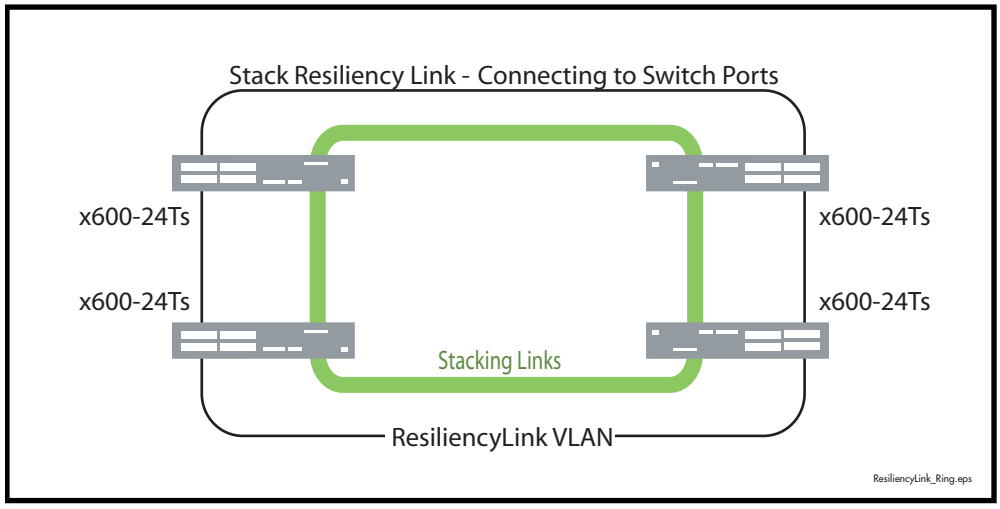
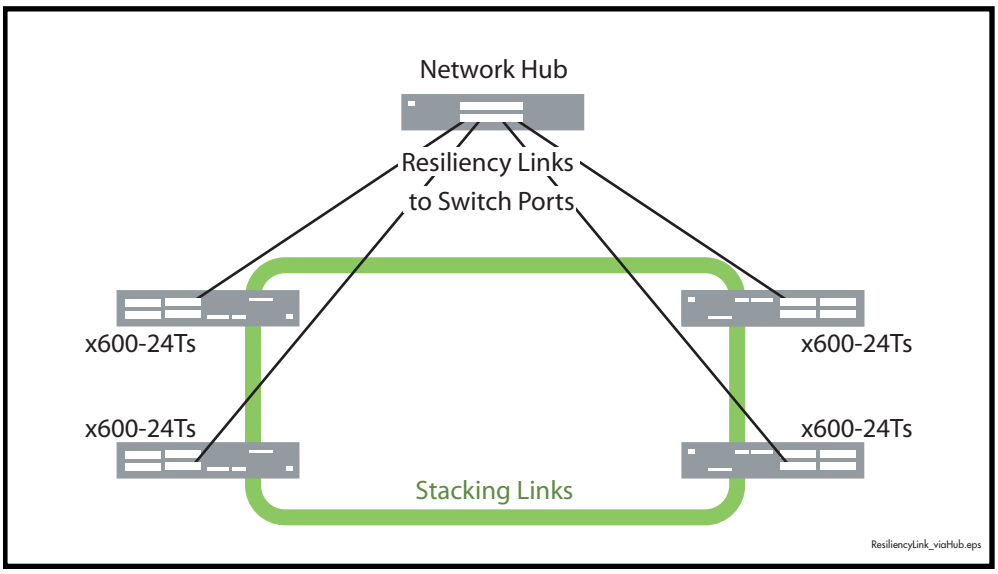


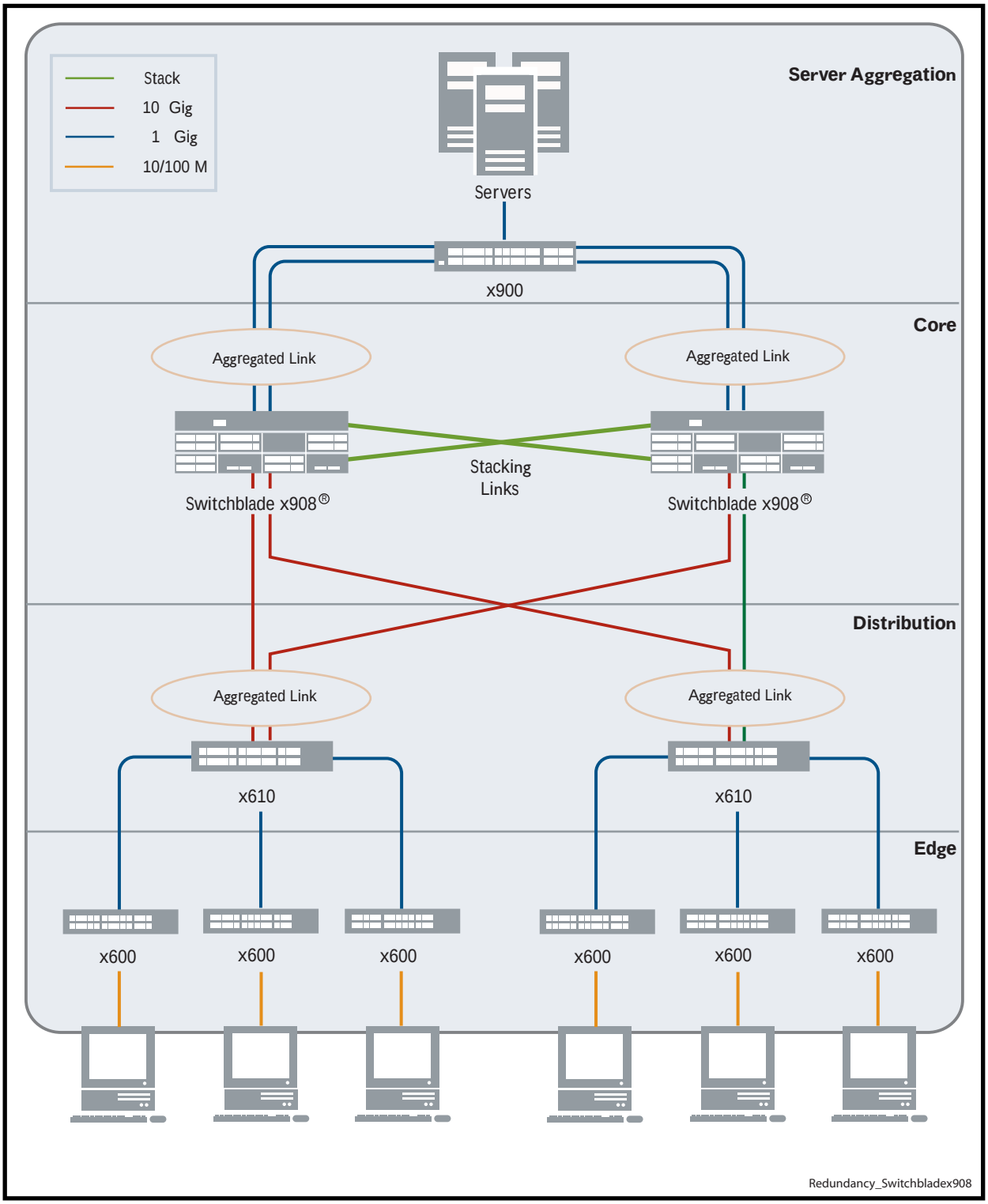
Figure 102-3: Resiliency link connecting to switch ports over the ResiliencyLink VLAN using a network hub.



Resilient Stacked Topology

Where network connectivity uptime is a major criteria, you can use virtual chassis stacking to create highly reliable network configurations. The network shown in Figure 102-4 employs duplicate links and switches to create a stacked network that offers extremely reliable user connectivity.

Figure 102-4: VCStack Resilient Stacked Topology Example



This network employs two SwitchBlade® x908 switches to form an expandable network core. These switches are stacked and so appear as a single logical switch (note that smaller switches such as the x610 can be also be used to form the stacked core).

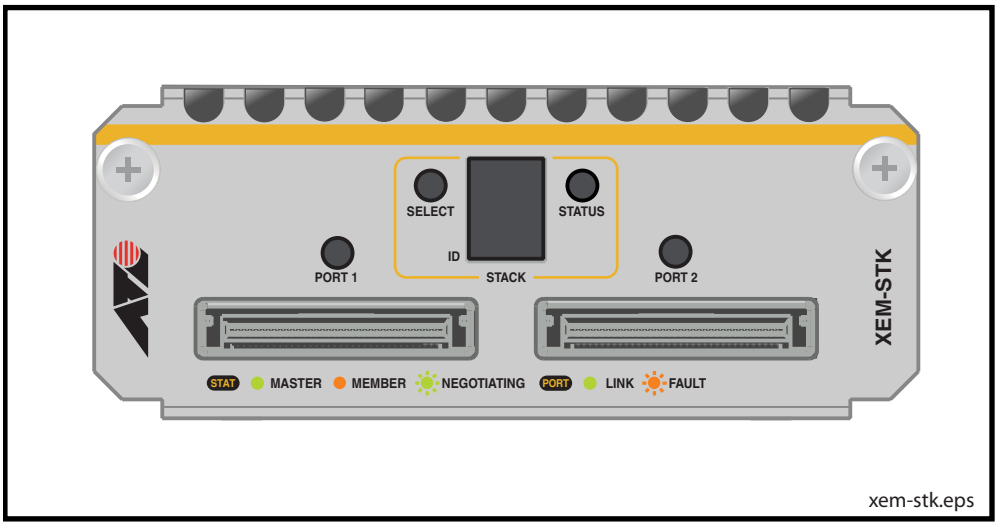
This network topology supplies multiple dual connections to a number of downstream distribution switches that can in turn connect to user devices. Similarly, the dual network paths provide very reliable connectivity to the server aggregation portion of the network.

Employing link aggregation rather than spanning tree to manage the parallel paths, enables the bandwidth of both data links to be utilized under normal conditions, whilst enabling a single data link to operate should its partner link fail.

Stack Formation

As previously mentioned, a VCStack always contains a stack master and a stack member. To be part of a stack, a switch must connect to the other potential stack member via dedicated stacking ports. These ports can either be those on the front of a XEM-STK stacking module, or in the case of the SwitchBlade x908, the stacking ports located on the back panel. Figure 102-5 on page 102.8 shows a stacking XEM-STK module.

Figure 102-5: VCStack Stacking Module (XEM-STK)



On the SwitchBlade® x908, at least one non XEM-STK must be installed in the switch before it is able to participate as a stack member. The SwitchBlade x908 will remain a standalone node until a non-stacking XEM is inserted, at which point it will initiate a topology discovery sequence and join the stack. Note that when the SwitchBlade x908 is operating as a standalone node it will not switch data around the stacking ring.

Once the switches have been physically connected to form a stack, powering all the members on automatically sets off a number of processes that enable the stack members to detect the presence of the other stack members and form themselves into a VCStack.

The Role of the Stack Master

In addition to being a member of its VCStack, the stack master manages functions such as software version control and distribution, routing processing, and network management.

Selecting the stack master

The stack members are able to automatically select which switch will become the stack master. This selection is based on two components:

1. The stack member's priority setting.
2. The stack member's MAC address.

For both components, the lower the number the higher the priority. To set the stack priority, run the stack priority command on page 103.31. Note that changes to these settings will not take effect until the next master re-election. To display these components run the show stack command on page 103.20.

The master is the switch with the lowest 'priority setting', or if the 'priority settings' are equal, the switch with the lowest MAC address will become the stack master. When a stack member is initially booted, its priority value defaults to 128. Therefore if all switches retain their defaults, then the stack master will be determined by MAC address comparison.

The stack also assigns a Stack Member-ID number to each member. This number provides a unique reference number for switches within the stack; it plays no part in selecting the stack master. The Stack Member-ID is the entity used as the first digit of the three component port identifier numbers. For example, port number 2.0.14 has the Stack Member-ID of 2.

Note

This last point is an important one to remember when using configuration scripts. You should ensure that you modify your configuration scripts to match any changes you have made to the Stack Member-ID assignments.

Note

The ability to independently set both a stack member's priority and its ID means that the stack master does not need to have an ID of `1`; although configuration is simplified by arranging for ID `1` to be the device with the lowest priority value - and thereby forcing it to be the stack master. If you create a stack using new switches, the following (simplified) process should ensure that the master member has an ID of `1`.

New switches are shipped with a Stack Member-ID of `1` and a priority of 128. If two such switches are created as a stack, the switch with the lowest MAC address will be selected to be the stack master (because all priority settings are 128). The remaining stack member device will then reboot. The stack master does not reboot and retains its Stack Member-ID of `1`.

You can change the Stack Member-ID by using either the ID select button on the XEM-STK, or by using the stack renumber command on page 103.32.

Common Stack Configuration

Once the switches have configured themselves into a VCStack, they all share the same configuration information and startup scripts.

Caution

Once the stack is formed, each stack member's configuration is associated with its Stack Member-ID number. Pressing the select button on a XEM-STK will set its switch member to have Stack Member-ID 1, and it will acquire the configuration settings assigned to that particular ID number. The other switch in the stack will then realign its Stack Member-IDs according to the stack's physical topology.

Stack Management VLAN

Managing the stack is the same as managing an individual switch. You can connect to the asynchronous console port of any stack member, or you can set an IP address on a network VLAN (for example, VLAN 1) and use SSH for remote access.

As the switches form themselves into a stack, each switch creates a common stack management VLAN and a management IP address. Both the VLAN ID and the IP address are internal entities that are used between the stacked switches, via either the stack XEM or rear panel interfaces, and therefore do not appear on the user network.

Initially the stack assigns the default VLAN tag ID of 4094 to the management VLAN, and assigns an IP address from the subnet 192.168.255.0 / 28 to this VLAN as the management IP address. Once the stack has formed, you can change both these settings. To change the VLAN ID use the stack management vlan command on page 103.30. To change the management IP address use the stack management subnet command on page 103.29. Note however, that you must keep the 28 bit subnet mask, (/28 or 255.255.255.240). Also note that because the stack's internal address mapping tables will register the management VLAN ID and the management IP address, these must be unique across the stack's internal and external network. To view the current settings for the stack management VLAN ID and IP address, use the show stack command on page 103.20.

Stack member identification

When a switch that is connected via a XEM-STK module, becomes a stack member, the numeric display on the XEM-STK indicates the switch's member ID, see the Figure 102-6 on page 102.11. If the switch is not a stack member, the XEM-STK seven-segment display will be blank. The following LEDs indicate the switch's status within the stack.

Table 102-2: Stacking LED Functions

LED	State	Meaning
Port 1 and Port 2	Green	A stacking link is established
	Amber (flashing slowly)	The link has transmission fault
	Off	The stacking link is down
Status	Green	The switch is the stack master
	Amber	The switch is a (non master) stack member
	Green (flashing)	The stack is selecting a stack master
	Off	The switch is not a stack member
Numeric ID	1 to 4	The stack member ID
	Off	The switch is not a stack member

The following figure shows the XEM-STK ports and LEDs.

Figure 102-6: XEM-STK LEDs

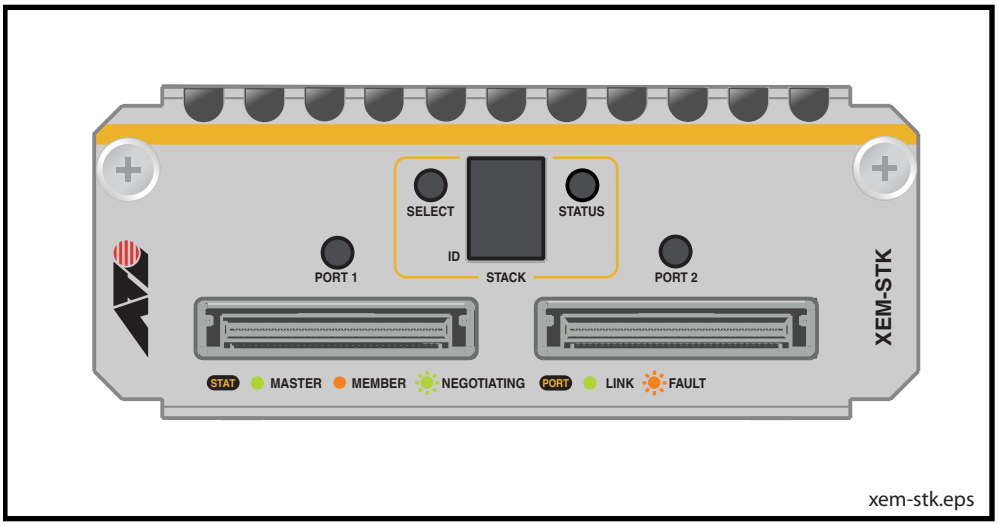
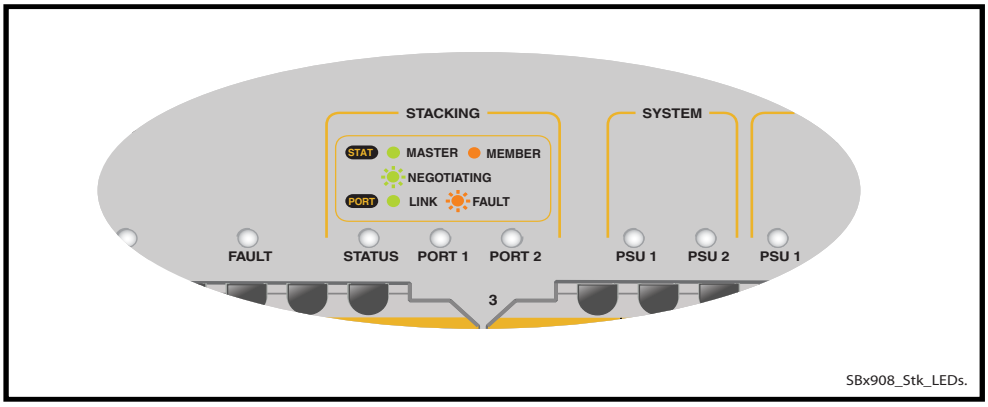


Figure 102-7: SB x908 Stacking LEDs (SwitchBlade x908)



Running commands on specific stack members

In some situations, you may want to obtain information that is specific to a particular stack member. To achieve this you can use the remote-command feature. For example, to see the processes running on stack member 3, you can run the following remote-command:

```
awplus# remote-command 3 show process
```

For more information and options on this feature, see the remote-command command on page 103.8 of this manual.

Running QoS within a VCStack

In general you can apply the same principles when configuring QoS on a VCStack as you would for single switch; however there are a few specific changes that you will need to make.

Switches within a VCStack exchange their stack management information and user data over their high speed inter-stacking links. The stack management information is pre-assigned to the egress queue 7. This is the highest value queue, and (in a stacked configuration) its traffic should not be shared with any user data. However, any CoS tagging of 7 applied to the incoming data will automatically be assigned to queue 7 as it crosses the internal stacking links. You will therefore need to reconfigure your CoS to Queue settings to ensure that no user data is sent to queue 7.

To prevent this from happening, we recommend that you make appropriate changes to your queue settings (mappings) to reflect the stacking requirement previously described. For more information on this topic, see “Mapping CoS tags to traffic types” on page 60.12.

This process should include (but not be limited to) running the following command to ensure that any remaining user packets still carrying a CoS 7 tag, will be mapped to egress queue 6.

To remap priority CoS traffic to egress queue 6, run the following commands:

```
awplus# config terminal
awplus(config)# mls qos map cos-queue 7 to 6
```

Stack Member Failure and Recovery

Fixed or Virtual MAC Addressing

A VCStack operates using a single virtual MAC address. This address is configurable by using the stack virtual-mac command on page 103.38.

Enabling the stack virtual-mac

When the stack virtual-mac command is enabled, the stack uses a virtual MAC address that is either manually entered, or has been randomly selected from an allocated pool of MAC addresses. The stack will then always use this MAC address even if the stack master fails or is removed from the stack. In this situation, the new elected master will still retain the originally configured virtual MAC address.

The virtual MAC address will be used for all external ports, and VLAN interfaces, except the management VLAN. Although each individual switch in the stack retains its own native MAC address; this is only used over the stack management VLAN.

Note

If one stack member has the virtual MAC address feature enabled and another has the virtual MAC address feature disabled then they will be able to form together as a stack. From master election onwards, the stack master's virtual MAC address setting will be used by the rest of the stack.

Virtual MAC format and value

The virtual MAC address is selected from within the range 0000.cd37.0000 to 0000.cd37.0FFF. This can be considered as a MAC prefix component of 0000.cd37.0xxx.
Where xxx is called the stack virtual-chassis-ID, and has the range 000 to FFF.

Manually selected virtual address

To manually select a virtual MAC address you enable the stack virtual MAC feature by using the commands:

```
awplus# configure terminal
awplus(config)# stack virtual-mac
```

Then configure the stack virtual-chassis-id command on page 103.37 to set a stack virtual-chassis-ID of your chosen value - entered as a decimal number within the range 0 to 4095. The value 120 is used in the following example:

```
awplus# configure terminal
awplus(config)# stack virtual-chassis-id 120
```

Automatically selected virtual address

If you set the stack virtual-mac command without entering a value for the stack virtual-chassis-ID, the switch will randomly select a virtual-chassis-ID from the allocated range.

Disabling the stack virtual-mac

When the stack virtual-mac command is disabled, the stack will use the MAC address of the current Master. If the stack master fails, the stack MAC address changes to reflect the new master's MAC address. If the stack MAC address does change, ARP tables of devices on the network will update to reflect the change in MAC address via ip gratuitous-arp-link command on page 25.29.

Stack Resiliency Link

The purpose of the resiliency link is to provide the stack members with status information that allows them to detect whether the stack master is still operational after a stack failure occurs.

Using the resiliency link, a stack member can differentiate between the master suffering a power-down or a software lock-up, where the master is offline, compared with a stacking-link failure, where the master is still online but connectivity over the stacking cables has been lost.

This enables the other stack members to either operate in the fall-back Disabled Master mode, or to re-elect a new stack master. The "State Change Table" on page 102.14 shows how the stack members respond to various problems occurring on the master node.

Stack recovery states

The following state-change-table shows stack member failure conditions and recovery actions in situations where the resiliency link is present or absent.

Table 102-3: State Change Table

Event on Master Node	Reaction on Master	Reaction on Stack Member	Reaction on Stack Member
		With Resiliency Link	Without Resiliency Link
Both stack links removed	No change	Disabled Master	Re-elect master [2]
XEM-STK Removed or Faulty	No change	Disabled Master	Re-elect master [2]
Hardware reset (or fault)	Reset / offline	Re-elect master	Re-elect master [2]
Run the no stack enable command[3]	No change	Disabled Master	Not allowed Displays Error Message
Software application problem (lock-up or continual crashes)	Reboot as stack member	Re-elect master	Re-elect master
Software crash or lock-up	Frozen[4]	Re-elect master	Re-elect master
Power-down or PSU failure	Powered down	Re-elect master	Re-elect master
Event on Stack Member Node	**Reaction on Master**	**Reaction on Stack Member**	**Reaction on Stack Member**
Both stack links removed	No change	Disabled Master[1]	Re-elect master [2]
XEM-STK removed or faulty	No change	Disabled Master[1]	Re-elect master [2]
Hardware reset (or fault)	No change	Reset/offline	Reset/offline

Table 102-3: State Change Table

Run the no stack enable command[3]	No change	Disabled Master	Disabled Master
Software application failover (lock-up or continual crashes)	No change	Re-boot as backup member	Reboot as stack member
software crash or lock-up	No change	Frozen[4]	Frozen[4]
Power-down / PSU failure	No change	Powered Down	Powered down

1. When a backup member becomes the Disabled Master it will first disable all its switch ports, then activate any triggers specified with the type stack disabled-master command that have been configured.
2. The stack member assumes the role of stack master. In specific situations this condition could result in a stack containing two masters. This would present problems with network management and the control of links that were previously aggregated.
3. The following situation will apply to a switch that has been removed from the stack by the using the “no stack enable” command:
   - The switch will be unaware of further faults within the stack it was previously a member of.
   - Should this switch then be powered down, all links previously shutdown (as a result of running the no stack enable command) will remain down.
4. If the backup member’s ports are still up, this may cause downstream switches with trunked ports to operate incorrectly.

Stack Failure Recovery

If the stack master either fails, or is removed, the other stack members will re-elect a new stack master. The stack members automatically determine which of them becomes the new stack master. See the Disabled Master Monitoring (DMM) and the Disabled Master sections for more information. Alternatively, you can manually configure a trigger with the type stack disabled-master command on page 97.26 to activate on a stack member if it becomes the disabled master.

Table 102-3 shows how the stack backup members would respond to various problems occurring on the stack master stack.

Note

When VCStack is used with EPSR, the EPSR failovertime must be set to at least 5 seconds to avoid any broadcast storms during failover. Broadcast storms may occur if the switch cannot failover quickly enough before the EPSR failovertime expires. See the epsr command for further information about the EPSR failovertime. See the reboot rolling command for further information about stack failover.

Stack Separation and Recovery

Stack stubs occur when a fault results in the stack splitting into two, with one of the stack members taking on the role of stack master. Where the stack master is still active after a fault, and other stack members are not aware that the stack master is still active, the result can be two independently operating stacks, or stubs.

When two stub stacks are reconnected, a dual master situation will be detected, and the console log will display the message that a 'duplicate master' was detected. This situation results in the re-election of the stack master based upon the lowest Priority ID, or, where both members have the same Priority ID, the lowest MAC address. The 'losing' master and other prospective stack members will then reboot and join the new stack as backup stack members.

Note

Stubs are unlikely to cause network connectivity problems if a resiliency link is used.

Stack Maintenance

Adding a stack member

An unstacked switch can be added to an existing stack (hot-swapped in) with minimal impact on traffic. To do this, power down the new member switch, then connect its stacking ports and power on the switch. The switch will boot as a member of the stack.

Note

The existing Stack Member-ID and the device MAC address will have no effect on the status of the new member switch. The stack will admit the new device as an ordinary stack member and allocate it a new Stack Member-ID if its ID is one that already exists.

However, for good practice we recommend pre-configuring the new member with settings that are appropriate for when the new switch becomes a stack member. This is to avoid unexpected situations occurring when the stack is rebooted. For example, if the new member had a priority setting that was lower than 128 and all the existing stack members were configured with the default; then, when the stack is rebooted, the new member would be elected as the stack master.

Replacing a stack member

A stack member can be removed from a stack (hot-swapped out) with minimal impact on stack traffic. To do this, power-down the stack member, disconnect its XEM-STK ports. Insert the new stack member, reconnect the stacking ports and power-up the new stack member.

You can seamlessly swap a stack member switch into the stack to replace another with the same configuration. This provides a simple way to replace an out-of-service switch with minimal impact, and minimal administration requirement. You should configure the replacement switch with the same member ID as its replacement prior to inserting it into the stack.

Disabled Master

The technical term for the stack master, as displayed in the show stack command, is the active master. There is another variant of stack master called the disabled master. The disabled master will rarely, if ever, be seen because it is only used if the stack separates into two stubs. By disabling all its switchports, the disabled master avoids potentially detrimental network connectivity problems caused by having two stack masters using the same configuration. The active master's ports are unaffected by this, and it will continue to forward traffic normally.

To bring down its switchports, the disabled master actually applies the shutdown command to every switchport in its running configuration. Apart from this, the operation and 'look and feel' of a disabled master is very similar to an active master.

A disabled master trigger also allows you to specify a script to reconfigure the disabled master on the fly, should a catastrophic failure separate the stack. This is useful to configure an alternate IP address so you can still login to the disabled master via an SSH or a Telnet connection. The trigger script should use the no shutdown command to re-enable any switchports needed for an SSH or a Telnet management connection. For trigger command information see the type stack disabled-master command on page 97.26.

Note

In a stack of more than two units, several stack members could become separated from the stack master. In this case, these stack members will form a stack stub together. Only one stack member will become the disabled master. The other switches will remain as backup stack members, but their switchports will still be disabled. Status information for the stack members can be accessed by logging into the disabled master, in the same way as obtaining status information for a normal stack.

Disabled Master Monitoring (DMM)

The stack resiliency link and disabled master state offer a unique prevention of catastrophic network connectivity problems. However, when stack members become separated, the network is still left in a fragile state where the stack master no longer has the redundancy of a backup stack member. If the original stack master were to subsequently fail whilst the stack was separated, then all network connectivity would be lost if the disabled master's switchports remained shutdown.

The Disabled Master Monitoring (DMM) feature avoids this situation by continuing to monitor the status of the original stack master (the active master) via the stack resiliency link. When the DMM feature is enabled, the disabled master can detect a failure of the original stack master within a few seconds. If a failure is detected, the disabled master transitions to the active master state and automatically re-enables all its switchports. This allows traffic forwarding via the stack to continue.

For more information about the disabled master state, see the section "Disabled Master" on page 102.17. Note that a disabled master has the same configuration as an active master, but a disabled master has all its links shutdown.

Table 102-4: Stack behavior comparison

Stack behavior with DMM disabled	Stack behavior with DMM enabled
■ The VCStack breaks with the Stack Resiliency Link configured and enabled.	■ The VCStack breaks with the Stack Resiliency Link configured and enabled.
■ The separated stack member becomes a disabled master.	■ The separated stack member becomes a disabled master.
■ The disabled master does not monitor the active master.	■ The disabled master monitors the active master.
■ If the active master fails then the disabled master does not become the active master (no state transition).	■ If the active master fails then the disabled master becomes the active master (disabled to active transition).
■ No switchports are re-enabled on the disabled master. No traffic is forwarded.	■ Switchports on the disabled master are re-enabled. Traffic is still forwarded,

To enable the DMM feature, use the commands:

```
awplus# configure terminal
awplus(config)# stack disabled-master-monitoring
```

To disable the DMM feature, use the commands:

```
awplus# configure terminal
awplus(config)# no stack disabled-master-monitoring
```

To show the status of DMM on the VCStack, use the command:

```
awplus# show stack detail
```

To apply a trigger upon transition from active master state to disabled master state, use the command:

```
awplus# type stack disabled-master
```

To apply a trigger upon transition from disabled master state to active master state, use the command:

```
awplus# type stack master-fail
```

Note

A disabled master trigger allows you to specify a script to reconfigure the disabled master on the fly, should a catastrophic failure separate the stack. This is useful to configure an alternate IP address so you can still log in to the disabled master via an SSH or a Telnet connection. The trigger script should use the no shutdown command to re-enable any switchports needed for an SSH or a Telnet management connection.

Provisioning (Stack Members)

Stack member provisioning is the pre-configuration of a stack member's position ready for insertion at a later time. Provisioning enables a network administrator to pre-configure vacant stack member capacity within a VCStack, ready to be hot-swapped in at a later time. Later, when the stack member switch is physically added, its configuration is automatically applied with the minimum network disruption. Provisioning is ON by default, and cannot be disabled.

Provisioned capacity can be applied by either of the following actions:

- applying the switch provision command on page 103.39
- installing, then removing a provisionable device from its physical location, that is, a switch from its stack.

When a vacant switch is provisioned, its ports are assigned the shutdown state and are therefore not able to be activated. Applying the shutdown or no shutdown commands to a provisioned port will change only its administrative state.

Provisioned Board Classes

Provisioning introduces the concept of defined board classes. Table 102-5 on page 102.20 lists the stack member classes that have been defined for provisioning. Each board class is assigned a class and an appropriate port count. Presently no further definitions have been made for additional features such as media type, or PoE capability. This structure simplifies configuration.

Table 102-5: Provisioned Stack Member Classes

Board Classes		
Class	**Port Count**	**Bays**
x900-12	12	1
x900-24	24	2
SBx908	0	8

Provisioning limits for devices and ports

These devices have the following device and port limits.

Table 102-6: Maximum Device and Port Limits per Product Type

Device Type	Device Limit	Port Limit
SBx908	2	192
x900	2	96

Note that although the SBx908 switch can be provisioned with VCStack IDs of 1-4, and x900 switches are able to be provisioned with VCStack IDs of 1-8, both of these switch families have the limit of two switches per stack.

Applying Hardware Provisioning

As previously mentioned, provisioning is the pre-configuration of vacant (i.e. unused) device capacity ready for device insertion at a later time.

Without provisioning

On software versions prior to version 5.3.4 - trying to configure an unused port will result in the following error message:

```
awplus(config)# interface port4.0.1
% Can't find interface port4.0.1
```

With provisioning

With provisioning, you can configure stack members and their ports ready for future addition, even though they are not currently physically present:

```
awplus(config)# switch 4 provision x600-24
```

Now that the switch is provisioned within the stack—although not yet physically present—you can move on to provisionally configure the switch ports themselves. The following example sets the port speed of port 4.0.1 to be 1000 Mbps.

```
awplus(config)# interface port4.0.1
awplus(config-if)# speed 1000
```

You can apply provisional configuration to all interface related commands. However, you cannot apply provisioning where it changes the network's physical topology. For example, you can't provision a switch as stack member 3 and then later change it - while its position is still vacant - to stack member 4. In this situation, you would need to unprovision the switch, then provision it again as stack member 4.

The following example creates a provisioned configuration that shows the association of ports with a VLAN:

```
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 12 state enable
awplus(config-vlan)# exit
awplus(config)# interface port2.0.1
awplus(config-if)# switchport mode access
awplus(config-if)# switchport access vlan 12
awplus(config-if)# exit
awplus(config)# interface port2.0.2-port2.0.26
awplus(config-if)# switchport mode access
```

Provisioning Error Messages

The following error messages may appear when configuring provisioning.

Table 102-7: Provisioning Error Messages (switch x [bay y] provision)

Error Message	Comment
`% Maximum port count (208) reached. No more devices can be provisioned`	Allows for a maximum eight 24 port x600 switches in a VCStack
`% Maximum stack size (%d) reached. No more switches can be provisioned`	`%d` = 2 for x908 or x900
`Switch %d must be provisioned before bays can be provisioned.`	`%d` = stack member id
`% Switch %d (%s) has 0 expansion bays.`	`%d` = stack member id `%s` = board class
`% Board class %s is incompatible with this system.`	`%s` = board class from cmd line. Indicates x600/x900 class mismatch
`% Board class %s is incompatible with existing stack members.`	`%s` = board class from cmd line. Indicates a mismatch between x900-class devices.
`% switch %d is already populated with %s.`	Indicates an attempt to provision a switch that is already present.
`% switch %d is already provisioned for %s.`	Indicates an attempt to provision a switch that is already provisioned.
`% switch %d bay %d is already populated with %s.`	Indicates an attempt to provision a XEM bay that is already populated.
`% switch %d bay %d is already provisioned for %s.`	Indicates an attempt to provision a XEM bay that is already provisioned.

Table 102-8: Provisioning Error Messages (no switch x [bay y] provision)

Error Message	Comment
`% switch %d bay %d is currently populated by %s`	You must remove hardware before unprovisioning

Removing Hardware Provisioning

Hardware capacity that has been previously provisioned *and is presently unoccupied* can be unprovisioned with the no switch provision command. This removes the provisioned configurations for hardware that has either not yet been physically added to a switch or VCStack, or has previously existed, but has been removed.

The no switch provision command will also delete any switch bay commands with the same unit number and all associated interfaces, as well as all configuration for that switch or XEM module.

You cannot unprovision hardware that is currently installed. A no switch command will not succeed if the unit/unit.bay location is currently occupied. For example:

```
awplus(config)# no switch 2 bay 8 provision
                % switch 2 bay 8 is currently populated by xem-1
```

The following example displays the output of a show stack that includes a provisioned VCStack member 3:

```
Virtual Chassis Stacking summary information
ID  Pending ID  MAC address        Priority  Status    Role
1   -           0000.cd28.5377     128       Ready     ActiveMaster
2   -           0000.cd29.95bf     128       Ready     BackupMember
3   -           0000.0000.0000     -         -         Provisioned
```

Switch ID 3 is then unprovisioned:

```
awplus(config)# no switch 3 provision
```

Run the show stack command to confirm that switch 3 has been unprovisioned.

```
awplus# show stack
```

```
Virtual Chassis Stacking summary information
ID  Pending ID  MAC address        Priority  Status    Role
1   -           0000.cd28.5377     128       Ready     ActiveMaster
2   -           0000.cd29.95bf     128       Ready     BackupMember
```

Note Ensure that you save your running configuration to your startup configuration after making any provisioning changes using copy running-config startup-config

Displaying Provisioned Configurations

In this respect the major difference associated with provisioning, is that interface configurations will still exist in the config files and will appear in show commands, even though a device itself may not be physically installed. This (provisioning) could result from device capability that has been preconfigured for future installation, or could result from the removal of an installed device.

The show running-config command includes switch commands for existing hardware, plus all non-existent, but provisioned, hardware. The following example output of the show running-config command illustrates how provisioned and existing hardware is displayed.

Figure 102-8: Sample display of existing and provisioned show output

```
sh running-config
.
.
switch 1 provision x908
switch 1 bay 1 provision xem-12
switch 1 bay 2 provision xem-12
switch 1 bay 3 provision xem-12
switch 1 bay 5 provision xem-12
switch 1 bay 7 provision xem-1
switch 1 bay 8 provision xem-1
switch 2 provision x908
switch 2 bay 1 provision xem-12
switch 2 bay 2 provision xem-12
switch 2 bay 3 provision xem-1
switch 2 bay 8 provision xem-1
!
interface port1.1.1-1.1.12
 switchport
 switchport mode access
!
interface port1.2.1-1.2.12
 switchport
 switchport mode access
!
interface port1.3.1-1.3.12
 switchport
 switchport mode access
.
.
.end
```

Displaying provisioned hardware status

The status, present or provisioned, appears in monitoring commands such as the show interface brief command. The following sample output from the show interface brief command shows the provisioning status of two configured stack members.

Figure 102-9: Sample **show interface brief** output showing hardware provisioning status

```
awplus#show interface brief
Interface              Status          Protocol
port2.0.24             admin up        down
port3.0.1              admin up        provisioned
port3.0.2              admin up        provisioned
```

A more detailed inspection of the provisioned port 2.8.1 is shown below. Note that the MAC address of 0000.0000.0000, which is the value applied as a placeholder for all provisioned ports. Also note that although the port is in the link DOWN state its administrative state of UP PROVISIONED means that it can be further configured. For example, it can be associated with a VLAN, or added to a link aggregation group etc.

Figure 102-10: Sample display showing provisioning status of a specific port

```
Interface port2.8.1
  Scope: both
  Link is DOWN, administrative state is UP PROVISIONED
  Thrash-limiting
    Status Unknown, Action learn-disable, Timeout 1(s)
  Hardware is Ethernet, address is 0000.0000.0000
  index 6801 metric 1 mtu 1500 mru 1522
  <BROADCAST,MULTICAST>
  VRF Binding: Not bound
  SNMP link-status traps: Disabled
    input packets 0, bytes 0, dropped 0, multicast packets 0
    output packets 0, bytes 0, multicast packets 0 broadcast
pks0
```

Provisioning and Configuration Management

A benefit of provisioning is configuration settings are no longer dependant on the existence of hardware devices. When a device is removed, all the interfaces for that device are shutdown and its provisioning status is set. This means that you can add or remove physical hardware without affecting your network interfaces. Of course when ports go down (i.e. are physically removed) there will be other changes to network configuration, as protocols may re-converge or, for example, routes may be removed etc.

Switches within a VCStack (or XEMs within a switch) can be hot-swapped without the need for reconfiguration.

The configuration of a newly inserted device that matches the provisioned board-class is achieved on a best-effort basis. For example inserting a non-POE switch into a stack member location configured for PoE will result in the failure of the PoE configuration commands.

Take care that your provisioned configurations, match with the type of hardware that you plan to install. For example, the XEM-12 configuration shown below has the port speed set for one of its ports:

```
awplus(config)# switch 2 bay 4 provision xem-12
awplus(config)# int port2.4.1
awplus(config-if)# speed 10
```

This will be fine if a XEM-12T is installed; however installing a XEM-12S (a device that cannot run its ports at 10 Mbps) would result in an error condition.

Software Version Auto Synchronization

Introduction

Different software releases have functional and operational differences between them. To maintain consistent behavior across the stack, all new member switches must be running the same software release before they can fully join the stack.

Manually upgrading the software release of each new stack member that joins a stack would be a cumbersome process. The VCStack software version auto synchronization feature automates this process by ensuring the same software release is used on all stack members, and automatically upgrading stack members where required.

How auto synchronization works

Software version comparison

When the stack is formed, it elects one of its switches to become the master. The software release running on the stack master will then become the software version used throughout the stack. After a master is elected, all the stack members compare their current software version with the version that is running on the stack master.

If the comparison process detects differences between software versions, the software version synchronization feature will automatically copy the master's software release onto the appropriate stack members. Once the software release has successfully been copied, this version will become the boot software for that particular stack member, which will then reboot in order to load the new software release.

If a software version running on a stack member is incompatible with that running on the master, and software-auto-synchronization is turned off, then that switch will be removed as a stack member. See stack software-auto-synchronize command on page 103.36.

From release 5.4.1 onwards, when auto-synchronization upgrades a stack member, the member's current running software will be set as the backup software release. If there are any problems loading the new software, then the backup software release will be used to recover.

If the stack member does not have enough free Flash memory space for the new release, then the new release will replace up to two older release files in Flash memory, which is determined by software build dates of the older release files. The oldest release files are replaced first.

Auto synchronization limitations

Because the stack master's software version gets applied to the rest of the stack, care must be taken to ensure the correct switch is elected master. If the master is running an older software release, then software version auto synchronization may actually downgrade the software releases running on other stack members. For configuring which stack member becomes the master, see the stack priority command on page 103.31.

Software auto-synchronization will not work if stack members are booting using either one-off boot or from TFTP or ymodem. In these situations, any stack members running different software will boot as standalone devices.

If software-auto-synchronization is configured as off for a stack member that is running a different software release to the master, by applying the command, no stack software-auto-synchronize, then that switch will boot as a standalone device. For more information, see the stack software-auto-synchronize command on page 103.36.

Incompatible software releases

The auto-synchronization feature will not always work if there have been significant VCStack or system changes between the two different software releases. The VCStack discovery of other stack members uses an internal 'stack S/W version' to detect compatibility between builds.

If the VCStack software between two stack members is incompatible, the software auto-synchronization feature will not work. Instead, a “incompatible stack S/W version” log message will be displayed and both stack members will boot as standalone devices. This is an undesirable situation because both devices may load the same configuration file, which could cause network conflicts. In order to avoid this situation when upgrading the stack to a new major release, ensure the 'boot system' command succeeds.

In general, the software-auto-synchronize feature will always work between maintenance releases, such as between 5.3.2-0.1 and 5.3.2-0.2, but may not work between major releases that have new VCStack features, such as between 5.2.2-0.9 and 5.3.2-0.2.

Upgrading stack software reliably

When upgrading a stack to a new software release, the boot system command on page 7.7 will automatically synchronize the new software release across all stack members. If there is insufficient file space on a backup member, the boot system command has an interactive mode that prompts you to delete old releases to free up file space. However, if you choose not to delete any release files, or if Flash space is taken up with other types of files, then the boot system command can fail to set the preferred release on the backup member. If this situation occurs, it is recommended to manually free up file space on the stack member and then reenter the boot system command.

If you are unsure which files to delete, the following process may assist you.

```
awplus# remote-login 2
awplus-2# enable
awplus-2# dir
```

Use the remote-login command to login to the backup member with insufficient free file space, in this example member-2.

Look for any .rel (release) files, .jar (GUI), or .tgz and .gz (diagnostic) files that are no longer needed and use the delete command to remove them from the back-up member's file system.

Alternatively, you can use the file system commands directly from the master's console prompt using the filepath of the backup member's Flash. Substitute awplus for the hostname in the configuration, and use awplus-3 for stack member-3, and so on.

```
dir awplus-2/flash:*
delete awplus-2/flash:/x900-5.4.2.rel
```

Stack License Management

You can manage feature licenses across all members of a stack concurrently. This means that a feature license for a product family, which is defined as a set of devices containing variants of the same product type that are able to be stacked together, can be enabled or disabled on all members of the stack at the same time. Previously, you had to configure each member of the stack individually.

Feature licenses across a stack can be managed either via the CLI with the license member command or via SNMP using the AT-LICENSE-MIB Enterprise MIB.

The stack does not have to be restarted when a feature license is enabled or disabled. When a new feature license is enabled across the stack some protocol modules may need to be restarted before the license is activated. A warning is given about the need to restart the protocol modules and a “y/n” prompt is given to proceed with the license installation. If SNMP is used to enable a feature license, the affected protocol modules are restarted automatically.

When you remove a feature license across all members of the stack via the CLI you are prompted for confirmation before the license is disabled. If SNMP is used to disable a feature license no warning is generated.

To maintain consistent behavior across the stack, all member switches should have the same feature licenses enabled. However, you can enable or disable a feature license on a single stack member if required. Note that doing so could result in the stack failing to operate correctly or in the stack separating. If you enable or disable a feature license on a single stack member via the CLI a warning message is generated. A warning message is not generated if you manage the stack via SNMP.

A license key can be purchased that includes a limit on the number of switches that it can be applied to. If the license is applied to a stack that has more members than the license is valid for via the CLI, a warning message is generated and the event is logged.

For feature licenses, contact your authorized distributor or reseller. If a license key expires or a proper key is not installed, some software features will not be available.

Note

See the AlliedWare Plus™ datasheet for a list of current feature licenses available by product, and the AlliedWare Plus™ How To notes for information on obtaining them.

To enable a feature license on all stack members, use the command:

```
awplus# license <name> <key> member all
```

To enable a feature license on a specific stack member, use the command:

```
awplus#  license <name> <key> member <1-8>
```

To disable a feature license on all stack members, use the command:

```
awplus# no license <name> member all
```

To disable a feature license on a single stack member, use the command:

```
awplus# no license <name> member <1-8>
```

To display detailed information about feature licenses on all stack members, use the command:

```
awplus# show license [<name>] member all
```

To display brief information about feature licenses on all stack members, use the command:

```
awplus# show license [<name>] brief member all
```

To display detailed information about feature licenses on a single stack member, use the command:

```
awplus# show license [<name>] member <1-8>
```

To display brief information about feature licenses on a single stack member, use the command:

```
awplus# show license [<name>] brief member <1-8>
```

Chapter 103: Stacking Commands

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stack virtual-mac 103.38
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switchport resiliencylink 103.40
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Introduction

This chapter provides an alphabetized reference for each of the Stacking commands. Also note the following stacking trigger commands that are documented in the Triggers chapter:

type stack disabled-master command on page 97.26
type stack master-fail command on page 97.27
type stack member command on page 97.27
type stack link command on page 97.28

In addition to the stacking commands shown in this chapter, stacking content also exists in the following commands:

hostname command on page 8.18
reload command and reboot command on page 8.23
show cpu command on page 8.27
show cpu history command on page 8.31
show exception log command on page 10.39
show file systems command on page 7.33
show memory command on page 8.39
show memory allocations command on page 8.41
show memory history command on page 8.44
show process command on page 8.49
show system command on page 8.53

Command List

clear counter stack

This command clears all VCStack counters for all stack members.

Syntax `clear counter stack`

Mode Privileged Exec

Example To clear all VC Stack counters:

```
awplus# clear counter stack
```

Related Commands show counter stack

debug stack

This command enables the Virtual Chassis Stacking (VCStack) debugging facilities.

Syntax

```
debug stack [link|topology|trace]
no debug stack [link|topology|trace]
```

Parameter	Description
`link`	Stacking neighbor discovery events on stack links.
`topology`	Stacking topology discovery messages.
`trace`	Notable stacking events.

Default Stack trace debugging is enabled.

Mode Privileged Exec and Global Configuration

Usage This command enables the Virtual Chassis Stacking (VCStack) debugging facilities. It can only be entered on the stack master.

The command displays debug information about the stacked devices. If no parameter is specified, all the stack debugging information will be displayed, including link events, topology discovery messages and all notable stacking events. If link parameter is specified, only the link events debugging information will be displayed.

Examples To enable debugging, enter the following command on the stack master:

```
awplus# debug stack
```

To enable link debugging, enter the following command on the stack master:

```
awplus# debug stack link
```

To enable topology discovery debugging, enter the following command on the stack master:

```
awplus# debug stack topology
```

To enable stack trace debugging, enter the following command on the stack master:

```
awplus# debug stack trace
```

Related Commands undebug stack

license member

This command enables a licensed software feature set on either a specific stack member, or on all stack members.

Use the no variant of this command to disable a licensed software feature set on either a specific stack member, or on all stack members provided the specified license has the same set of features on each stack member.

For feature licenses, contact your authorized distributor or reseller. If a license key expires or a proper key is not installed, some software features will not be available.

Note

See the AlliedWare Plus™ datasheet for a list of current feature licenses available by product, and the AlliedWare Plus™ How To notes for information on obtaining them.

Syntax

```
license <name> <key> member [<1-8>|all]
no license <name> member [<1-8>|all]
```

Parameter	Description
<name>	A unique user-defined name for the license. To determine names already in use, use the show license member command.
<key>	The encrypted license key to enable this set of software features.
<1-8>	The ID of the stack member on which the license is to be installed.
all	All stack members.

Mode Privileged Exec

Usage When a licensed software feature is not enabled on all devices within a stack it will result in a mismatch between licenses across the stack, possibly resulting in the stack failing to operate correctly. A warning message is generated if you only specify a single stack member when operating in a stacked configuration:

```
% Warning: licensed features do not match on all stack members.
To prevent the risk of an outage, please resolve.
```

You can obtain a license key that includes a limit on the number of switches that it can be applied to. If the license is applied to a stack that has more members than the license is valid for a warning message is generated and the event is logged.

Examples To enable the license `name1` with the key `12345678ABCDE123456789ABCDE` on all stack members, use the command:

```
awplus# license name1 12345678ABCDE123456789ABCDE member all
```

To remove the license `name1` from all stack members, use the command:

```
awplus# no license name1 member all
```

Validation Command show license member

Related Commands license
show license

reboot rolling

This command reboots a stack in a rolling sequence to minimize downtime.

The stack master is rebooted, causing the remaining stack members to failover and elect a new master. The rebooted unit remains separate from the remaining stack and boots up as a stand-alone unit. Once the rebooted unit has finished running its configuration and has brought its ports up, it reboots the remaining stack members in the order of their stack member IDs.

Syntax `reboot rolling`

Mode Privileged Exec

Usage If you are upgrading to a new software version, the new version must also support rollling reboot.

Note When VCStack is used with EPSR, the EPSR failovertime must be set to at least 5 seconds to avoid any broadcast storms during failover. Broadcast storms may occur if the switch cannot failover quickly enough before the EPSR failovertime expires. For further information about EPSR failovertime, see the epsr command on page 82.3.

Examples To rolling reboot the stack, use the following commands:

```
awplus# reboot rolling

Continue the rolling reboot of the stack? (y/n):
```

After running this command, the stack master will reboot immediately with the configuration file settings. The remaining stack members will then reboot once the master has finished re-configuring.

```
Continue the rolling reboot of the stack? (y/n):

awplus# y
```

Related Commands boot system
epsr

reload rolling

This command performs the same function as the reboot rolling command on page 103.7.

remote-command

This command executes a number of host-directed commands that are specific to stack members.

Syntax

```
remote-command <1-8>
   show {cpu|counter|exception|file|memory|process|stack|system}

remote-command <1-8>
   clear counter stack
```

Parameter	Description
<1-8>	The ID of the stack member where the command should be executed on.
`clear counter stack`	Can be used on a VCStack master to remotely run the clear counter stack command on page 103.3.
`cpu`	Selects the show cpu command on page 8.27.
`counter`	Selects the show counter stack command on page 103.11.
`exception`	Selects the show exception log command on page 10.39.
`file`	Selects the show file command on page 7.32.
`memory`	Selects the show memory command on page 8.39.
`process`	Selects the show process command on page 8.49.
`stack`	Selects the show stack command on page 103.20.
`system`	Selects the show system command on page 8.53.
`show CPU history`	Selects the show cpu history command on page 8.31.
`show CPU sort pri`	Selects the show cpu command on page 8.27 to run with the parameters sort and pri selected.
`show CPU sort runtime`	Selects the show cpu command on page 8.27 to run with the parameters sort and runtime selected.
`show CPU sort sleep`	Selects the show cpu command on page 8.27 to run with the parameters sort and pri selected.
`show CPU sort thrds`	Selects the show cpu command on page 8.27 to run with the parameters sort and thrds selected.
`show exception log`	Selects the show exception log command on page 10.39.
`show file systems`	Selects the show file systems command on page 7.33.

Parameter(cont.)	Description(cont.)
`show log permanent`	Selects the show file systems command on page 7.33.
`show log permanent`	Selects the show log permanent command on page 10.45.
`show log permanent tail`	Selects the tail parameter of the show log permanent command on page 10.45.
`show memory`	Selects the show memory command on page 8.39.
`show memory history`	Selects the history parameter of the show memory command on page 8.39.
`show memory sort peak`	Selects the sort and peak parameters of the show memory command on page 8.39.
`show memory sort size`	Selects the sort and size parameters of the show memory command on page 8.39.
`show memory sort stk`	Selects the sort and stk parameters of the show memory command on page 8.39.
`show process`	Selects the show process command on page 8.49.
`show process sort cpu`	Selects the sort and cpu parameters of the show process command on page 8.49.
`show process sort mem`	Selects the sort and mem parameters of the show process command on page 8.49.
`show stack`	Selects the show stack command on page 103.20.
`show stack detail`	Selects the details parameter of the show stack command on page 103.20.
`show system`	Selects the details parameter of the show stack command on page 103.20.
`show system environment`	Selects the show system command on page 8.53.
`show system pluggable`	Selects the pluggable parameter of the show system command on page 8.53.
`show system serialnumber`	Selects the serialnumber parameter of the show system command on page 8.53.

Default None

Mode Privileged Exec, and can be also be used in the same mode as the equivalent non-remote command.

Usage This command is used only from the master to execute a command subset that is specific to stack members. If the member ID is not used by any current stack member, the command will be rejected.

Example To execute the show system command on stack member 2, use the command:

```
awplus# remote-command 2 show system
```

remote-login

This command is used only on the master in order to log onto the CLI of another stack member. In most respects the result of this similar to being logged into the stack master. Configuration commands are still applied to all stack members, but show commands, and commands that access the file system are executed locally.

The specific output obtained will vary greatly depending on the show command chosen.

Syntax `remote-login (<1-8>`

Parameter	Description
<1-8>	The specific stack member whose CLI is to be accessed.

Mode Privileged Exec

Usage Note that some commands such as ping or telnet are not available when the remote-login is used.

Example To log onto stack member 2, use the following command:

```
awplus# remote-login 2
```

To return to the command prompt on the master stack member, type exit.

show counter stack

Use this command to display Virtual Chassis Stack (VCStack) related counter information.

Syntax `show counter stack`

Default All counters are reset when the stack member is rebooted.

Mode User Exec and Privileged Exec

Usage If this command is entered on the stack master, it will display all the stacking counter information for every stack member.

When used as a host-directed command, it will display only the stacking counter information for the specific stack member.

Examples To display the stacking counter information about the whole stack, use the following command on the stack master.

```
awplus# show counter stack
```

To display the stacking counter information about stack member 2, use the command:.

```
awplus# remote-command 2 show counter stack
```

Figure 103-1: Example output from the **show counter stack** command

```
Virtual Chassis Stacking counters

Stack member 1:

Topology Event counters
Units joined          ......... 1
Units left            ......... 0
Links up              ......... 1
Links down            ......... 0
ID conflict           ......... 0
Master conflict       ......... 0
Master failover       ......... 0
Master elected        ......... 1
Master discovered     ......... 0
SW autoupgrades       ......... 0

Stack Port 1 Topology Event counters
Link up               ......... 3
Link down             ......... 2
Nbr re-init           ......... 0
Nbr incompatible      ......... 0
Nbr 2way comms        ......... 1
Nbr full comms        ......... 1
```

Figure 103-1: Example output from the **show counter stack** command(cont.)

```
Stack Port 2 Topology Event counters
Link up                 ......... 0
Link down               ......... 0
Nbr re-init             ......... 0
Nbr incompatible        ......... 0
Nbr 2way comms          ......... 0
Nbr full comms          ......... 0

Topology Message counters
Tx Total                ......... 4
Tx Hellos               ......... 4
Tx Topo DB              ......... 0
Tx Topo update          ......... 0
Tx Link event           ......... 0
Tx Reinitialise         ......... 0
Tx Port 1               ......... 4
Tx Port 2               ......... 0
Tx 1-hop transport      ......... 4
Tx Layer-2 transport    ......... 0
Rx Total                ......... 1
Rx Hellos               ......... 1
Rx Topo DB              ......... 0
Rx Topo update          ......... 0
Rx Link event           ......... 0
Rx Reinitialise         ......... 0
Rx Port 1               ......... 1
Rx Port 2               ......... 0
Rx 1-hop transport      ......... 1
Rx Layer-2 transport    ......... 0

Topology Error counters
Version unsupported     ......... 0
Product unsupported     ......... 0
XEM unsupported         ......... 0
Too many units          ......... 0
Invalid messages        ......... 0


Resiliency Link counters
Health status good      ......... 1
Health status bad       ......... 0
Tx                      ......... 0
Tx Error                ......... 0
Rx                      ...... 3600
Rx Error                ......... 0

Stack member 2:

-- Output repeated for other stack members - details not shown--
```

Table 103-1: Parameters in the output of the **show counter stack** command

Parameters	Description
Topology Event Counters	
Units joined	Number of times that the stack acquires a member.
Units left	Number of times that the stack loses a member.
Links up	Number of times that a stack link is up in the stack.
Links down	Number of times that a stack link is down in the stack.
ID conflict	Number of times that stack member ID conflicts.
Master conflict	Number of times that stack master conflict occurs.
Master failover	Number of times that stack master fails.

Table 103-1: Parameters in the output of the **show counter stack** command(cont.)

Parameters	Description
`Master elected`	Number of times that stack master is elected.
`Master discovered`	Number of times that stack master is discovered.
`SW autoupgrades`	Number of times that the software in the stack members are auto upgraded.
`Stack port counters`	
`Link up`	Number of times that this unit's physical stack link has come up.
`Link down`	Number of times that this unit's physical stack link has come down.
`Nbr re-init`	Number of times that the neighbor is detected as having reinitialised.
`Nbr incompatible`	Number of times that the neighbor is detected as incompatible.
`Nbr 2way comms`	Number of times that the neighbor is in two way communication. status.
`Nbr full comms`	Number of times that the neighbor is in full communication status.
`Topology message counters`	
`Total`	Number of total topology messages.
`Hellos`	Number of hello messages.
`Topology DB`	Number of topology database messages.
`Topology update`	Number of topology database update messages.
`Link event`	Number of link events messages.
`Reinitialise`	Number of reinitialise messages.
`1-hop transport`	Number of 1-hop transport messages.
`Layer-2 transport`	Number of layer 2 transport messages.
`Link event`	Number of link events messages.
`Reinitialise`	Number of reinitialise messages.
`1-hop transport`	Number of 1-hop transport messages.
`Layer-2 transport`	Number of layer 2 transport messages.
`Topology error counters`	Reasons why a neighboring unit could not join the stack.
`Version unsupported`	Number of stack software version unsupported errors.
`Product unsupported`	Number of Product unsupported errors.
`XEM unsupported`	Number of XEM unsupported errors.
`Too many units`	Number of too may units errors.

Table 103-1: Parameters in the output of the **show counter stack** command(cont.)

Parameters	Description
`Invalid messages`	Number of invalid messages.
`Health status good`	The number of times that the resiliency link has successfully carried healthchecks following a failure at startup.
`Health status bad`	The number of times that the resiliency link healthcheck has timed out. A timeout occurs when a backup stack member detects a delay greater than two seconds between healthcheck messages received.
`Rx`	The total number of healthcheck messages that a stack member has received from the stack master.
`Rx Error`	The total number of invalid healthcheck messages that have been received from the master. This message is not applicable to the stack master.

Related Commands show stack

show debugging stack

This command shows which debugging modes are currently enabled for virtual chassis stacking.

Syntax `show debugging stack`

Mode User Exec and Privileged Exec

Usage To display the stack debugging mode status, use the command:

```
awplus# show debugging stack
```

Figure 103-2: Example output from the show debugging stack command

```
Virtual Chassis Stacking debugging status:
  VCS link debugging is on
  VCS topology debugging is on
  VCS trace debugging is on
```

Related Commands debug stack
remote-command

show license member

Use this command to display information about either a specific software license, or all software feature licenses enabled on either a specific stack member or all stack members.

Syntax `show license [<name>] [brief] member [<1-8>|all]`

Parameter	Description
`<name>`	The name of the license to show information about.
`brief`	Display a brief summary of license information.
`<1-8>`	The ID of the stack member to show information about.
`all`	Display information about all stack members.

Mode User Exec and Privileged Exec

Examples To display a brief summary of information about all enabled licenses on stack member 2, use the command:

```
awplus# show license brief member 2
```

To display full information about all enabled licenses on all stack members, use the command:

```
awplus# show license member all
```

To display full information about the license `name1` on all stack members, use the command:

```
awplus# show license name1 member all
```

Output Figure 103-3: Example output from the **show license member** command

```
awplus#show license index member 1
Stack Member 1
OEM Territory: ATKK
Software Feature Licenses
-----------------------------------------------------------------
Index                          : 0
License name                   : Base License
Customer name                  : Base License
Quantity of licenses           : 1
Type of license                : Full
License issue date             : 07-Jul-2000
License expiry date            : N/A
Features included              : OSPF-64, VRRP
```

Table 103-2: Parameters in the output of the **show license member** command

Parameter	Description
Index	Index identifying entry.
License name	Name of the license key bundle (case-sensitive).
Customer name	Customer name.
Quantity of licenses	Quantity of licensed installations.
Type of license	Full or Temporary.
License issue date	Date the license was generated.
License expiry date	Expiry date for temporary license.
Features included	List of features included in the license.

Figure 103-4: Example output from the **show license brief member <*1-8*>** command

```
awplus#show license brief member 2
Stack Member 2
OEM Territory: ATKK
Software Feature Licenses
-----------------------------------------------------------------
Index License name    Quantity     Customer name
      Type                        Period
-----------------------------------------------------------------
0     Base License    1            Base License
      Full                         N/A

Current enabled features for displayed licenses:
 OSPF-64, VRRP
```

Table 103-3: Parameters in the output of the **show license brief member** command

Parameter	Description
Index	Index identifying entry.
License name	Name of the license key bundle (case-sensitive).
Quantity	Quantity of licensed installations.
Customer name	Customer name.
Type	Full or Temporary.
Period	Expiry date for temporary license.
Current enabled features for displayed licenses	List of features included in the license.

Related Commands

license
license member
show license

show running-config stack

Use this command to display the running system information specific to the virtual chassis stack.

```
show running-config stack
```

Mode Privileged Exec and Global Configuration

Example To display the stacking running configuration information, use the command:

```
awplus# show running-config stack
```

Output Figure 103-5: Example output from the **show running-config stack** command

```
stack management vlan 4000
stack management subnet 192.168.0.0
stack resiliencylink eth0
no stack 1 software-auto-synchronize
no stack 4 software-auto-synchronize
stack 2 priority 0
```

Related Commands remote-command
show running-config

show provisioning (stack-member)

Use this command to display the provisioning status of all installed or provisioned hardware. Provisioning is the preconfiguration necessary to accommodate future connection of hardware items such as a switch.

Syntax `show provisioning`

Mode User Exec and Privileged Exec

Example To show provisioning, use the following command:

```
awplus# show provisioning
```

Output Figure 103-6: Example output from the **show provisioning** command

```
Switch provisioning summary information

ID  Board class Status
1.0 x908        Hardware present
1.1 xem-12      Provisioned
1.4 xem-2       Hardware present
1.5 xem-1       Provisioned
```

Table 103-4: Parameters in the output of the **show provisioning** command

Parameter	Description
`ID`	The unit.bay-location of the hardware provision.
`Board class`	The hardware type.
`Status`	The provisioned state: ■ Hardware Present means that the hardware is currently installed in the stack. ■ Provisioned means that although the hardware is not currently installed; the stack is preconfigured ready to accept the hardware installation.

Related Commands show stack
switch provision

show stack

Use this command to display information about current stack members.

Syntax `show stack [detail]`

Parameter	Description
`detail`	Display detailed stacking information.

Default Display summary information only.

Mode User Exec and Privileged Exec

Usage This command displays information about current stack members. If the detail parameter is specified, additional information will be displayed for each stack member. By default, only summary information is displayed.

This command can be entered on any stack member as a host-directed command. However, all stack members display the same stacking information.

Examples To display basic information about the stack, use the command:

```
awplus# show stack
```

To display the detailed stacking information about the whole stack:

```
awplus# show stack detail
```

Output Figure 103-7: Example output from the **show stack** command

```
Virtual Chassis Stacking summary information

ID  Pending ID  MAC address       Priority  Status  Role
1   -           0000.cd28.07e1    128       Ready   Active Master
2   -           0015.77c2.4d44    128       Ready   Backup Member

Operational Status                Normal operation
Stack MAC address                 0000.cd28.07e1
```

Table 103-5: Parameters in the output from the **show stack** command

Parameter	Description
`ID`	Stack member ID
`MAC address`	Stack member MAC address
`Priority`	Stack member master election priority (between 0 and 255) Note that the lowest number has the highest priority.
`Role`	Stack member's role in the stack, this can be one of: ■ Active Master. ■ Disabled Master (The temporary master when there is a communication break within the stack, but communication still exists across the resiliency link. In this state all switch ports within the stack are disabled by default, but a different configuration can be run by a "type stack disabled-master" trigger). ■ Backup Member (A device other than the stack master). ■ Provisioned - Indicates that the stack position is provisionally configured, i.e. ready to accept a particular switch type into the stack.

Figure 103-8: Example output from the **show stack detail** command

```
Virtual Chassis Stacking detailed information

Stack Status:
-----------------------------------------------------------------
Operational Status                      Normal operation
Management VLAN ID                      4094
Management VLAN subnet address          192.168.255.0
Virtual Chassis ID                      388 (0x184)
Virtual MAC address                     0000.cd37.0184
Disabled Master Monitoring              Enabled

Stack member 1:
-----------------------------------------------------------------
ID                                      1
Pending ID                              -
MAC address                             0000.cd28.070d
Last role change                        Wed May  7 22:31:58 2008
Product type                            SwitchBlade x908
SwitchBlade x908 Stacking Ports         Disabled (XEM-STK
Present)
Role                                    Active Master
Priority                                128
Host name                               awplus
S/W version auto synchronizaion         On
Resiliency link status                  Configured
Stack port 1.1.1 status                 Learnt neighbor 2
Stack port 1.1.2 status                 Learnt neighbor 2

Stack member 2:
-----------------------------------------------------------------
ID                                      2
Pending ID                              -
MAC address                             0000.cd29.716d
Last role change                        Wed May  7 23:47:21 2008
Product type                            SwitchBlade x908
SwitchBlade x908 Stacking Ports         Disabled (XEM-STK
Present)
Role                                    Backup Member
Status                                  Ready
Priority                                128
Host name                               awplus-2
S/W version auto synchronization        On
Resiliency link status                  Successful
Stack port 2.1.1 status                 Learnt neighbor 1
Stack port 2.1.2 status                 Learnt neighbor 1
```

Table 103-6: Parameters in the output from the **show stack detail** command

Parameter	Description
`Auto upgrade`	Whether the software-auto-configuration feature is turned on, or off.
`Host name`	The host name of the stack member.
`ID`	The stack member ID.
`Last Role Change`	The date and time with the stack member last changed its role in the stack.
`MAC address`	Stack member MAC address.
`Management VLAN ID`	The VLAN ID currently used for stack management: Default is 4094.
`Management VLAN subnet address`	The current stacking management VLAN subnet address.
`Virtual Chassis ID`	The Virtual Chassis ID determines the last 12 bits of the Virtual MAC address: `0000.cd37.0xxx`
`Virtual MAC Address`	The Virtual MAC address of the stack.
`Disabled Master Monitoring`	The current Disabled Master Monitoring status. This can be: ■ Enabled ■ Disabled ■ Inactive
`Operational Status`	The status of the stack - either enabled or disabled.
`Stack Status`	The stack's overall status. Note that a warning is issued if the stack is not connected in a standard ring topology.
`Pending ID`	The pending stack member ID. This can be changed by the stack renumber command on page 103.32. If there is no pending ID, the "–" symbol will display.
`Stack port status`	The status of the stack port. This can be: ■ Down - neighbor incompatible ■ Discovering neighbor, or Learnt neighbor *<neighbor member = ""id>=""">*
`Priority`	Stack member master election priority (between 1 and 255) Note that the lowest number has the highest priority.
`Product Type`	Stack member product type. For example, switchblade x908.
`Switchblade x908 Stacking Ports`	This shows the status of the chassis rear stacking port, only on the SwitchBlade x908.
`Provisioned`	Indicates that the stack position is provisionally configured, i.e. ready to accept a particular switch type into the stack.

Table 103-6: Parameters in the output from the **show stack detail** command(cont.)

Parameter	Description
`Resiliency link status`	The current status of the resiliency link. The status can be one of: ■ Not configured, (Master or Member). ■ Configured (Master only). ■ Successful: Successfully receiving healthchecks from the Active Master. ■ Failed (Member only): Not receiving any healthchecks from the Active Master. ■ Stopped: The resiliency link is configured, but is inactive. This may occur in a Disabled Master stack, for example if the Disabled Master Monitoring feature is not used.
`Role`	Stack member's role in the stack, this can be one of: ■ Active Master. ■ Disabled Master (The temporary master when there is a communication break within the stack, but communication still exists across the resiliency link. In this state all switch ports within the stack are disabled by default, but a different configuration can be run by a "type stack disabled-master" trigger command). ■ Backup Member (a device other than the stack master). ■ Discovering - joining the stack.
`Status`	Indicates how readily a stack member can take over as master if the current stack master were to fail. ■ Init - the stack member is completing the startup initialization. ■ Syncing - the stack member is synchronizing state information with the stack master following startup. ■ Ready - the stack member is fully synchronized with the current master and is ready to take over immediately.

Related Commands

show counter stack
show stack resiliencylink
stack disabled-master-monitoring
stack resiliencylink
stack software-auto-synchronize

show stack resiliencylink

Use this command to display information about the current status of the resiliency-link across the members of the stack.

```
show stack resiliencylink
```

Mode User Exec and Privileged Exec

Example To display information about the current status of the resiliency-link across the stack members, use the command:

```
awplus# show stack resiliencylink
```

Output Figure 103-9: Example output from the **show stack resiliencylink** command

```
awplus(config)# show stack resiliencylink
Stack member 1:
---------------------------------------------------------
Status                          Configured
Interface                       vlan4093
Interface state                 UP
Resiliency-link port(s)         port1.2.11

Stack member 2:
---------------------------------------------------------
Status                          Successful
Interface                       vlan4093
Interface state                 UP
Resiliency-link port(s)         port2.2.11
```

Table 103-7: Parameters in the output of the **show stack resiliencylink** command

Parameter	Description
`Status`	The current status of the stack member's resiliency link. Can be one of: ■ Not configured, (Master or Member). ■ Configured (Master only). ■ Successful: Successfully receiving healthchecks from the Active Master. ■ Failed (Member only): Not receiving any healthchecks from the Active Master. ■ Stopped: The resiliency link is configured, but is inactive. This may occur in a Disabled Master stack, for example if the Disabled Master Monitoring feature is not used.
`Interface`	The name of the eth0 or VLAN interface that is connected to the resiliency link.
`Interface state`	The current status of the interface. Can be one of: ■ Up ■ Down
`Resiliency-link port(s)`	The switch port(s) the resiliency link is connected to.

See Also show stack detail
stack resiliencylink
switchport resiliencylink

stack disabled-master-monitoring

This command enables the Disabled Master Monitoring (DMM) feature. If a stack member becomes a disabled master, the DMM feature will use the stack resiliency link to continue monitoring the health of the separated stack master.

Use the no variant of this command to disable the DMM feature.

Syntax

```
stack disabled-master-monitoring
no stack disabled-master-monitoring
```

Default By default, Disabled Master Monitoring is enabled. However, it only operates if there is a resiliency link.

Mode Global Configuration

Usage This command enables additional stack resiliency link functionality, which is used if a stack separation occurs. For DDM to operate, a resiliency link must also be configured (stack resiliencylink command on page 103.34). A stack separation could result in a stack member becoming a disabled master, which has the configuration as a normal stack master except that all its switchports are shutdown.

For more information about the disabled master state, see "Disabled Master" on page 102.17.

When the DMM feature is enabled, the disabled master will continue to monitor the health of the original stack master over the stack resiliency link connection. If the original stack master were to fail, when the DMM feature is enabled, then the disabled master will detect this and will automatically re-enable its switchports. This ensures that the stack will continue to pass network traffic, even if a catastrophic stack failure occurs.

For more information about the DMM feature when the stack member is a disabled master, see "Disabled Master Monitoring (DMM)" on page 102.18.

Examples To enable the DMM feature, use the following commands:

```
awplus# configure terminal
awplus(config)# stack disabled-master-monitoring
```

To disable the DMM feature, use the following commands:

```
awplus# configure terminal
awplus(config)# no stack disabled-master-monitoring
```

Related Commands show stack
stack resiliencylink
type stack disabled-master
type stack master-fail

stack enable

This command is used on a stackable stand-alone switch to manually turn on the virtual chassis stacking feature and XEM-STK links.

By default, the VCStack feature starts automatically at the device start-up when XEM-STK is detected.

This command is run on a switch that has previously been removed from the stack (by using the no variant of this command) in order to return its stack membership member.

The no variant of this command will remove a selected stack member switch from the virtual chassis stack.

Syntax

```
stack enable

no stack <1-8> enable
```

Mode Global Configuration

Usage Running the no variant of this command will remove the selected stack member from the VCStack. At this point the removed member will act as a stand-alone master and will disable all of its ports. The switch can then only be accessed via its console port.

To return the switch to stack membership, you first run the stack enable command. Note that to do this you must direct connectivity via the console port. Then you must run the reboot command on page 8.23. This will reboot the switch and it will re-join the stack as an ordinary member.

If the switch was previously the stack master, you might want to return it to its original stack master status. To do this you must run the reboot command on page 8.23 again. This time—because the switch is now a stack member—the command will reboot the whole stack and generate the master election processes. See the following notes.

Note the following conditions of applying the no stack <*1-8*> enable command:

- If the specified member is a stack master, and no resiliency link is configured, this command will be rejected.
- If the specified member ID is not used by any current stack member, the command will be rejected.

Caution

Disabling a stack member can significantly degrade the throughput capability of the stack.

Example To turn on stacking on a stackable stand-alone unit, use the command:

```
awplus# configure terminal
awplus(config)# stack enable
```

Related Commands reboot

stack fallback-config (Disabled)

This command has been disabled. To simplify stack recovery, stub reconfiguration is now achieved by using a trigger that is generated by the type stack disabled-master command on page 97.26.

This command is used to set the fallback configuration file to use if the stack splits into stubs due to connectivity failures.

Syntax

```
stack fallback-config <url>

no stack fallback-config
```

Parameter	Description
<url>	The URL of the stack fallback configuration file.

Mode Global Configuration

Usage This command is used to select the fallback configuration file to be used if a connectivity fault causes the stack splits into stubs. The stack splits into stubs when:

- connectivity is lost between stack members and the stack master across the inter-stack connection.
- the stack master is assumed to be still online, but is no longer reachable by all stack members.

In a stub scenario, the remaining stack members cannot use the same stack configuration, because this will result in potential configuration conflicts, particularly where static channels terminate on different stacking units.

The fallback-config allows the remaining stack members to continue processing network traffic to some degree, without clashing with the existing stack's configuration. Configuring a fallback-configuration also means that the isolated stub members can still be accessible via a management IP address, and so can be re-configured on the fly.

Caution

It is important that any ports that are configured as trunked ports across master and stack members are disabled at their stack member termination when operating in the fallback configuration. Otherwise, the trunked ports will not function correctly on the switch that is connected downstream.

Example

```
awplus# configure terminal
awplus(config)# stack fallback-config flash:/stk_stb.conf
```

Related Commands stack resiliencylink

stack management subnet

This command configures the stack's VLAN subnet management address.

Use the no variant of this command to reset the stack's VLAN subnet management address back to the default address and mask (192.168.255.0/28).

Syntax

```
stack management subnet <ip-address>
no stack management subnet
```

Parameter	Description
<ip-address>	The new subnet address for VCStack management VLAN.

Default The default stacking management VLAN subnet address is 192.168.255.0 with a subnet mask 255.255.255.240 or /28.

Mode Global Configuration

Usage This command is used only in the master and configures the stack management VLAN subnet address.

The management VLAN will be used for high speed communication between stacked units via the inter-stack connection. Although this command enables you to change the IP address command, the subnet mask must always remain as shown.

The VCStack management IP subnet is solely used internally to the stacked devices, and cannot be reached external to the stack. You should only change the VCStack management VLAN subnet address if it causes a conflict within your network.

Note that several separate stacks can use the same default management VLAN subnet address even though their user ports may share the same external network. If the VCStack subnet address is changed, then the configuration for any new units must also be updated before they are inserted into the stack.

If the management VLAN subnet address is changed by this command, you can use the no variant of this command reset it to its default.

Example To set the management VLAN subnet address to 192.168.255.144:

```
awplus# configure terminal
awplus(config)# stack management subnet 192.168.255.144
```

Related Commands stack management vlan

stack management vlan

Use this command to configure the virtual stack management VLAN ID. It can only be entered from the stack master.

Use the no variant of this command to change the virtual stack management VLAN ID back to the default (VLAN ID 4094).

Syntax

```
stack management vlan <2-4094>
no stack management vlan
```

Parameter	Description
<2-4094>	VCStack management VLAN ID. The default is 4094.

Default The default VCStack management VLAN ID is 4094.

Mode Global Configuration

Usage This command is used only in the master and configures the VCStack management VLAN ID.

The management VLAN is used for high speed communication between stacked units via the XEM-STK or the two back panel stacking ports (SwitchBlade® x908 only). This command enables you to change the ID of this VLAN.

The default stacking management VLAN ID is 4094, which is the last configurable VLAN ID in the switch.

The VCStack management VLAN is created and configured automatically so that the VCStack VLAN cannot be used in the stack's VLAN configuration commands (such as `awplus(config-vlan)# vlan <VCS management VLAN ID>`).

The management VLAN should only be changed if the default VCStack VLAN ID needs to be used in the stack's VLAN configuration.

Caution

When the command is entered, the updated management VLAN configuration will take effect once the stack is restarted.

If the management VLAN ID is changed by this command, you can use the no variant of this command to change it back to default value.

Examples To set the management VLAN to 4000, enter the following commands:

```
awplus# configure terminal
awplus(config)# stack management vlan 4000
```

To reset the management VLAN back to the default (4094), enter the following commands:

```
awplus# configure terminal
awplus(config)# no stack management vlan
```

Related Commands stack management subnet

stack priority

Use this command to changes a specific stack member's stack ID and its master-election priority.

Syntax

```
stack <1-8> priority <0-255>
no stack <1-8> priority
```

Parameter	Description
<1-8>	The ID of the stack member that needs to be configured.
`priority`	The stack member's election priority value.
<0-255>	The stack member's new priority value. The lowest value is assigned the highest priority. The default is 128.

Mode Global Configuration

Usage This command is used to change the value of a specific stack member's master-election priority. If the specified member ID is not used by any current stack member, the command will be rejected.

The election criteria selects the stack member with the lowest priority value to become the stack master. Where two stack members both have the same lowest priority value, then the stack member with the lowest MAC address will be elected as master.

Note

Assigning a new priority value will not immediately change the current stack master. In order to force a master re-election after the new priority value is assigned, use reboot stack-member <master's ID> to reboot the current stack master, a new stack master will then be elected based on the new priority values.

Example To change the priority of stack member 4 to be 2, use the commands:

```
awplus# configure terminal
awplus(config)# stack 4 priority 2
```

Validation Command show stack

stack renumber

Use this command to change the ID of a specific stack member.

Syntax `stack <member's-existingID> renumber <member's-newID>`

Parameter	Description
<member's-existingID>	The the stack member ID to be renumbered - also referred to as the "current member ID". Can have a value in the range 1 to 8. We recommend that you use only numbers 1 & 2.
`renumber`	Change the existing stack member ID.
<member's-newID>	The stack member's new ID - also referred to as the new member ID. Can have a value in the range 1 to 8. We recommend that you use only numbers 1 & 2. Note that when operating two member stacks, we advise using stack IDs 1 and 2.

Default Every stack unit will initially try to use stack member ID of 1.

Mode Global Configuration

Usage This command is used to change the ID of a specific stack member - primarily when exchanging stack members. The changes made by this command will not take effect until the switch is rebooted.

Note
This command does not alter any of the stacks's existing configuration, apart from the member-ID specified. For example, if stack member 2 were removed from the stack and a new stack unit is assigned the member 2 stack ID then the interface configuration that existed for the removed stack member 2 will be applied to the new stack member 2.

The *current member ID* must already be assigned to an existing stack member. To avoid duplicating IDs, a warning message will appear if you assign a *new member ID* that is currently assigned to another stack member. However, you can continue to rename the stack member IDs and remove ID duplications. If you do not remove the duplications, then the device with the highest root priority will be allocated this ID. Once you have removed any duplicate IDs, you can reboot the switch to implement your changes.

Note that the configured member-ID is saved immediately on the renumbered member, and so is not reliant on using the copy running-config command for it to take effect

Example To change the stack member ID 2 to be member ID 3, use the commands:

```
awplus# configure terminal
awplus(config)# stack 2 renumber 3
```

Validation Command show stack

stack renumber cascade

This command is used to renumber the members of a stack so that their IDs are ordered sequentially, relative to the member's physical position within the stack.

Caution

Changing the stack numbering will upset the existing stack member configurations such as port settings etc. This command is intended for use when the stack is either initially commissioned, or has undergone a major reconfiguration. In this situation you run the stack renumber command (which will automatically reboot the switch), then configure the stack members to meet the new requirements.

Syntax `stack <1-8> renumber cascade [<1-8>]`

Parameter	Description
<1-8>	The ID of the stack member to start renumbering from.
`renumber`	Change the existing stack member ID.
`cascade`	Renumber the existing stack member ID in cascade order.
<1-8>	The new ID for the first member renumbered.

Default If no member-ID is specified, the member will take the default ID of 1.

Mode Global Configuration

Usage This command is used to renumber the members of a stack so that their member's IDs are ordered sequentially, based on physical order of the XEM-STK connections. This would normally be done either when the stack is initially configured or following a major reconfiguration.

This command is equivalent to pressing and holding the select button on the XEM-STK to renumber the stack members. The renumber will start on the specified stack member. If that member ID is not used by any of the existing stack member, the command will be rejected.

The starting stack member will be renumbered with the new member-ID specified, or the default of member ID of 1. The stack ID of the next physically will be the starting members ID +1, for example member ID 2. This renumbering will continue in cascading order around the stack members.

The changes will take place immediately and reboot all stack members. For this reason a confirmation prompt follows this command entry, asking whether you are sure you want to renumber and reboot the entire stack.

Example

```
awplus(config)# stack 1 renumber cascade
Any existing interface configuration may no longer be valid
Are you sure you want to renumber and reboot the entire stack?
(y/n): y
```

Related Commands show stack
stack renumber

stack resiliencylink

This command configures the resiliency link used by Virtual Chassis Stacking. The interface used may be either an eth0 port or a dedicated VLAN (resiliencylink VLAN) to which switch ports may become members. This VLAN is dedicated to the resiliency link function and must not be the stack management VLAN.

Syntax

```
stack resiliencylink <interface>

no stack resiliencylink
```

Parameters	Description
<interface>	The name of the interface that is connected to the resiliency link. This may be either the eth0 port or the resiliencylink VLAN.

Mode Global Configuration

Usage The resiliency-link is only used when a backup member loses connectivity with the master via the stacking cables. Such a communication loss would occur if:

- a XEM-STK is removed or fails,
- two or more XEM-STK cables are unplugged or fail,
- the stack master itself fails due to a reboot or power failure.

The resiliency-link allows the backup member to determine if the master is still present in the network by the reception of health-check messages sent by the master over the resiliency-link interface.

Reply health-check messages are received if the master is still online, but the stack will now split into two different 'stubs'. The stub containing the existing master will continue operating as normal. The members in the masterless stub will now use a “type stack disabled-master” trigger to run a configuration to form a second temporary stack. This utilizes the remaining stack members' resources without conflicting directly with the master's configuration. If no “type stack disabled-master” trigger was configured on the switches, then the masterless stub members will disable their switch ports.

If no health-check messages are received, then the master is assumed to be completely offline, and so the other stack members can safely take over the master's configuration.

Caution

The purpose of the resiliency link is to enable the stack members (particularly the backup master) to check the status of the master under fault conditions. If the resiliency link is not configured, and the master loses communication with its other stack members, then Virtual Chassis Stacking will assume the master is NOT present in the network, which could cause network conflicts if the master is still on line. Note that this is a change to the stacking of releases prior to version 5.3.1.

Example To set the resiliency link to be `eth0`:

```
awplus# configure terminal
awplus(config)# stack resiliencylink eth0
```

To set the resiliency link to be VLAN 4093.

First use the stack resiliencylink command to create the resiliency `vlan 4093`

```
awplus# configure terminal
awplus(config)# stack resiliencylink vlan4093
```

Next use the switchport resiliencylink command to assign the resiliencylink vlan to the interface port, in this case `port1.0.1`.

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# switchport resiliencylink
```

Related Commands

show stack
show stack resiliencylink
stack disabled-master-monitoring
switchport resiliencylink

stack software-auto-synchronize

This command is used only on the stack master and enables the software version auto-synchronization feature either on a specified stack member or all stack members and candidates. A stack candidate is a switch that is about to join a stack.

Use the no variant of this command to turn the software version auto synchronization feature off.

Syntax

```
stack {all|<1-8>} software-auto-synchronize
no stack {all|<1-8>} software-auto-synchronize
```

Parameter	Description
`all`	All stack members.
<1-8>	The ID of a stack member.

Default All the stack members have the stack software-auto-synchronize feature enabled by default.

Mode Global Configuration

Usage This command is used to enable the software version auto-synchronization feature for either a specific stack member or all stack members and candidates.

Note that if a stack candidate attempts to join a stack, but is running a software release that is different to the other stack members, then the software version auto-synchronization feature will copy the master's software release onto the new candidate. If the software version auto-synchronization feature is not enabled, then the candidate will be rejected from the stack.

Note that the software version auto-synchronization feature may also result in the stack candidate downgrading its software release if the master is running an older software version.

Examples To turn on the software-auto-synchronize feature on stack member 2, which was previously turned off, use the following commands:

```
awplus# configure terminal
awplus(config# stack 2 software-auto-synchronize
```

To turn on the software-auto-synchronize feature for all stack members, which were previously turned off, use the following commands:

```
awplus# configure terminal
awplus(config)# stack all software-auto-synchronize
```

Validation Command show stack

stack virtual-chassis-id

This command specifies the VCStack virtual chassis ID. The ID selected will determine which virtual MAC address the stack will use. The MAC address assigned to a stack must be unique within its network.

Note The command will not take effect until the switch has been rebooted.

Syntax

```
stack virtual-chassis-id <id>
```

Parameter	Description
<id>	The value of the ID - enter a number in the range 0 to 4095.

Mode Global Configuration

Usage The virtual-chassis-id entered will form the last 12 bits of a pre selected MAC prefix component; that is, `0000.cd37.0xxx`. If you enable the VCStack virtual MAC address feature (by using the stack virtual-mac command) without using the stack virtual-chassis-id command to select the virtual-chassis-id, then the stack will select a virtual-chassis-id from a number within the assigned range.

Example To set the stack virtual-chassis-id to 63 use the commands

```
awplus# configure terminal
awplus(config)# stack virtual-chassis-id 63
```

This will result in a virtual MAC address of: `0000.cd37.003f`.

Related Commands

show running-config
show stack detail
stack virtual-mac

stack virtual-mac

This command enables the VCStack virtual MAC address feature. For more information on this topic refer to "Fixed or Virtual MAC Addressing" on page 102.13. With this command set, the value applied for the virtual MAC address is determined by the setting of the command stack virtual-chassis-id command on page 103.37.

Note This command will not take effect until the switch has been rebooted.

Syntax

```
stack virtual-mac
no stack virtual mac
```

Mode Global Configuration

Example

```
awplus# configure terminal
awplus(config)# stack virtual mac
```

Related Commands

show running-config
show stack detail
stack virtual-chassis-id

switch provision

This command enables you provide the configuration for a new VCStack member switch prior to physically connecting it to the stack. To run this command, the stack position must be vacant. The selected hardware type must be compatible existing stack hardware.

Use the no variant of this command to remove an existing switch provision.

Syntax

```
switch <1-8> {provision|reprovision}{x900-12|x900-24|x908}
no switch <1-8> provision
```

Parameter	Description
<1-8>	The stack member switch position to be provisioned.
`provision`	Provides settings within the stack configuration ready for a specific switch type to become a stack member.
`reprovision`	Reconfigure an existing provision configuration.
`x900-12`	Provision an x900-12switch.
`x900-24`	Provision an x900-24 switch.
`x908`	Provision an x908 switch.

Mode Global Configuration

Examples x900: To reprovision the switch to be an x900-12 switch as stack member 2, use the following commands:

```
awplus# configure terminal
awplus(config)# switch 2 reprovision x900-12
```

x900: To remove the provision of the x900-12 switch as stack member 2, use the following commands:

```
awplus# configure terminal
awplus(config)# no switch 2 provision
```

Related Commands show provisioning (stack-member)

switchport resiliencylink

This command configures the switch port to be a member of the stack resiliency link VLAN. Note that this switchport will only be used for stack resiliency-link traffic and will not perform any other function, or carry any other traffic.

The no variant of this command removes the switchport from the resiliency link VLAN.

Syntax

```
switchport resiliencylink
no switchport resiliencylink
```

Mode Global Configuration

Examples To set the resiliency link to be VLAN 4093.

First use the stack resiliencylink command to create the resiliency `vlan4093`

```
awplus# configure terminal
awplus(config)# stack resiliencylink vlan4093
```

Next use the switchport resiliencylink command to assign the resiliencylink vlan to the 31 port, in this case `port1.0.1`.

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# switchport resiliencylink
```

See Also stack resiliencylink
show stack resiliencylink

undebug stack

This command applies the functionality of the no debug stack command on page 103.4.

Appendix A: Command List

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Appendix B: Changes in Version 5.4.2-0.1

This appendix lists the changes made in Version 5.4.2.

- New or Changed Features: (Table B-1 on page B.1)
- New or Changed Commands: (Table B-2 on page B.4)
- New or Changed SNMP MIBs: (Table B-3 on page B.36)

Clicking on a topic in the Feature column will take you to the appropriate section of the manual.

Table B-1: New or Change Features

Feature	Status	Chapter / Section	Description
Extended VRF-Lite Support Environments	Modified	VRF-Lite Introduction and Configuration	VRF-Lite now also supports the following features: VLAN Tagging with Multiple VRF-Lite Instances, VCStack (Virtual Chassis Stacking), “route limits,” and user-configurable static and dynamic routing resource limits that can be applied on a per-VRF basis.
The AlliedWare Plus TACACS+ Implementation	Modified	TACACS+ Introduction and Configuration	The AlliedWare Plus™ TACACS+ implementation now supports TACACS+ accounting. In addition, support for TACACS+ enable password authentication has been added.
Trouble-shoot fiber and pluggable issues	New	Getting Started	You can now trouble-shoot fiber cable and pluggable issues with diagnostic information about installed XFP and SFP pluggable transceivers, where SFPs are installed in the switch that support DDM (Digital Diagnostic Monitoring) functionality and XFPs are installed in the switch that support DOM (Digital Optical Monitoring) functionality.
The Autoboot Feature	New	Creating and Managing Files	The Autoboot feature enables the device to automatically load a specific release file and/or configuration file from external media, such as an SD card, into Flash memory. The Autoboot feature is disabled by default.
PIM-SSM	New	PIM-SM Introduction and Configuration	Protocol Independent Multicast - Source Specific Multicast (PIM-SSM) is supported in this software version.
Introduction	New	EPSR Introduction and Configuration	Where interlinked EPSR rings share a common segment and common data VLANs, a break in the common segment can result in a path loop existing around the rings. Loop Protection avoids this problem by applying priorities to the master node ring ports. These priorities modify the blocking behavior of these ports if a break occurs in the shared segment.

Table B-1: New or Change Features(cont.)

Feature	Status	Chapter / Section	Description
IPv6 enhancements	New	IPv6 Introduction NTP Introduction and Configuration Dynamic Host Configuration Protocol (DHCP) Introduction Internet Protocol (IP) Addressing and Protocols	IPv6 on the switches now supports: ■ IPv6 RA Guard Because an entire IPv6 network configuration can be modified by what is contained in Router Advertisements, the network is vulnerable to rogue messages that are generated either through misconfiguration or due to a malicious attack. RA Guard (RFC6105) defends against these vulnerabilities by blocking RAs and redirects received from the untrusted hosts connected to untrusted ports. For more information, see the IPv6 Introduction chapter in the Software Reference. ■ NTP over IPv6 In addition to existing support for NTP via IPv4 addresses, NTP on the switch is now able to synchronize time via IPv6. NTP peer and NTP server addresses can now be specified in the form of IPv6 addresses. For more information, see the NTP Introduction and Configuration chapter in the Software Reference. ■ DHCP Relay over IPv6 While stateless address autoconfiguration is the IPv6 way of automatically configuring hosts' network information, it is not fully supported by some vendors, so Dynamic Host Configuration Protocol is still commonly used. Where the DHCPv6 server does not reside on the same IP subnet as its clients, a relay agent can act as an intermediate device between the two subnets. Alliedware Plus DHCP relay now supports IPv6 addresses, in addition to existing support for IPv4 addresses. For more information, see the Dynamic Host Configuration Protocol (DHCP) Introduction chapter in the Software Reference. ■ DNS Relay over IPv6 In addition to existing support for DNS relay via IPv4, you can now access a domain name server via an IPv6 network. For more information, see the Internet Protocol (IP) Addressing and Protocols chapter in the Software Reference.

Table B-1: New or Change Features(cont.)

Feature	Status	Chapter / Section	Description
Privilege level enhancements	Modified	User Access Commands	AlliedWare Plus now supports 15 privilege levels, divided into 3 groups: ■ levels 1-6 provide access to most show commands, in User Exec mode ■ levels 7-14 provide access to some more show commands, in Privileged Exec mode ■ level 15 provides access to some additional show commands and all configuration commands, in Privileged Exec mode Network administrators can now control user access to each privilege level by configuring separate enable passwords for each privilege level, and configuring each user's initial privilege level (for locally configured users). Users can move from their initial privilege level to a higher level by entering the enable command, specifying a privilege level, and entering that level's password. These enhancements mean that network administrators can manage user access rights to network devices more effectively than was previously possible. The following command changes are introduced to support these enhancements: ■ For the username command, the meaning of the level parameter has changed. This is now the maximum privilege level that you can access without having to enter an enable password. ■ The enable password and enable secret commands now store up to 15 different passwords. You can enter these passwords to access privilege levels greater than their configured privilege level. You can not access levels above your configured privilege level unless an enable password has been configured for that level. ■ The enable commands now take an optional level parameter that specifies which level you want to access. ■ A new command enables AAA authentication to determine the privilege level that you can access for passwords authenticated locally. See the aaa authentication enable default local command in the chapter, AAA Commands. ■ Many show commands that were previously available at privilege level 7 are now available at privilege level 1 or 15 instead. ■ As before, you can display your current privilege level. See the show privilege command in the chapter, User Access Commands chapter.

Table B-1: New or Change Features(cont.)

Feature	Status	Chapter / Section	Description
Superloop Protection	New	EPSR Introduction and Configuration	Where interlinked EPSR rings share a common segment and data VLANs, a break in the common segment can result in a path loop around the rings. Superloop Protection avoids this problem by modify the blocking behavior of these ports when this condition occurs.

Table B-2: New or Changed Commands

Feature		Status	Chapter / Section	Description
enable (Privileged Exec mode)	Command	Modified	CLI Navigation Commands	You can now optionally set the privilege level for a session with this command, as well as entering the Privileged Exec mode. If the privilege level is omitted then only users with the maximum privilege level can access Privileged Exec mode without providing the password as specified by the enable password or enable secret commands. If no password is specified then only users with the maximum privilege level set with the username command can assess Privileged Exec mode.
show history	Command	Modified	CLI Navigation Commands	You can now access this command from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
enable password	Command	Modified	User Access Commands	You can now set a local password to control access to various privilege levels with this command. Note that the enable secret command is an alias for the enable password command, and the no enable secret command is an alias for the no enable password command.
enable secret	Command	Modified	User Access Commands	You can now set a local password to control access to various privilege levels with this command. Note that the enable secret command is an alias for the enable password command, and the no enable secret command is an alias for the no enable password command. Note that if this command is entered then enable password is shown in the configuration.
flowcontrol hardware (asyn/ console)	Command	New	User Access Commands	With this command you can now enable and disable RTS/CTS (Ready To Send/Clear To Send) hardware flow control on a terminal console line (asyn port) between the DTE (Data Terminal Equipment) and the DCE (Data Communications Equipment).
show telnet	Command	Modified	User Access Commands	You can now access this command from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
terminal resize	Command	New	User Access Commands	Use this command to automatically adjust the number of rows of output on the console that the device will display before pausing, to the number of rows configured on the user's terminal.
autoboot enable	Command	New	File Management Commands	Use this command to enable the device to restore a release file and/or a configuration file from external media.
create autoboot	Command	New	File Management Commands	Use this command to create an autoboot.txt file on external media.
show autoboot	Command	New	File Management Commands	Use this command to display the Autoboot configuration and status.
show boot	Command	Modified	File Management Commands	This command now displays the status of the Autoboot feature.
show running-config	Command	Modified	File Management Commands	This command is available from the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show running-config interface	Command	Modified	File Management Commands	This command is available from the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show running-config lldp	Command	Modified	File Management Commands	This command is available from the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
max-fib-routes	Command	Modified	System Configuration and Monitoring Commands	This command now enables you to control the maximum number of FIB routes configured. It operates by providing parameters that enable you to configure preset maximums and warning message thresholds.
show cpu	Command	Modified	System Configuration and Monitoring Commands	You can now separately display CPU processes for individual stack members.
show cpu history	Command	Modified	System Configuration and Monitoring Commands	You can also display CPU process history for individual stack members.
show debugging	Command	Modified	System Configuration and Monitoring Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show diagnostic monitor pcsping	Command	Modified	System Configuration and Monitoring Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show memory	Command	Modified	System Configuration and Monitoring Commands	You can now additionally display CPU memory for individual stack members.

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show memory history	Command	Modified	System Configuration and Monitoring Commands	You can now additionally display CPU memory history for individual stack members.
show process	Command	Modified	System Configuration and Monitoring Commands	You can now run this command for individual stack members.
show router-id	Command	Modified	System Configuration and Monitoring Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show system pluggable	Command	Modified	System Configuration and Monitoring Commands	Support for SFP DDM (Digital Diagnostics Monitoring) and XFP DOM (Digital Optical Monitoring) has been added. You can now select all pluggables on the switch, or a single pluggable on the switch, or a range of pluggables on the switch with the optional <port-list> placeholder.
show system pluggable detail	Command	Modified	System Configuration and Monitoring Commands	Support for SFP DDM (Digital Diagnostics Monitoring) and XFP DOM (Digital Optical Monitoring) diagnostics has been added. You can now select eitehr a single, or all pluggables on the switch, or a range of pluggables on the switch with the optional <port-list> placeholder.
show system pluggable diagnostics	Command	New	System Configuration and Monitoring Commands	Support for SFP DDM (Digital Diagnostics Monitoring) and XFP DOM (Digital Optical Monitoring) diagnostics has been added. This command displays diagnostic information about the pluggable transceivers that are currently installed in your switch.
show counter log	Command	Modified	Logging Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show exception log	Command	Modified	Logging Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show log	Command	Modified	Logging Commands	This command is now available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration command mode prompt (awplus(config)#).
show log config	Command	Modified	Logging Commands	This command is now available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration command mode prompt (awplus(config)#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show log permanent	Command	Modified	Logging Commands	This command is now available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration command mode prompt (awplus(config)#).
clear mac address-table dynamic	Command	Modified	Switching Commands	Use this command to clear the filtering database of all entries learned for a selected MAC address, an MSTP instance, a switch port interface or a VLAN interface. This command now includes an optional MSTI instance for the switch port.
platform enhancedmode (deprecated)	Command	Deprecated	Switching Commands	This command has been replaced by the new platform silicon-profile command.
platform silicon-profile	Command	New	Switching Commands	This command replaces the deprecated command platform enhanced-mode. A new silicon profile option for a SwitchBlade x908 with all XEM-2XP, XEM-2XT, and XEM-2XS XEMs installed increases hardware table sizes.
show debugging loopprot	Command	Modified	Switching Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show debugging platform packet	Command	Modified	Switching Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show flowcontrol interface	Command	Modified	Switching Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show loop-protection	Command	Modified	Switching Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show mirror	Command	Modified	Switching Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show mirror interface	Command	Modified	Switching Commands	This command is now available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Interface Configuration command mode prompt (awplus(config-if)#).
show provisioning (xem-bay)	Command	Modified	Switching Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show storm-control	Command	Modified	Switching Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show vlan	Command	Modified	VLAN Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show vlan classifier group	Command	Modified	VLAN Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show vlan classifier group interface	Command	Modified	VLAN Commands	Use this command to display information about all switch port interfaces or a single switch port interface for all configured VLAN classifier groups.
show vlan classifier interface group	Command	Modified	VLAN Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show vlan classifier rule	Command	Modified	VLAN Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show vlan private-vlan	Command	Modified	VLAN Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
vlan classifier activate	Command	Modified	VLAN Commands	This command can now optionally associate a VLAN identifier with a VLAN classifier group. This command primarily associates and removes VLAN classifier groups with switch port interfaces in Interface Configuration.
vlan classifier rule ipv4	Command	Modified	VLAN Commands	You can now set up to twelve IPv4 subnet-based VLAN classifier rules. If you attempt to set more than twelve rules an error message is displayed.
vlan classifier rule proto	Command	Modified	VLAN Commands	You can now set up to twelve protocol type-based VLAN classifier rules. If you attempt to set more than twelve rules an error message is displayed.
clear spanning-tree statistics	Command	Modified	Spanning Tree Commands	You can now optionally specify an MSTI (Multiple Spanning Tree Instance) instance to clear MSTP BPDU statistics with this revised command.
instance priority (MSTP)	Command	Modified	Spanning Tree Commands	You can now specify <1-63> MSTIs for a switch port with this revised command to set the priority for the switch to become the root bridge for the specified MSTI.

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
instance vlan (MSTP)	Command	Modified	Spanning Tree Commands	The range of MSTIs for a switch port has increased from <1-15> to <1-63>. Use this command to create an MST Instance (MSTI), and associate the specified VLANs with it. An MSTI is a spanning tree instance that exists within an MST region (MSTR). An MSTR can contain up to 63 MSTIs.
show debugging mstp	Command	Modified	Spanning Tree Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show spanning-tree	Command	Modified	Spanning Tree Commands	This command is now available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Interface Configuration mode prompt (awplus(config-if)#).
show spanning-tree brief	Command	Modified	Spanning Tree Commands	This command is now available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Interface Configuration mode prompt (awplus(config-if)#).
show spanning-tree mst	Command	Modified	Spanning Tree Commands	This command is now available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Interface Configuration mode prompt (awplus(config-if)#).
show spanning-tree mst config	Command	Modified	Spanning Tree Commands	This command is now available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Interface Configuration mode prompt (awplus(config-if)#).
show spanning-tree mst detail	Command	Modified	Spanning Tree Commands	This command is now available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Interface Configuration mode prompt (awplus(config-if)#).
show spanning-tree mst detail interface	Command	Modified	Spanning Tree Commands	This command is now available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Interface Configuration mode prompt (awplus(config-if)#).
show spanning-tree mst instance	Command	Modified	Spanning Tree Commands	The range of MSTI instances for a switch port has increased from <1-15> to <1-63>. This command is now available from the User Exec command mode prompt (awplus>), Privileged Exec command mode prompt (awplus#) and Interface Configuration mode prompt (awplus(config-if)#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show spanning-tree mst instance interface	Command	Modified	Spanning Tree Commands	The range of MST instances for a switch port increased from <1-15> to <1-63>. This command is now also available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Interface Configuration mode prompt (awplus(config-if)#)
show spanning-tree mst interface	Command	Modified	Spanning Tree Commands	This command is now available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Interface Configuration mode prompt (awplus(config-if)#).
show spanning-tree mst detail interface	Command	Modified	Spanning Tree Commands	This command is now available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Interface Configuration mode prompt (awplus(config-if)#).
show spanning-tree statistics	Command	New	Spanning Tree Commands	This command displays BPDU (Bridge Protocol Data Unit) statistics for all spanning-tree instances, and all switch ports associated with all spanning-tree instances.
show spanning-tree statistics instance	Command	Modified	Spanning Tree Commands	The range of MSTI instances for a switch port increased from <1-15> to <1-63>. This command displays BPDU (Bridge Protocol Data Unit) statistics for the specified MST instance, and all switch ports associated with that MST instance.
show spanning-tree statistics instance interface	Command	Modified	Spanning Tree Commands	The range of MSTI instances for a switch port has increased from <1-15> to <1-63>. This command displays BPDU (Bridge Protocol Data Unit) statistics for the specified MST (Multiple Spanning Tree) instance and the specified switch port associated with that MST instance.
show spanning-tree statistics interface	Command	Modified	Spanning Tree Commands	The range of MSTI instances for a switch port increased from <1-15> to <1-63>. This command displays BPDU (Bridge Protocol Data Unit) statistics for the specified switch port, and all MST instances associated with that switch port.
show spanning-tree vlan range-index	Command	New	Spanning Tree Commands	Use this new command to display information about MST (Multiple Spanning Tree) instances and the VLANs associated with them including the VLAN range-index value for the switch.
spanning-tree mst instance	Command	Modified	Spanning Tree Commands	The range of MSTIs for a switch port has increased from <1-15> to <1-63>. Use this command to assign a Multiple Spanning Tree instance (MSTI) to a switch port or channel group.

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
spanning-tree mst instance path-cost	Command	Modified	Spanning Tree Commands	The range of MSTI instances for a switch port has increased from <1-15> to <1-63>. Use this command to set the cost of a path associated with a port, for the specified MSTI (Multiple Spanning Tree Instance) identifier.
spanning-tree mst instance priority	Command	Modified	Spanning Tree Commands	The range of MSTI instances for a switch port has increased from <1-15> to <1-63>. Use this command to set the port priority for an MST instance (MSTI).
spanning-tree mst instance restricted-role	Command	New	Spanning Tree Commands	This command enables the restricted role for an MSTI on a switch port. The “no”’ variant of this command disables the restricted role for an MSTI on a switch port allowing the switch port to become the root port in a spanning tree topology.
spanning-tree mst instance restricted-tcn	Command	New	Spanning Tree Commands	Use this new command in Interface Configuration mode to set the restricted TCN (Topology Change Notification) value to TRUE for the specified MSTI . Use the no variant of this command to reset the restricted TCN for the specified MSTI to the default value of FALSE.
show debugging lacp	Command	Modified	Link Aggregation Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show diagnostic channel-group	Command	Modified	Link Aggregation Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show etherchannel detail	Command	Modified	Link Aggregation Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show etherchannel summary	Command	Modified	Link Aggregation Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show lacp-counter	Command	Modified	Link Aggregation Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show lacp sys-id	Command	Modified	Link Aggregation Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show port etherchannel	Command	Modified	Link Aggregation Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show debugging gvrp	Command	Modified	GVRP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show gvrp configuration	Command	Modified	GVRP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show gvrp machine	Command	Modified	GVRP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show gvrp statistics	Command	Modified	GVRP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show gvrp timer	Command	Modified	GVRP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
arp opportunistic-nd	Command	New	IP Addressing and Protocol Commands	This command enables opportunistic neighbor discovery for the global ARP cache, or a specified named VRF instance. The no variant of this command disables opportunistic neighbor discovery Opportunistic neighbor discovery changes the behavior for unsolicited ARP packet forwarding on the switch.
ip name-server	Command	Modified	IP Addressing and Protocol Commands	This command now adds the IPv6 address of a DNS server to the device's list of servers. The DNS client on your device sends DNS queries to devices on this list when trying to resolve a DNS hostname.
show debugging ip dns forwarding	Command	Modified	IP Addressing and Protocol Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show debugging ip packet	Command	Modified	IP Addressing and Protocol Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show hosts	Command	Modified	IP Addressing and Protocol Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show debugging ip dns forwarding	Command	Modified	IP Addressing and Protocol Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show ip dns forwarding cache	Command	Modified	IP Addressing and Protocol Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip domain-list	Command	Modified	IP Addressing and Protocol Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip domain-name	Command	Modified	IP Addressing and Protocol Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip forwarding	Command	Modified	IP Addressing and Protocol Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip interface	Command	Modified	IP Addressing and Protocol Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip interface vrf	Command	Modified	IP Addressing and Protocol Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip irdp	Command	Modified	IP Addressing and Protocol Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip irdp interface	Command	Modified	IP Addressing and Protocol Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip name-server	Command	Modified	IP Addressing and Protocol Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
ipv6 address	Command	Modified	IPv6 Commands	You can now use this command to set the IPv6 address of a VLAN interface and enable IPv6 with an optional eui64 parameter to apply the MAC address of the interface. Note that the MAC address of the default VLAN is applied if the interface does not have a MAC address of its own when specifying the eui64 parameter.
ipv6 address autoconfig	Command	New	IPv6 Commands	Use this new command to enable IPv6 stateless address autoconfiguration (SLAAC) on an interface This configures an IPv6 address on an interface derived from the MAC address on the interface.

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
ipv6 enable	Command	Modified	IPv6 Commands	This revised command now enables IPv6 with a IPv6 link-local address not with an IPv6 global address. Use this command to enable IPv6 on an interface without an IPv6 global address set for the interface.
ipv6 nd current-hoplimit	Command	New	IPv6 Commands	Use this new command to specify the advertised current hop limit used between IPv6 Routers.
ipv6 nd minimum-ra-interval	Command	New	IPv6 Commands	Use this new command in Interface Configuration mode to set a minimum Router Advertisement (RA) interval for a VLAN interface. Use the no variant of this command in Interface Configuration mode to remove the minimum RA interval for a VLAN interface.
ipv6 nd prefix	Command	Modified	IPv6 Commands	The no-autoconfig and offlink parameters have been added to this command and its “no” varient. Use this command to specify the IPv6 prefix information that is advertised by the router advertisement for IPv6 address auto-configuration. Use the no parameter with this command to reset the IPv6 prefix.
ipv6 nd ra-interval	Command	Modified	IPv6 Commands	The Router Advertisements (RA) interval range has changed from <3-1800> seconds to <4-1800> seconds. Use this revised command to specify the interval between IPv6 RA transmissions. The no variant of this command resets the IPv6 RA interval to the default of 600 seconds.
ipv6 nd retransmission-time	Command	New	IPv6 Commands	Use this new command to specify the advertised retransmission interval for Neighbor Solicitation in milliseconds between IPv6 Routers.
ipv6 opportunistic-nd	Command	New	IPv6 Commands	Use this new command to enable opportunistic neighbor discovery for the global IPv6 ARP cache. Use the no variant of this command to disable opportunistic neighbor discovery for the global IPv6 ARP cache. Opportunistic neighbor discovery changes the behavior for unsolicited ARP packet forwarding on the switch.
show ipv6 forwarding	Command	Modified	IPv6 Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 interface brief	Command	Modified	IPv6 Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 neighbors	Command	Modified	IPv6 Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show ipv6 route	Command	Modified	IPv6 Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 route summary	Command	Modified	IPv6 Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip route	Command	Modified	Routing Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip route database	Command	Modified	Routing Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip route summary	Command	Modified	Routing Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show debugging rip	Command	Modified	RIP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip protocols rip	Command	Modified	RIP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip rip	Command	Modified	RIP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#)
show ip rip database	Command	Modified	RIP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip rip interface	Command	Modified	RIP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip rip vrf database	Command	Modified	RIP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip rip vrf interface	Command	Modified	RIP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show debugging ipv6 rip	Command	Modified	RIPng Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 protocols rip	Command	Modified	RIPng Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 rip	Command	Modified	RIPng Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 rip database	Command	Modified	RIPng Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 rip interface	Command	Modified	RIPng Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show debugging ospf	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf border-routers	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf database	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf database asbr-summary	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf database external	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf database network	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show ip ospf database nssa-external	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf database opaque-area	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf database opaque-as	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf database opaque-link	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf database router	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf database summary	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf interface	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf neighbor	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf route	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip ospf virtual-links	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip protocols ospf	Command	Modified	OSPF Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show debugging ipv6 ospf	Command	Modified	OSPFv3 for IPv6 Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show ipv6 ospf	Command	Modified	OSPFv3 for IPv6 Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 ospf database	Command	Modified	OSPFv3 for IPv6 Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 ospf database external	Command	Modified	OSPFv3 for IPv6 Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 ospf database network	Command	Modified	OSPFv3 for IPv6 Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 ospf database router	Command	Modified	OSPFv3 for IPv6 Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 ospf interface	Command	Modified	OSPFv3 for IPv6 Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 ospf neighbor	Command	Modified	OSPFv3 for IPv6 Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 ospf route	Command	Modified	OSPFv3 for IPv6 Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
debug bgp	Command	Modified	BGP Commands	Use this command to turn on one or more BGP debug options. This command now has the option to debug for BGP NHT (Next Hop Tracking). You can also now issue this command from Privileged Exec and Global Configuration command modes at the awplus# and awplus(config)# prompts respectively.
show bgp nexthop-tracking	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show bgp nexthop-tree-details	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show bgp memory maxallocation	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show debugging bgp	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp attribute-info	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp cidr-only	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp community	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp community-info	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp community-list	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp dampening	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp filter-list	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp inconsistent-as	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp longer-prefixes	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show ip bgp neighbors	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp neighbors connection-retrytime	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp neighbors hold-time	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp neighbors keepalive	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp neighbors keepalive-interval	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp neighbors notification	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp neighbors open	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp neighbors rcvd-msgs	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp neighbors sent-msgs	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp neighbors update	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp paths	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp prefix-list	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show ip bgp quote-regexp	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp regexp	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp route-map	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp scan	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp summary	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp view	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp view neighbors	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip bgp view summary	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip community-list	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip extcommunity-list	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip protocols bgp	Command	Modified	BGP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
undebug bgp	Command	Modified	BGP Commands	Use this command to disable BGP debugging functions. This command now has the option to disable BGP NHT (Next Hop Tracking) debugging. You can also now issue this command from Privileged Exec and Global Configuration command modes at the awplus# and awplus(config)# prompts respectively.
show route-map	Command	Modified	Route Map Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
max-fib-routes (VRF)	Command	Modified	VRF-Lite Commands	This command now enables you to control the maximum number of FIB routes configured for a VRF Instance. It operates by providing parameters that enable you to configure preset maximums and warning message thresholds.
max-static-routes	Command	Modified	VRF-Lite Commands	This command now enables you to set the maximum number of static routes (excluding FIB—Forwarding Information Base routes) for VRF Instances.
show ip vrf	Command	Modified	VRF-Lite Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip vrf detail	Command	Modified	VRF-Lite Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip vrf	Command	Modified	VRF-Lite Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
ip multicast route	Command	New	Multicast Introduction and Commands	Use this command to add a static multicast route for a specific mulitcast source and group address to the multicast Routing Information Base (RIB).
ip multicast wrong-vif-suppression	Command	New	Multicast Introduction and Commands	Use this command to prevent unwanted multicast packets received on an unexpected VLAN being trapped to the CPU.
show ip mroute	Command	Modified	Multicast Introduction and Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip mvif	Command	Modified	Multicast Introduction and Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show ip rpf	Command	Modified	Multicast Introduction and Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
ip igmp ssm	Command	New	IGMP and IGMP Snooping Commands	Use this command to define a non-default Source Specific Multicast (SSM) range of IP multicast addresses in IGMP. Incoming IGMPv1 and IGMPv2 join requests are ignored if the multicast IP address is in the SSM range and no SSM mapping is configured for these addresses. By default, the SSM range is 232/8.
ip igmp ssm-map enable	Command	New	IGMP and IGMP Snooping Commands	Use this command to enable Source Specific Multicast (SSM) mapping on the device.
ip igmp ssm-map static	Command	New	IGMP and IGMP Snooping Commands	Use this command to specify the static mode of defining Source Specific Multicast (SSM) mapping. SSM statically assigns sources to IGMPv1 and IGMPv2 groups to translate such (*,G) groups' memberships to (S,G) memberships for use with PIM-SSM.
ip igmp startup-query-count	Command	New	IGMP and IGMP Snooping Commands	Use this command to configure the IGMP startup query count on a VLAN interface in Interface Configuration mode. The IGMP startup query count is the number of general query messages sent at startup. The default IGMP startup query count is 2.
ip igmp startup-query-interval	Command	New	IGMP and IGMP Snooping Commands	Use this command to configure the IGMP startup query interval for a VLAN interface in Interface Configuration mode. The IGMP startup query interval is the amount of time in seconds between successive IGMP General Query messages sent by a querier during startup. The default IGMP startup query interval is one quarter of the IGMP query interval value.
show debugging igmp	Command	Modified	IGMP and IGMP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip igmp groups	Command	Modified	IGMP and IGMP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip igmp interface	Command	Modified	IGMP and IGMP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip igmp proxy	Command	New	IGMP and IGMP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show ip igmp snooping mrouter	Command	Modified	IGMP and IGMP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip igmp snooping routermode	Command	Modified	IGMP and IGMP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip igmp snooping statistics	Command	Modified	IGMP and IGMP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
ip pim ssm	Command	New	PIM-SM Commands	Use this command to define the Source Specific Multicast (SSM) range of IP multicast addresses.
show debugging pim sparse-mode	Command	Modified	PIM-SM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip pim sparse-mode bsr-router	Command	Modified	PIM-SM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip pim sparse-mode interface	Command	Modified	PIM-SM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip pim sparse-mode interface detail	Command	Modified	PIM-SM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip pim sparse-mode mroute	Command	Modified	PIM-SM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip pim sparse-mode mroute detail	Command	Modified	PIM-SM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip pim sparse-mode neighbor	Command	Modified	PIM-SM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip pim sparse-mode nexthop	Command	Modified	PIM-SM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show ip pim sparse-mode rp-hash	Command	Modified	PIM-SM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip pim sparse-mode rp mapping	Command	Modified	PIM-SM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show debugging pim dense-mode	Command	Modified	PIM-DM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip pim dense-mode interface	Command	Modified	PIM-DM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip pim dense-mode interface detail	Command	Modified	PIM-DM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip pim dense-mode mroute	Command	Modified	PIM-DM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip pim dense-mode neighbor	Command	Modified	PIM-DM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip pim dense-mode neighbor detail	Command	Modified	PIM-DM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip pim dense-mode nexthop	Command	Modified	PIM-DM Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 mld groups	Command	Modified	MLD Snooping Introduction and Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 mld interface	Command	Modified	MLD Snooping Introduction and Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ipv6 mld snooping mrouter	Command	Modified	MLD Snooping Introduction and Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show ipv6 mld snooping statistics	Command	Modified	MLD Snooping Introduction and Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
commit (IPv4)	Command	New	IPv4 Hardware Access Control List (ACL) Commands	Use this command to commit the ACL filter configuration to hardware immediately without exiting Hardware ACL Configuration mode.
show access-group	Command	Modified	IPv4 Hardware Access Control List (ACL) Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show access-list (IPv4 Hardware ACLs)	Command	Modified	IPv4 Hardware Access Control List (ACL) Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show access-list (IPv4 Software ACLs)	Command	Modified	IPv4 Software Access Control List (ACL) Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip access-list	Command	Modified	IPv4 Software Access Control List (ACL) Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip prefix-list	Command	Modified	IPv4 Software Access Control List (ACL) Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
commit (IPv6)	Command	New	IPv6 Hardware Access Control List (ACL) Commands	Use this command to commit the ACL filter configuration to hardware immediately without exiting Hardware ACL Configuration mode.
show ipv6 access-list (IPv6 Hardware ACLs)	Command	Modified	IPv6 Hardware Access Control List (ACL) Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
ipv6 access-list extended proto	Command	New	IPv6 Software Access Control List (ACL) Commands	Use this command when configuring an IPv6 extended access-list for filtering frames that permit or deny packets with a specific value based on the IP protocol number specified. The no variant of this command removes a specified IPv6 extended access-list with an IP protocol number.
show ipv6 access-list (IPv6 Software ACLs)	Command	Modified	IPv6 Software Access Control List (ACL) Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
police-aggregate	Command	Modified	QoS Commands	Use this command to apply a previously created aggregate-policer to the class-map. The command syntax has changed from police aggregate to police-aggregate. Note that a console message is displayed indicating the previous command syntax police aggregate is deprecated and is available as an alias to the police-aggregate keyword.
show class-map	Command	Modified	QoS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show mls qos aggregate-policer	Command	Modified	QoS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show mls qos fabric-queue	Command	Modified	QoS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show mls qos interface	Command	Modified	QoS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show mls qos interface policer-counters	Command	Modified	QoS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show mls qos interface queue-counters	Command	Modified	QoS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show mls qos interface storm-status	Command	Modified	QoS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show mls qos maps cos-queue	Command	Modified	QoS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show mls qos fabric-queue	Command	Modified	QoS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show mls qos maps policed-dscp	Command	Modified	QoS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show mls qos maps premark-dscp	Command	Modified	QoS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show mls qos queue-set	Command	Modified	QoS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show policy-map	Command	Modified	QoS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show debugging dot1x	Command	Modified	802.1X Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
aaa accounting commands	Command	New	AAA Commands	With this command you can configure and enable TACACS+ command accounting.
aaa accounting login	Command	Modified	AAA Commands	With this command you can now configure TACACS+ accounting for login shell sessions.
aaa accounting update	Command	Modified	AAA Commands	This command now enables periodic accounting reporting to a TACACS+ accounting server.
aaa authentication enable default group tacacs+	Command	New	AAA Commands	This command enables AAA authentication to determine the privilege level a user can access for passwords authenticated against the TACACS+ server.
aaa authentication enable default local	Command	New	AAA Commands	This command enables AAA authentication to determine the privilege level a user can access for passwords authenticated locally.
show debugging aaa	Command	Modified	AAA Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show debugging radius	Command	Modified	RADIUS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show radius	Command	Modified	RADIUS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show radius statistics	Command	Modified	RADIUS Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show tacacs+	Command	Modified	TACACS+ Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
domain-style	Command	New	Local RADIUS Server Commands	Use this command to enable a specified domain style on the local RADIUS server. The local RADIUS server decodes the domain portion of a username login string when this command is enabled.
show crypto pki certificates	Command	Modified	Local RADIUS Server Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show crypto pki certificates local-radius-all-users	Command	Modified	Local RADIUS Server Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show crypto pki certificates user	Command	Modified	Local RADIUS Server Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show crypto pki trustpoints	Command	Modified	Local RADIUS Server Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show radius local-server group	Command	Modified	Local RADIUS Server Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show radius local-server nas	Command	Modified	Local RADIUS Server Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration mode prompt (awplus(config)#).
show radius local-server statistics	Command	Modified	Local RADIUS Server Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show radius local-server user	Command	Modified	Local RADIUS Server Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#), and the Global Configuration mode prompt (awplus(config)#).
show crypto key hostkey	Command	Modified	Secure Shell (SSH) Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show crypto key pubkey-chain knownhosts	Command	Modified	Secure Shell (SSH) Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show crypto key pubkey-chain userkey	Command	Modified	Secure Shell (SSH) Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show crypto key userkey	Command	Modified	Secure Shell (SSH) Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show running-config ssh	Command	Modified	Secure Shell (SSH) Commands	This command is available from the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show ssh	Command	Modified	Secure Shell (SSH) Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show ssh client	Command	Modified	Secure Shell (SSH) Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show ssh server	Command	Modified	Secure Shell (SSH) Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show ssh server allow-users	Command	Modified	Secure Shell (SSH) Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show ssh server deny-users	Command	Modified	Secure Shell (SSH) Commands	This command is available from the User Exec command mode prompt (awplus>), the Privileged Exec command mode prompt (awplus#) and the Global Configuration prompt (awplus(config)#).
show debugging arp security	Command	Modified	DHCP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show debugging ip dhcp snooping	Command	Modified	DHCP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip dhcp snooping	Command	Modified	DHCP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip dhcp snooping acl	Command	Modified	DHCP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip dhcp snooping agent-option	Command	Modified	DHCP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip dhcp snooping binding	Command	Modified	DHCP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip dhcp snooping interface	Command	Modified	DHCP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip dhcp snooping statistics	Command	Modified	DHCP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip source binding	Command	Modified	DHCP Snooping Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
interface (VRRP) (deprecated)	Command	Deprecated	VRRP Commands	The interface (VRRP) command has been deprecated. Use the router vrrp (interface) command to configure VRRP and define the interface that will participate in virtual routing to send and receive advertisement messages.
router vrrp (interface)	Command	Modified	VRRP Commands	Use this command to configure VRRP and define the interface that will participate in virtual routing to send and receive advertisement messages. This command allows you to enter the Router Configuration mode. Note that the interface must be specified, and that the interface (VRRP) command has been deprecated from release 5.4.2.
show debugging vrrp	Command	Modified	VRRP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show vrrp	Command	Modified	VRRP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show vrrp counters	Command	Modified	VRRP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show vrrp (session)	Command	Modified	VRRP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
debug epsr	Command	Modified	EPSR Commands	You can now specify the parameter option timer to send EPSR timer information to the console.
epsr priority	Command	New	EPSR Commands	This command sets the priority of an EPSR instance on an EPSR node. Priority is used to prevent superloops forming under fault conditions with particular ring configurations.
show debugging epsr	Command	Modified	EPSR Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show epsr	Command	Modified	EPSR Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show epsr word	Command	Modified	EPSR Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show epsr word counters	Command	Modified	EPSR Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show epsr counters	Command	Modified	EPSR Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show counter ntp	Command	Modified	NTP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ntp associations	Command	Modified	NTP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show ntp status	Command	Modified	NTP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show counter dhcp-client	Command	Modified	Dynamic Host Configuration Protocol (DHCP) Commands	This command is available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show counter dhcp-relay	Command	Modified	Dynamic Host Configuration Protocol (DHCP) Commands	This command is available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show counter dhcp-server	Command	Modified	Dynamic Host Configuration Protocol (DHCP) Commands	This command is available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show dhcp lease	Command	Modified	Dynamic Host Configuration Protocol (DHCP) Commands	This command is available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip dhcp binding	Command	Modified	Dynamic Host Configuration Protocol (DHCP) Commands	This command is available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip dhcp pool	Command	Modified	Dynamic Host Configuration Protocol (DHCP) Commands	This command is available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip dhcp-relay	Command	Modified	Dynamic Host Configuration Protocol (DHCP) Commands	This command is available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip dhcp server statistics	Command	Modified	Dynamic Host Configuration Protocol (DHCP) Commands	This command is available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ip dhcp server summary	Command	Modified	Dynamic Host Configuration Protocol (DHCP) Commands	This command is available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show counter snmp-server	Command	Modified	SNMP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show debugging snmp	Command	Modified	SNMP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show lldp	Command	New	LLDP Commands	This command sets the type of port identifier used to enumerate, that is to count, the LLDP MIB local port entries. This command also enables you to optionally set an interface index to enumerate the LLDP MIB local port entries, if required by your management system.
show debugging lldp	Command	Modified	LLDP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show lldp	Command	Modified	LLDP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#). Console output now displays Port Number Type, which is the type of port identifier to enumerate LLDP MIB local port entries. Port Number Type is set by the new lldp port-number-type command.
show lldp interface	Command	Modified	LLDP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show lldp local-info	Command	Modified	LLDP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show lldp neighbors	Command	Modified	LLDP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show lldp neighbors detail	Command	Modified	LLDP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show lldp statistics	Command	Modified	LLDP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show lldp statistics interface	Command	Modified	LLDP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).

Table B-2: New or Changed Commands(cont.)

Feature		Status	Chapter / Section	Description
show location	Command	Modified	LLDP Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show rmon alarm	Command	Modified	RMON Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show rmon event	Command	Modified	RMON Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show rmon history	Command	Modified	RMON Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show rmon statistics	Command	Modified	RMON Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show counter ping-poll	Command	Modified	Ping-Polling Commands	This command is available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show ping-poll	Command	Modified	Ping-Polling Commands	This command is available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show debugging sflow	Command	Modified	sFlow Commands	This command is available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show counter stack	Command	Modified	Stacking Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show debugging stack	Command	Modified	Stacking Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show provisioning (stack-member)	Command	Modified	Stacking Commands	This command is now available from the User Exec command mode prompt (awplus>) and the Privileged Exec command mode prompt (awplus#).
show stack resiliencylink	Command	New	Stacking Commands	Use this command to display information about the current status of the resiliency-link across the members of the stack.

Table B-3: New or Changed MIBS

Feature		Status	Chapter / Section	Description
AT-PRODUCT-MIB	MIB	Modified	SNMP MIBs	New object identifiers for Allied Telesis products have been added.
AT-BOARDS-MIB	MIB	Modified	SNMP MIBs	New object identifiers for base CPU and expansion boards have been added.
AT-FILEv2-MIB	MIB	Modified	SNMP MIBs	New objects have been added for copying, moving and deleting files from local, stacked and remote sources.

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Introduction

This appendix describes how to install, configure and use the Graphical User Interface (GUI) on switches running the AlliedWare Plus™ OS. The GUI provides extensive monitoring and essential configuration functionality for Allied Telesis switches via a web browser. This document explains how to install the GUI using either an SD card or via a TFTP server.

The GUI functionality is provided via a Java applet file. Before you can use the GUI to manage your switches, you must download the Java applet file, and install it to your switch's Flash file system.

Once the Java applet file is present in your switch's Flash, no specific commands are required to enable the GUI, or to inform the switch which Java applet file to use. Instead, when an incoming browser connection is established with the switch, the switch will automatically send the most recent compatible Java applet file that is present in its Flash file system.

Different versions of the Java applet file will be compatible with different versions of the AlliedWare Plus™ OS. The AlliedWare Plus™ OS automatically determines if a Java applet file is compatible, so the Java applet file that is delivered to your browser will always be compatible with the AlliedWare Plus™ OS version running on the switch to which you have connected.

Note which products and software version the GUI works with, along with PC and browser specifications listed. You may need to install and run the latest Java Runtime Environment that you can download from the Sun site so your browser can fully support the GUI Java applet.

Installing and Setting-up the GUI

This section shows you how to install and setup the AlliedWare Plus™ GUI.

System Requirements

To install and run the AlliedWare Plus™ GUI you will require the following system products and setup:

- PC Platform:
  Windows XP SP2 and up / Windows Vista SP1 and up
- Browser: (must support Java Runtime Environment (JRE) version 6)
  Microsoft Internet Explorer 7.0 and up / Mozilla Firefox 2.0 and up

Installing the GUI to your switch using an SD card

Step 1: Download a GUI Java applet

The GUI Java applet file is available in a compressed (zip) file with the AlliedWare Plus™ Operating System software from the Support area of the Allied Telesis Website: http://www.alliedtelesis.com. Download the Java applet file. This file will have a `.zip` file name extension. You need to extract the Java `.jar` file from the compressed `.zip` file. The version number of the software applet file (`.jar`) gives the earliest version of the software file (`.rel`) that the GUI can operate with.

Step 2: Copy the GUI Java applet **.jar** file to an SD card

Insert the SD card in the SD slot on the front of your switch. Connect to the management port, then login to the switch.

Copy the GUI Java applet to your switch, using the below commands:

```
awplus# copy card:/<filename.jar> flash:/
```

Where `<filename.jar>` is the GUI Java applet file you downloaded in Step 1.

Installing the GUI to Your Switch Via TFTP server

Step 1: Download a GUI Java applet file from the support site:

The GUI Java applet file is available in a compressed (`.zip`) file with the AlliedWare Plus™ Operating System software from the Support area of the Allied Telesis Website: http://www.alliedtelesis.com. Download the Java applet file. This file will have a `.zip` file name extension. You need to extract the Java `.jar` file from the compressed `.zip` file. The version number of the software applet file (.jar) gives the earliest version of the software file (`.rel`) that the GUI can operate with.

Step 2: Copy the GUI applet

Copy the GUI applet .jar file onto a TFTP server. Ensure this TFTP server is enabled and ready for the switch. Connect to the management port of the switch, then login to the switch. Do not connect to the management port of the TFTP server.

Step 3: Copy the GUI Java applet to your switch

Use the following commands to copy the GUI Java applet to your switch:

```
awplus# copy tftp://<server-address>/
        <filename.jar> flash:/
```

Where *<server-address>* is the IP address for the TFTP server, and where *<filename.jar>* is the GUI Java applet file you downloaded in Step 1.

Setting up your switch and logging into the GUI

Step 1: Assign the IP addresses:

Use the following commands to configure your switch with an appropriate IP address:

```
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip address <address>/<prefix-
length>
```

Where *<address>* is the IP address that you will subsequently browse to when you connect to the GUI Java applet. For example, to give the switch an IP address of `192.168.2.6`, and a subnet mask of `255.255.255.0`, use the following command:

```
awplus(config-if)# ip address 192.168.2.6/24
```

Step 2: Configure the Default Gateway

In necessary, use the following commands to configure the default gateway.

```
awplus(config-if)# exit
awplus(config)# ip route 0.0.0.0/0 <gateway address>
```

Where *<gateway-address>* is the IP address for your gateway device. Note that you do not need to define a default gateway if you browse to the switch from within its own subnet.

Step 3: Create a user account

In order to log into the GUI, you must first create a user account. Use the following command to setup a user account:.

```
awplus(config)# username <username> privilege 15
password <password>
```

Note that you can create multiple users to log into the GUI. See the AlliedWare Plus Software Reference for information about the username command. The switch must be configured with a local database user, or the switch must be configured to remotely authenticate users with either TACACS+ or RADIUS.

Step 4: Ensure HTTP service is enabled

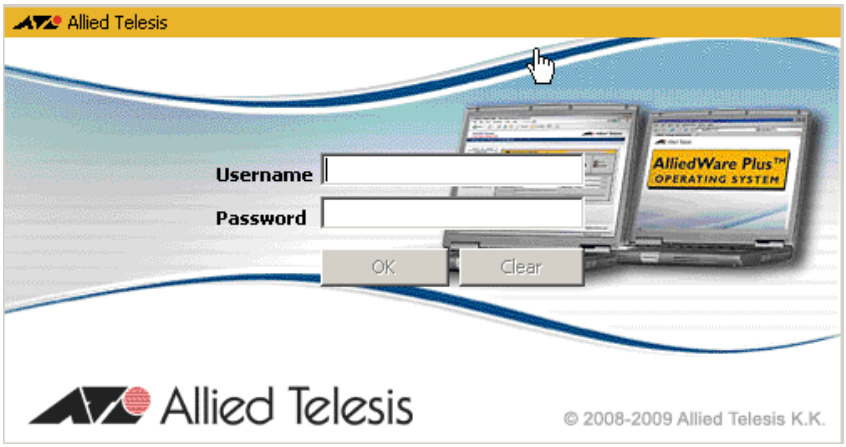
The HTTP service needs to be enabled on the switch before it accepts connections from a web browser. The HTTP service is enabled by default. However, if the HTTP service has been disabled then you must enable the HTTP service again. If the HTTP service is disabled then use the following command to enable the HTTP service:

```
awplus(config)# service http
```

See the AlliedWare Plus™ Software Reference for information about the service http command.

Step 5: Logging into the GUI

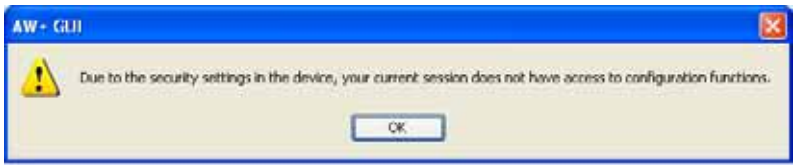
Start a browser then enter the IP address you configured in Step 3 as the URL. You will then be presented with a login screen after the GUI Java applet has started. You can then Log in with the username and password that you defined previously in Step 3.



Step 6: Security Check

You may also be presented with a security check password prompt. This will occur when you have logged into the GUI with a user that is configured on the switch and have a privilege level of less than 15, or if the switch has been configured to authenticate enable passwords via TACACS+ using the aaa authentication enable default group tacacs+ command.

You must enter the privilege level 15 enable password configured on the switch to access GUI configuration dialogs. If you enter an incorrect enable password, or no privilege level 15 enable password has been configured, the a message is shown stating you can use the GUI to monitor the switch, but not to configure the switch.



Using the GUI

This section explains how to use the AlliedWare Plus™ GUI. It assumes that you have installed the GUI on your switches and have the setup the browser on your PC. This procedure is covered in "Installing and Setting-up the GUI" on page C.4.

In this section each screen is presented by its tab name and explains the content of the screen components.

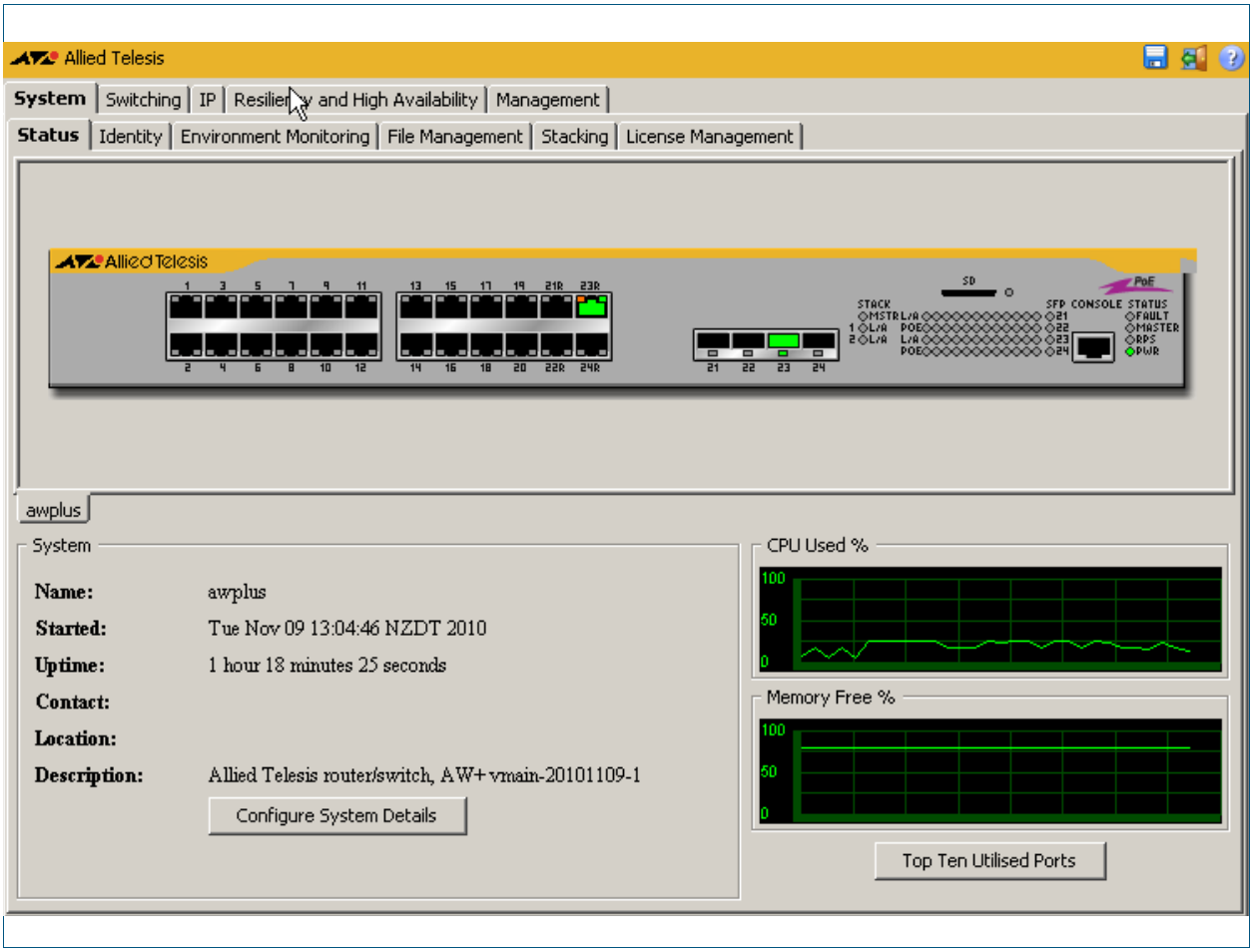
System > Status

The System > Status menu tab enables you to display and configure basic system information.

The CPU Used % and Memory Free % graphs provide a brief history of CPU and memory usage.

Note: For systems equipped and configured using VCStack, there is a separate tab for each stack member with the system name displayed on each tab.

Menu Tab Figure C-1: Example showing the **System > Status** menu tab:



Description

Display Label / Field	Description
System / Name	Specifies the network name of the system, as set with the 'hostname' command in the CLI.
System / Started	Date and time the switch was last booted.
System / Uptime	Elapsed time since the last boot.
System / Contact	Contact details for system maintenance.
System / Location	Location of the switch
System / Description	Description of the switch, including manufacturer, model, and software version.
Top Ten Utilised Ports	Displays a sorted list of the ten most used ports listed by port and its utilization. You can rearrange and resort the list by port or utilization.

Description

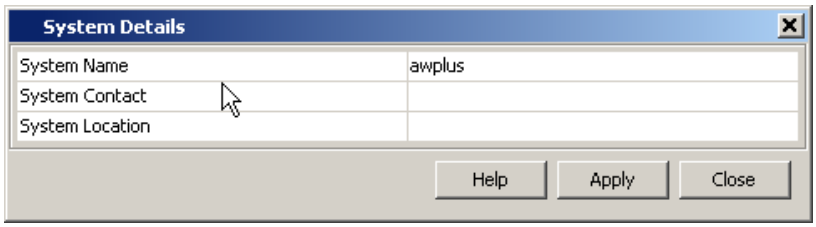
Configuration Button / Field	Description
System Time & Date (icon)	Add or modify System Date, System Time, UTC Time Zone Offset.
Configure System Details	Add or modify System Name, System Contact, System Location.
Configure System Details / System Name	Configures the network name of the system.
Configure System Details / System Contact	Configures the contact information for the system, from 0 to 255 characters long. Valid characters are any printable characters and spaces.
Configure System Details / System Location	Configures the location of the system, from 0 to 255 characters long. Valid characters are any printable characters and spaces.

System > Status > System Details

The System > Status > System Details dialog allows you to configure basic system information.

Configuration Dialog

Figure C-2: Example showing **System > Status > System Details** dialog:



Description

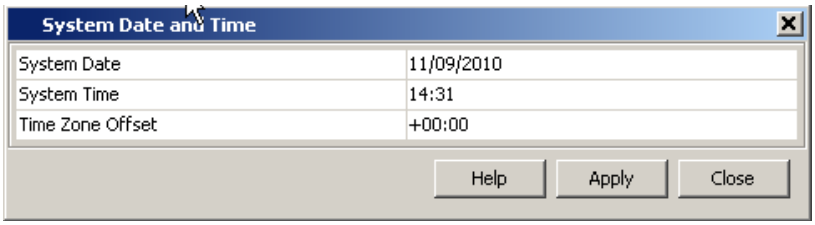
Label / Field / Button	Description
System Name	Enter the network name of the system.
System Contact	Enter the contact information for the system, from 0 to 255 characters long. Valid characters are any printable characters and spaces.
System Location	Enter the location of the system, from 0 to 255 characters long. Valid characters are any printable characters and spaces.

System > Status > System Date and Time

The System > Status > System Date and Time dialog allows you to configure the date and time for the switch.

Configuration Dialog

Figure C-3: Example showing **System > Status > System Date and Time** dialog:



Description

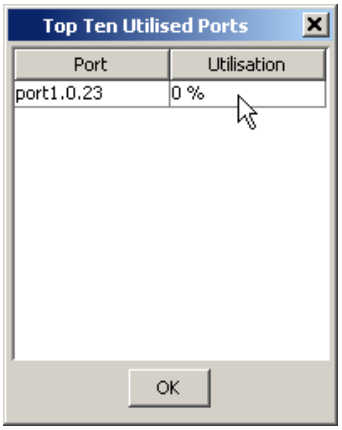
Label / Field / Button	Description
System Date	Enter the current system date in month, day, and year format.
System Time	Enter the local time for the system clock in hours and minutes.
Time Zone Offset	Enter the offset to the UTC (Coordinated Universal Timezone) for a local timezone in hours and minutes.

System > Status > Top Ten Utilised Ports

The System > Status > Top Ten Utilised Port dialog allows you to monitor port utilisation on the switch.

Configuration Dialog

Figure C-4: Example showing **System > Status > Top Ten Utilised Ports** dialog:



Description

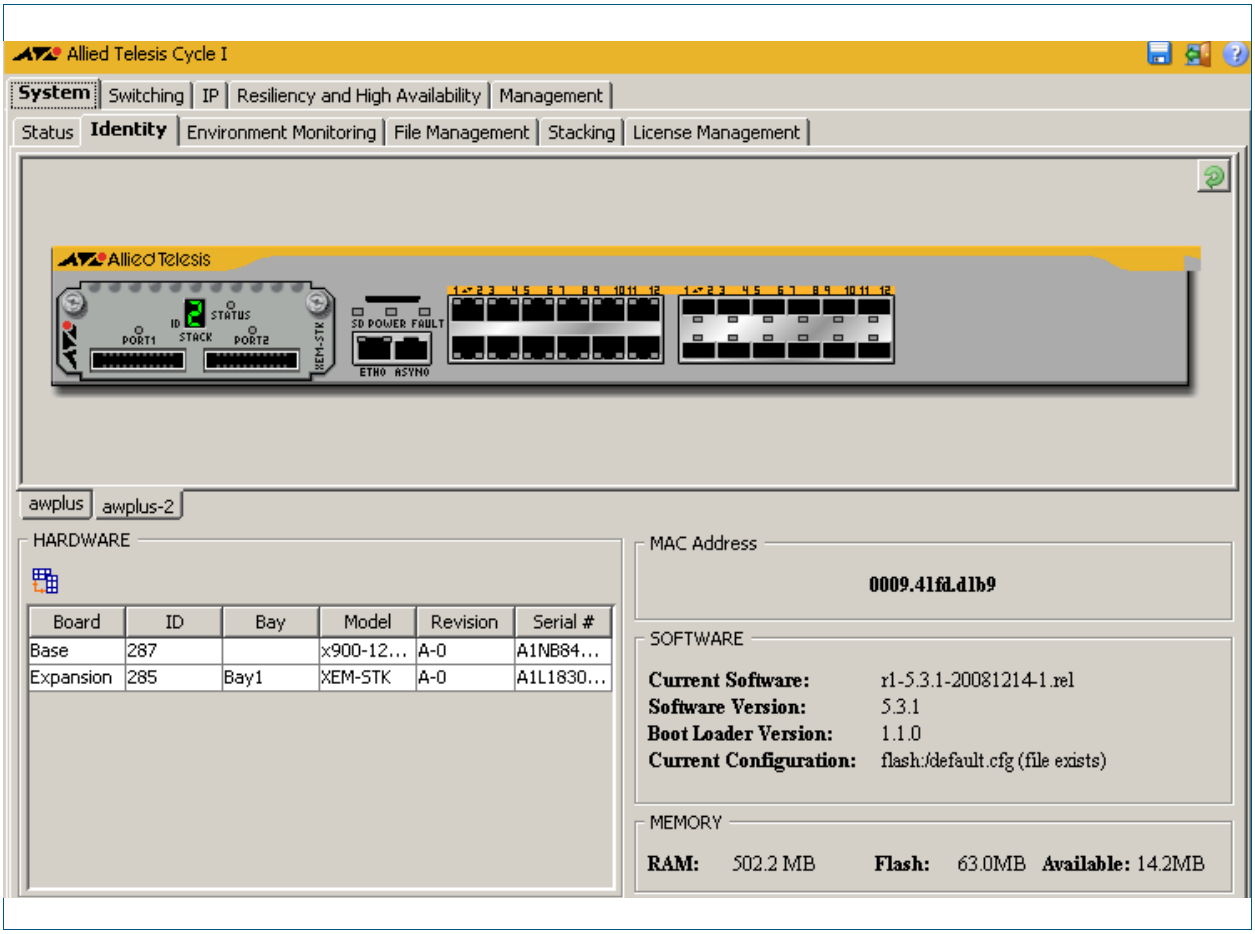
Label / Field / Button	Description
`Port`	Displays up to ten ports that are used the most on the switch. You can sort by ascending or descending port order.
`Utilisation`	Displays the utilisation percentage for the port. You can sort by ascending or descending utilisation percentage.

System > Identity

The System > Identity menu tab displays physical properties, software version and configuration file name.

Note: For systems equipped and configured using VCStack there is a separate tab for each stack member with the system name displayed on each tab.

Menu Tab Figure C-5: Example showing the **System > Identity** menu tab:



Description

Label / Field / Button	Description
HARDWARE	Displays the board, ID, bay, model, revision and serial number of the switch main board and any installed XEMs.
MAC Address	Displays the MAC Address of the switch in hexadecimal in the format HHHH.HHHH.HHHH.

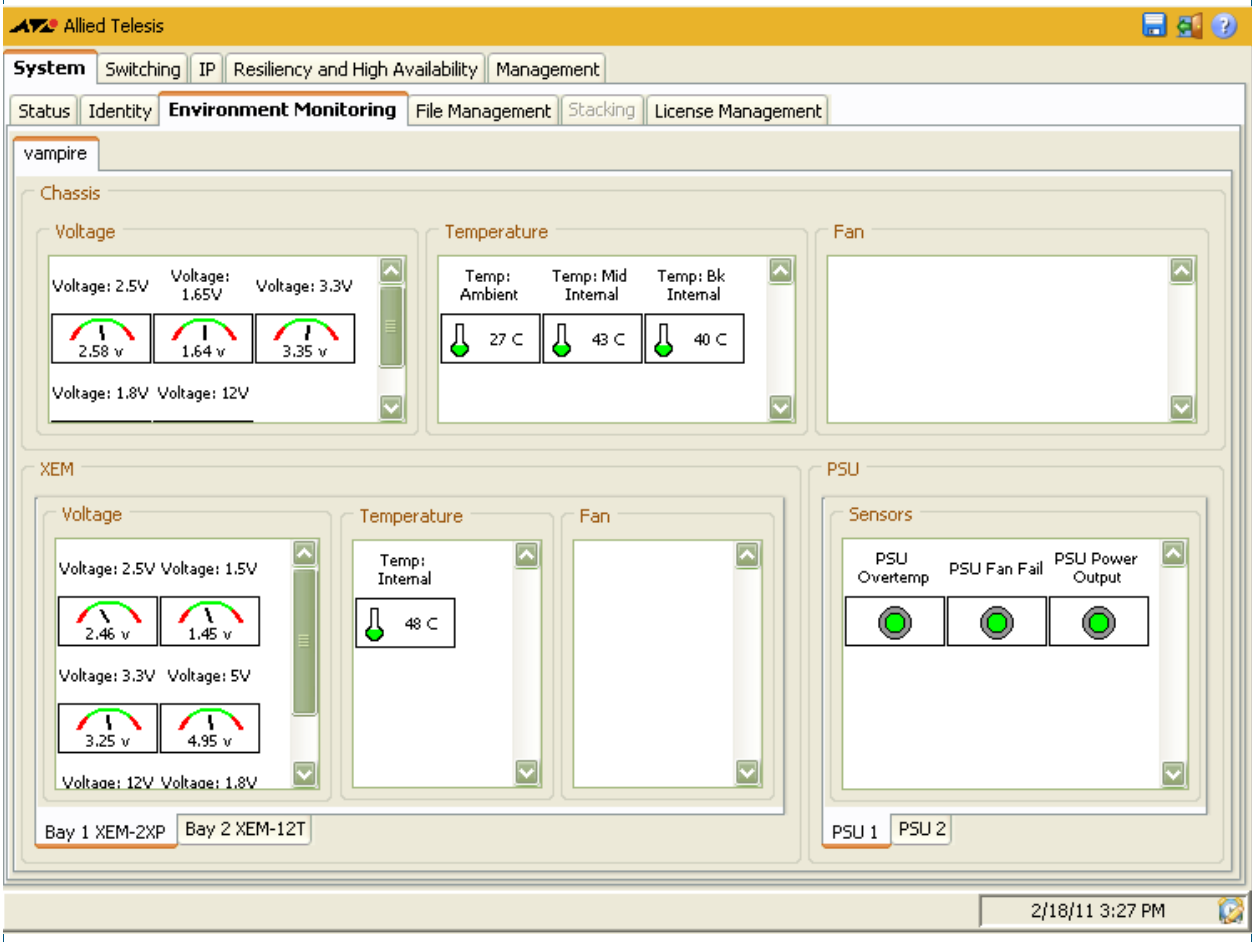
Label / Field / Button(cont.)	**Description**(cont.)
SOFTWARE	Displays the software release file name, software version, boot loader version, and configuration file name loaded on the switch.
MEMORY	Displays the amount of installed RAM and Flash, plus the remaining Flash available on the switch.

System > Environment Monitoring

The System > Environment Monitoring menu tab allows you to display the status of the environmental properties, such as all voltages and temperatures, which the system monitors.

Note: For systems equipped and configured using VCStack there is a separate tab for each stack member with the system name displayed on each tab.

Menu Tab Figure C-6: Example showing the **System > Environment Monitoring** menu tab:



Description

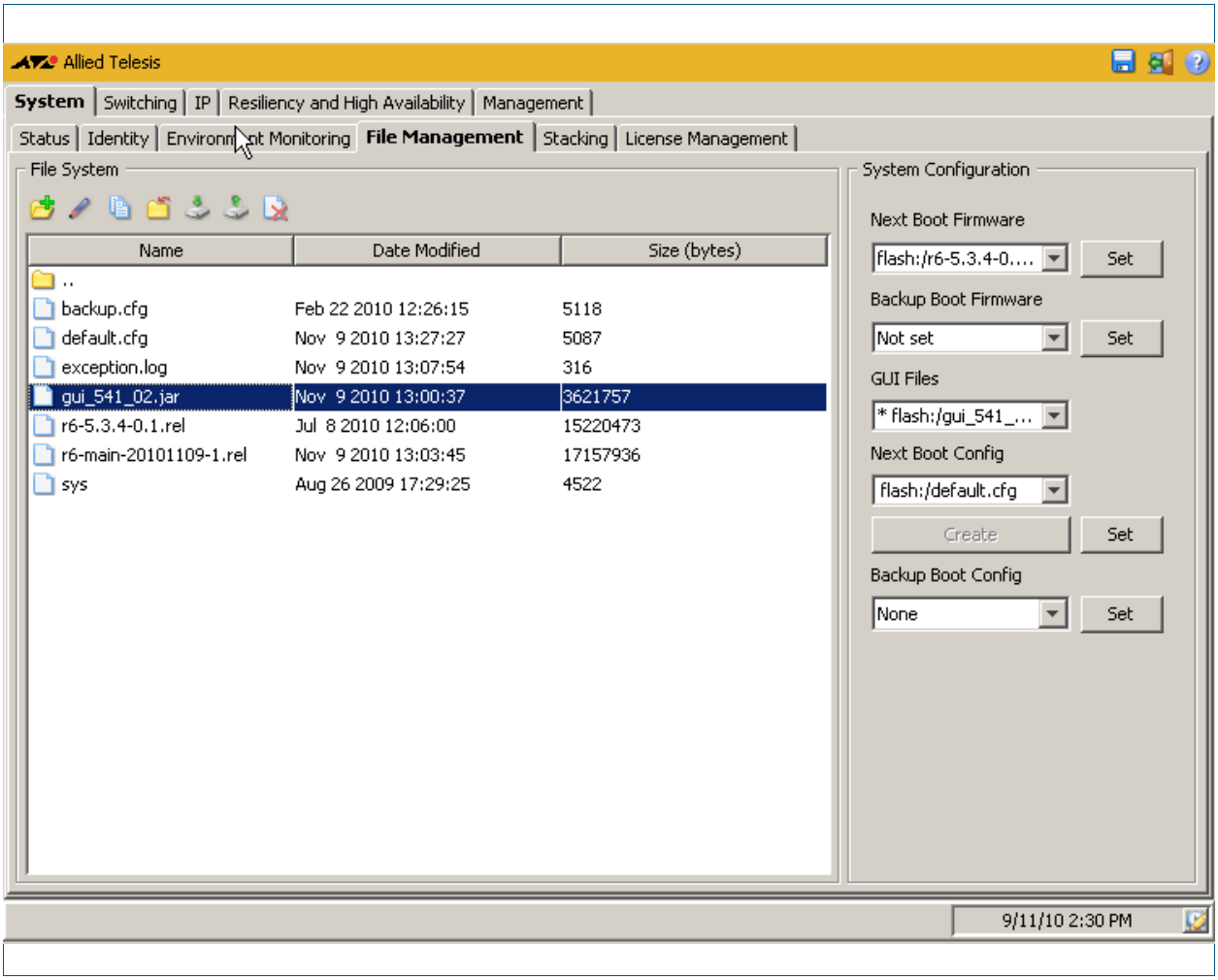
Label / Field / Button	Description
`Chassis`	Displays the operational status of chassis voltages and temperatures for the switch.
`Fan`	Displays the operational status of the switch fans.

Label / Field / Button(cont.)	**Description**(cont.)
XEM	Displays the operational status of voltages, temperatures, and fans for any installed XEMs.
PSU	Displays the operational status of temperatures and fans for any installed pluggable PSUs.

System > File Management

The System > File Management menu tab allows you to create, copy, delete, upload or download boot and backup release and configuration files to and from the switch. From 5.4.1 release onwards, you can specify fallback or backup release and configuration files in case the boot release or configuration files become corrupted, and you can also specify the boot release and configuration files to boot directly from SD card or to boot from flash.

Menu Tab Figure C-7: Example showing the **System > File Management** menu tab:



Description: File System

Label / Field / Button	Description
File System	Displays file names, file dates, and file sizes of files in Flash, NVS or SD card. Note that only SD card files that are resident on the stack master are shown. Also, only files that have a total URL length of 112 characters or less are displayed. The URL is the path to the file and is of the form <hostname>-<stack_id>/<filesystem>:/<pathname>, for example, awplus-1/flash:/test.cfg. The GUI will immediately show all file changes to the NVS and Flash filesystems, regardless of how they have been made, either via the GUI or CLI. However, the SD card filesystem is treated differently as it is not permanently mounted. The GUI will only update SD card files when the card is inserted/deleted, or when the changes are made via the GUI. They are not updated if modified via the CLI. The buttons shown below the File System label also allow you upload, download, move, copy, and delete files respectively.
File System / Add Folder	Select the folder you want to create a new sub-folder in then click on the Add Folder button located directly below the File System label.
File System / Rename File	Select the file you want to rename then click on the Rename File or Folder button located directly below the File System label.
File System / Copy File	Select the file you want to copy then click on the Copy File button located directly below the File System label. Choose the Destination Folder from the drop down list in the Copy File dialog then select OK to copy the file to the chosen destination.
File System / Move File	Select the file you want to move then click on the Move File button located directly below the File System label. Choose the Destination Folder from the drop down list in the Move File dialog then select OK to move the file to the chosen destination.
File System / Download File	Select the file you want to download then click on the Download File button located directly below the File System label.
File System / Upload File	Click on the Upload File button located directly below the File System label then select the file you want to upload.
File System / Delete File	Select the file or folder you want to delete then click on the Delete File button located directly below the File System label.

Description: System Configuration

Label / Field / Button	Description
System Configuration	Configures running and backup software, GUI software, and configuration files in Flash or card memory available on the switch.
System Configuration / Next Boot Firmware	Choose the Next Boot Firmware .rel file and path from the drop down list then click Set to make this file the firmware that starts after reboot. From 5.4.1 release onwards, you can set a Next Boot Firmware .rel file to boot directly from an SD card.

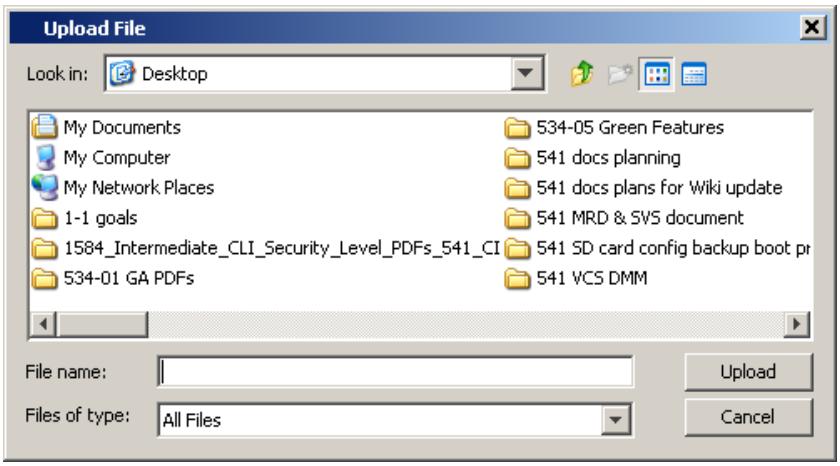
Label / Field / Button(cont.)	**Description**(cont.)
System Configuration / Backup Boot Firmware	Choose the Backup Boot Firmware `.rel` file and path from the drop down list then click Set to boot from this file at reboot. A Backup Boot Firmware .rel file is used instead of the Next Boot Firmware `.rel` file if the Next Boot Firmware `.rel` file is corrupted.
System Configuration / GUI Files	Displays the GUI file name and file location on the switch and indicates the currently running GUI file with a prefixed asterisk (e.g. `* flash:/gui_534_07.jar`). Note that you cannot set the GUI version from within the GUI itself. See the GUI installation instructions in *Appendix C: GUI Reference* of the current *AlliedWare Plus Software Reference* to install GUI files. The latest version of the GUI .jar file loaded is run by the switch automatically.
System Configuration / Next Boot Config	Choose the Next Boot Config `.cfg` file and path from the drop down list then click Set to make this file the Config `.cfg` file that the switch uses at reboot. From 5.4.1 release onwards, you can set a Next Boot Config `.cfg` file to load directly from an SD card.
System Configuration / Backup Boot Config	Choose the Backup Boot Config Files .cfg file and path from the drop down list then click Set to make boot from this file at reboot. A Backup Boot Config `.cfg` file is used instead of the Next Boot config `.cfg` file if the Next Boot Config `.cfg` file is corrupted.

System > File Management > Upload File

The System > File Management > Upload File dialog allows you to upload files (e.g. release and configuration files) from a client device to the switch. Select the Upload File button below the File System label to access this dialog.

Configuration Dialog

Figure C-8: Example showing **System > File Management > Upload File** dialog:



Description

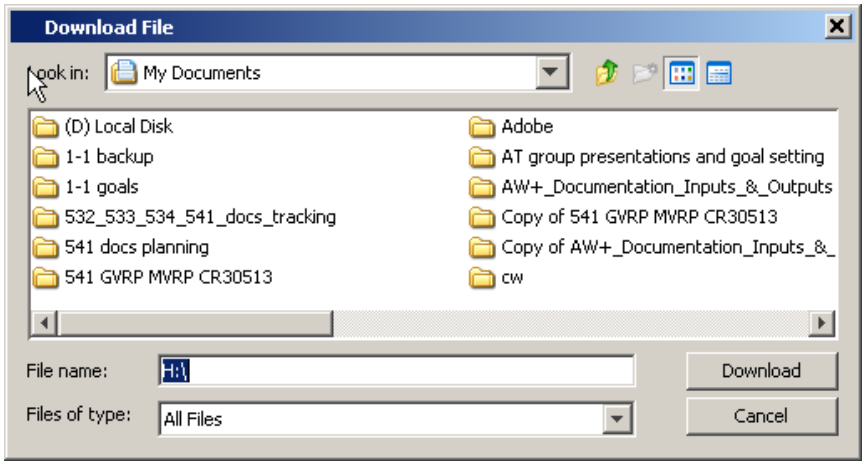
Label / Field / Button	Description
`Destination Folder`	Select the destination folder to upload the selected file from. An uploading progress bar displays after clicking the Upload button.

System > File Management > Download File

The System > File Management > Download File dialog allows you to download files (e.g. release and configuration files) from the switch to a client device. Select the Download File button below the File System label to access this dialog.

Configuration Dialog

Figure C-9: Example showing **System > File Management > Download File** dialog:



Description

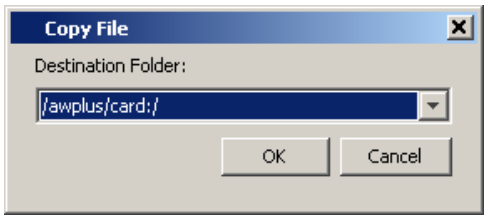
Label / Field / Button	Description
`Destination Folder`	Select the destination folder to download the selected file to. A downloading progress bar displays after clicking the Download button.

System > File Management > Copy File

The System > File Management > Copy File dialog allows you to copy files (e.g. release and configuration files). Select the Copy File button below the File System label to access this dialog.

Configuration Dialog

Figure C-10: Example showing **System > File Management > Copy File** dialog:



Description

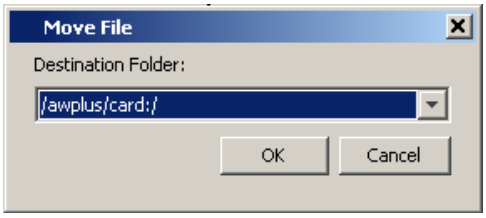
Label / Field / Button	Description
`Destination Folder`	Select the destination folder to copy the selected file to. A copying progress bar displays after clicking the OK button.

System > File Management > Move File

The System > File Management > Move File dialog allows you to move files (e.g. release and configuration files). Select the Move File button below the File System label to access this dialog.

Configuration Dialog

Figure C-11: Example showing **System > File Management > Move File** dialog:



Description

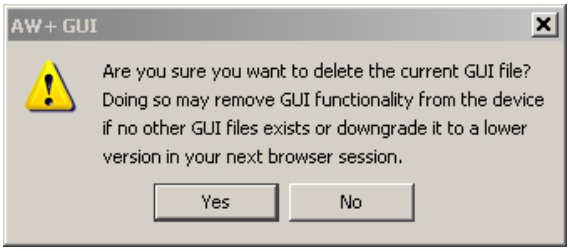
Label / Field / Button	Description
`Destination Folder`	Select the destination folder to move the selected file to. A moving progress bar displays after clicking the OK button.

System > File Management > Delete File

The System > File Management > Delete File dialog allows you to delete files (e.g. release and configuration files). Select the Delete File button below the File System label to access this dialog.

Configuration Dialog

Figure C-12: Example showing **System > File Management > Delete File** dialog:



Description

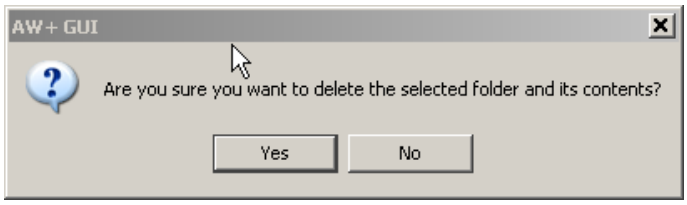
Label / Field / Button	Description
`Yes`	Confirm selected file deletion operation.
`No`	Cancel selected file deletion operation.

System > File Management > Delete Folder

The System > File Management > Delete Folder dialog allows you to delete folders in the flash or SD card file system containing files (e.g. release and configuration files). Select the Delete Folder button below the File System label to access this dialog.

Configuration Dialog

Figure C-13: Example showing **System > File Management > Delete Folder** dialog:



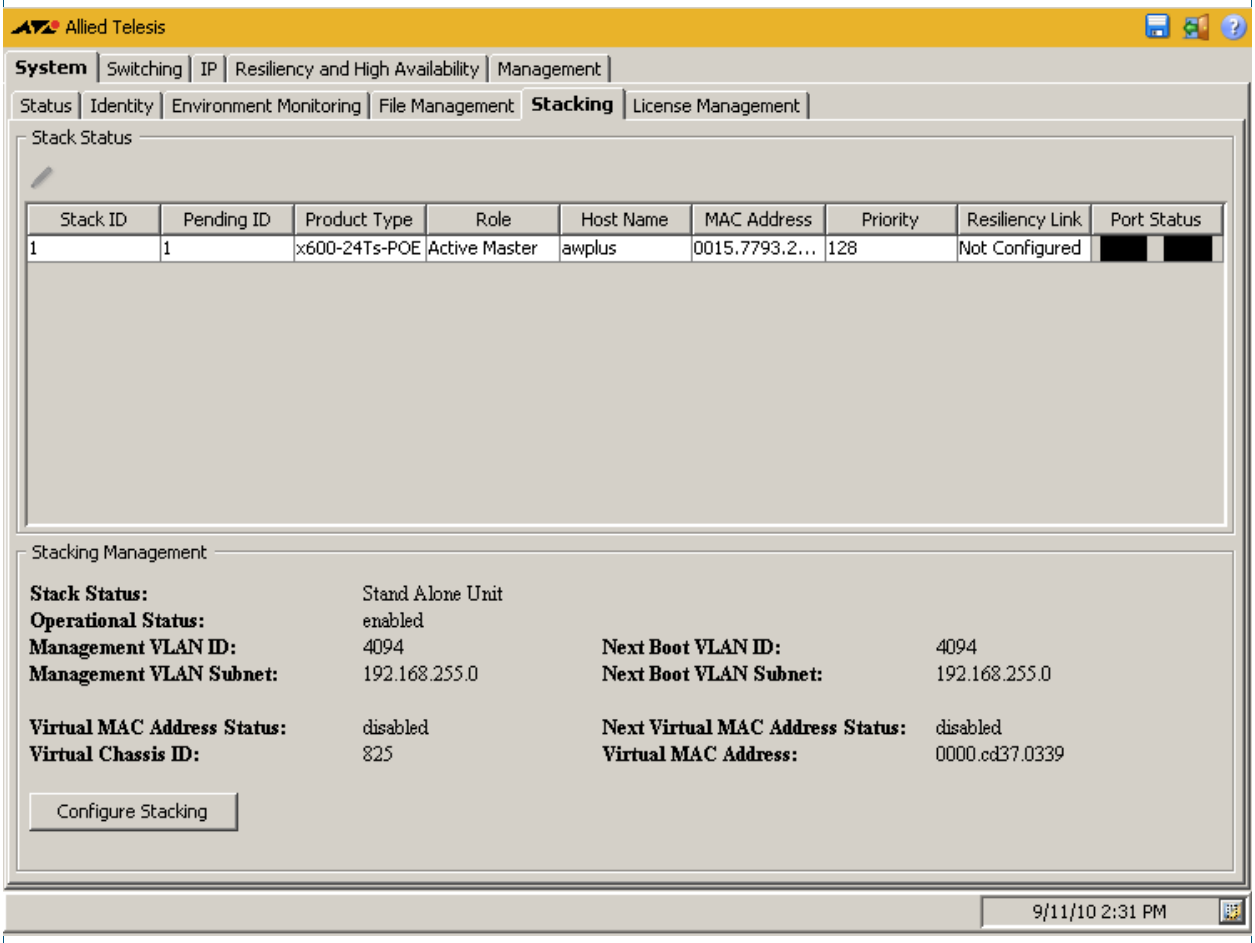
Description

Label / Field / Button	Description
Yes	Confirm selected folder deletion operation.
No	Cancel selected folder deletion operation.

System > Stacking

The System > Stacking menu tab allows you to display and monitor a summary of the identity and status of stack members, plus you can also configure the VLAN ID and IP subnets used for internal VCStack communication.

Menu Tab Figure C-14: Example showing the **System > Stacking** menu tab:



Description: Stacking Management

Label / Field / Button	Description
`Stacking Management / Stack Status`	The stack's overall status. Note that a warning is issued if the stack is not connected in a standard ring topology.
`Stacking Management / Operational Status`	The operational status of the stack. Can be: enabled (1), disabled (2).
`Stacking Management / Management VLAN ID`	The VLAN ID currently used for stack management. The default stack management VLAN ID is 4094.
`Stacking Management / Next Boot VLAN ID`	The VCS management VLAN ID to be assigned after the next reboot.

Label / Field / Button(cont.)	**Description**(cont.)
`Stacking Management / Management VLAN Subnet`	The VLAN subnet currently used for stack management.
`Stacking Management / Next Boot VLAN Subnet`	The stacking management VLAN subnet address after rebooting.
`Stacking Management / Virtual MAC Address Status`	Indicates whether the virtual MAC address is enabled or disabled.
`Stacking Management / Next Virtual MAC Address Status`	Indicates whether the next virtual MAC address is enabled or disabled.
`Stacking Management / Virtual Chassis ID`	Displays the current virtual chassis ID.
`Stacking Management / Virtual MAC Address`	Displays the virtual MAC address used by the stack.
`Configure Stacking`	Configures the VCS management VLAN ID, the subnet address of the VCS management VLAN, and the Virtual MAC Address Status.

Description: Stack Status

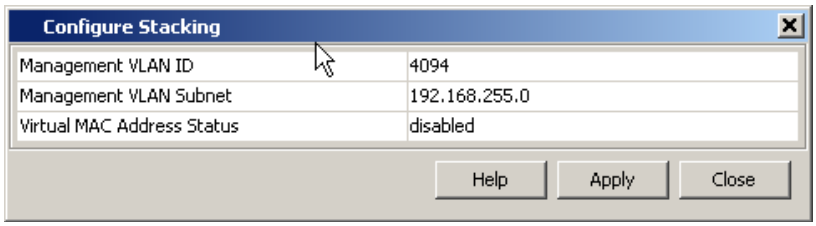
Label / Field / Button	Description
`Stack Status / Stack ID`	The Stack member ID.
`Stack Status / Pending ID`	The Stack member ID to be assigned to the device after the next reboot.
`Stack Status / Product Type`	The Stack member product type; for example, SwitchBlade x908.
`Stack Status / Role`	Stack member's role in the stack (either Active Master or Backup Member).
`Stack Status / Host Name`	The host name of the Stack member.
`Stack Status / MAC Address`	Stack member's hardware MAC address. Note that frames from devices within a stacked virtual chassis will carry the source address of the stack master.
`Stack Status / Priority`	The priority for election of stack master (0 to 255). The lowest number has the highest priority. Note that where stack members have the same priority setting, the switch with the lowest MAC address will become the stack master.
`Stack Status / Resiliency Link`	Status of the stack members resiliency link. Can be one of: `Configured`, `Successful`, `Failed`, `Not Configured`.
`Stack Status / Port Status`	When the rectangle is colored GREEN, it means that the port has a learned neighbor connected. Note that the number in the rectangle indicates the stack ID of the learned neighbor connected to the port. When the rectangle is colored BLACK then the port status is down. When the rectangle is colored RED then Operational Status for the port has been set to disabled.

System > Stacking > Configure Stacking

The System > Stacking > Configure Stacking dialog allows you to configure the VLAN ID and IP subnets used for internal VCStack communication.

Configuration Dialog

Figure C-15: Example showing **System > Stacking > Configure Stacking** dialog:



Description

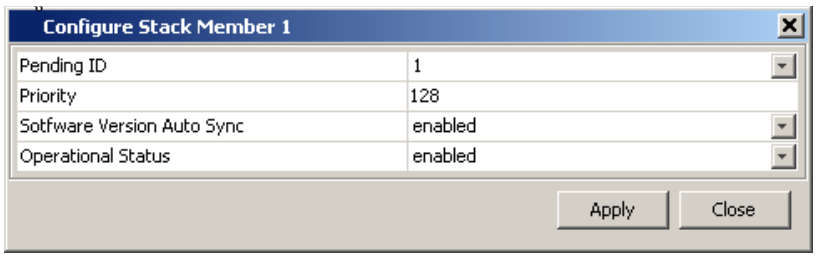
Label / Field / Button	Description
`Management VLAN ID`	Enter the VLAN ID for stack management. The default stack management VLAN ID is 4094.
`Management VLAN subnet`	Enter the subnet address of the VCS management VLAN.
`Virtual MAC Address Status`	Select the status for the Virtual MAC Addressing feature, which can be set to `disabled` or `enabled` from the drop down list.

System > Stacking > Configure Stack Member

The System > Stacking > Configure Stack Member dialog allows you to configure the Pending ID, Priority, Software Version Auto Synchronization and Operational Status used for internal VCStack communication.

Configuration Dialog

Figure C-16: Example showing **System > Stacking > Configure Stack Member** dialog:



Description

Label / Field / Button	Description
`Pending ID`	Enter the Pending ID for the stack member.
`Priority`	Enter the Priority for the stack member.

Label / Field / Button	Description(cont.)
Software Version Auto Sync	Select the enabled or disabled options to enable or disable the Software Version Auto Synchronization feature for the stack member.
Operational Status	Select the enabled or disabled options to enable or disable the stack member.

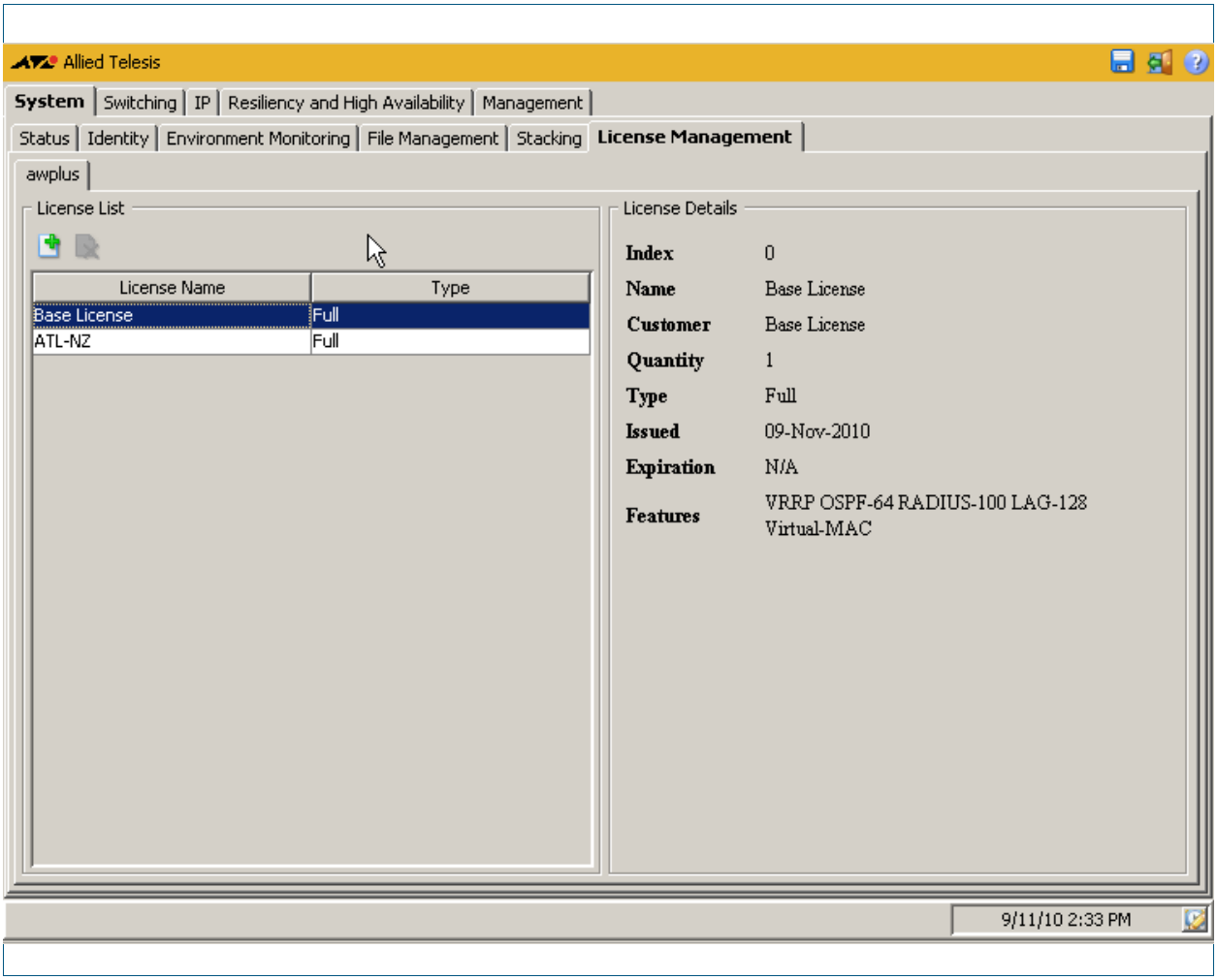
System > License Management

The System > License Management menu tab allows you to view, add and delete feature licenses.

Note: For systems equipped and configured using VCStack there is a separate tab for each stack member with the system name displayed on each tab.

Note: If a license is added to, or deleted from, a stack member then the same action must be taken on all other stack members. Otherwise incompatible licensing will occur and affected devices will not rejoin the stack following a reboot.

Menu Tab Figure C-17: Example showing the **System > License Management** menu tab:



Description

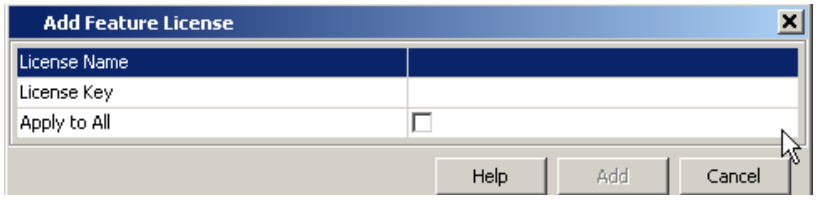
Label / Field / Button	Description
License List / License Name	Name of the license bundle.
License List / Type	The type of license activated on the switch: full or temporary.
License Details / Index	Index identifying entry.
License Details / Name	Name of the license bundle.
License Details / Customer	Customer name.
License Details / Quantity	Quantity of licenses included in the feature key.
License Details / Type	Full or temporary license types.
License Details / Issued	Date the key was generated.
License Details / Expiration	Expiry date for a temporary license.
License Details / Features	List of features enabled by the license.

System > License Management > Add Feature License

The System > License Management > Add Feature License dialog allows you add feature licenses by specifying the license name and the license key. You can add a license for all the stack members or for a single stack member.

Configuration Dialog

Figure C-18: Example showing **System > License Management > Add Feature License** dialog:



Description

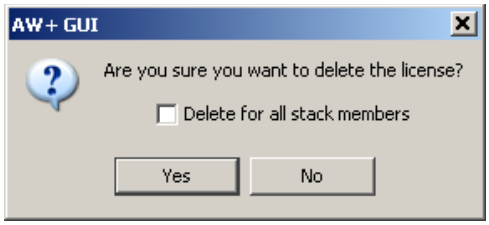
Label / Field / Button	Description
License Name	Enter the license name of the software feature.
License Key	Enter the encrypted license key to enable this software feature.
Apply to All	Select the checkbox to apply the license to all the stack members.

System > License Management > Delete Feature License

The System > License Management > Delete Feature License dialog allows you delete feature licenses by specifying the license name and the license key. You can delete a license for all the stack members or for a single stack member.

Configuration Dialog

Figure C-19: Example showing **System > License Management > Delete Feature License** dialog:



Description

Label / Field / Button	Description
`Delete for all stack members`	Select the checkbox to delete the license for all the stack members.

Switching > Ports

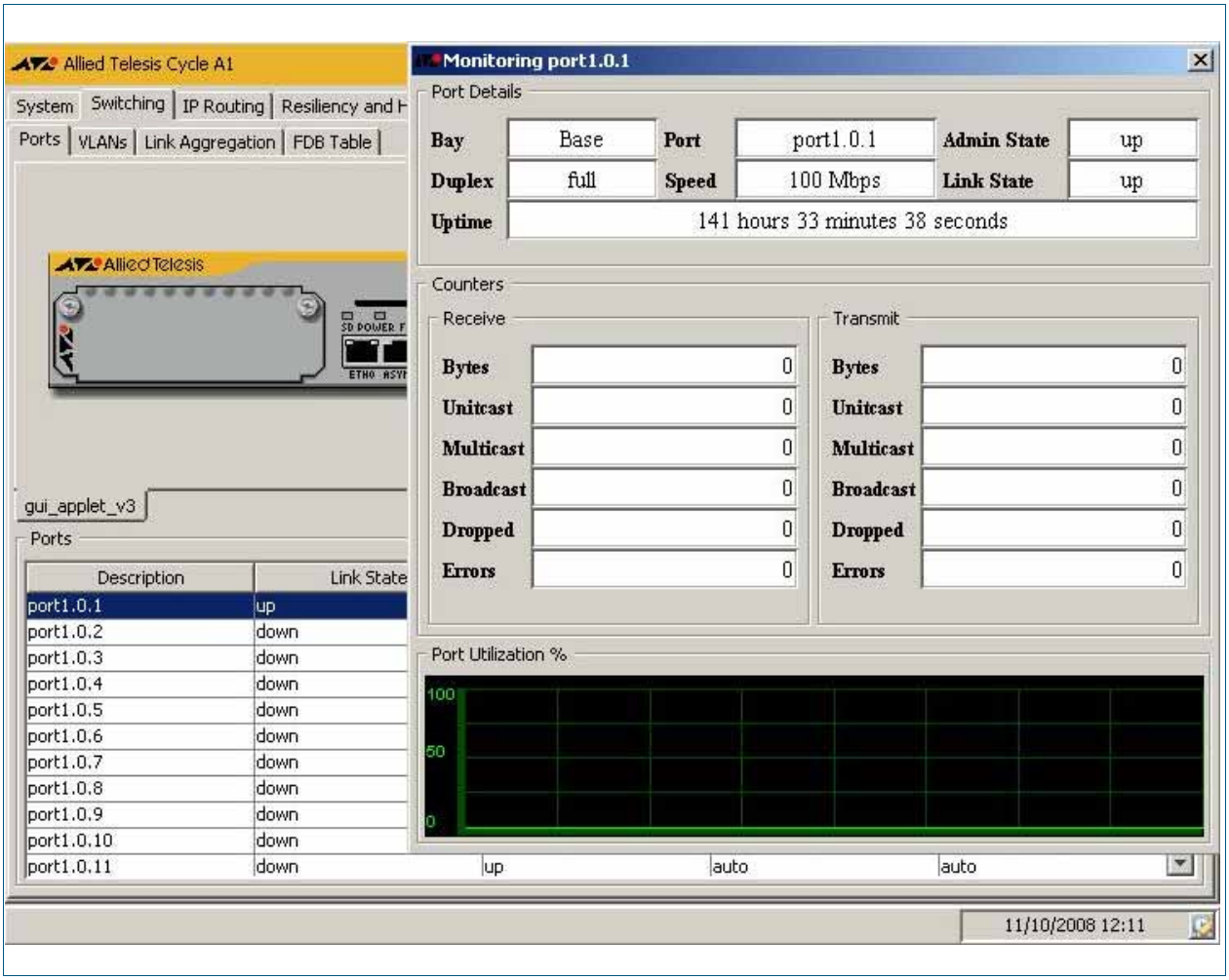
The Switching > Ports menu tab allows you to view, and configure Layer 1 properties:

- Right-clicking a port allows you to select monitoring or configuration dialogs for the selected port.
- The monitoring dialog displays port status, statistics and a brief utilization history.
- The configuration dialog allows you to configure Administrative State, Auto Negotiation, Speed and Duplex settings for the port.

Note: Speed and Duplex settings can only be changed if Auto Negotiation is disabled.

Note: For systems equipped and configured using VCStack there is a separate tab for each stack member with the system name displayed on each tab.

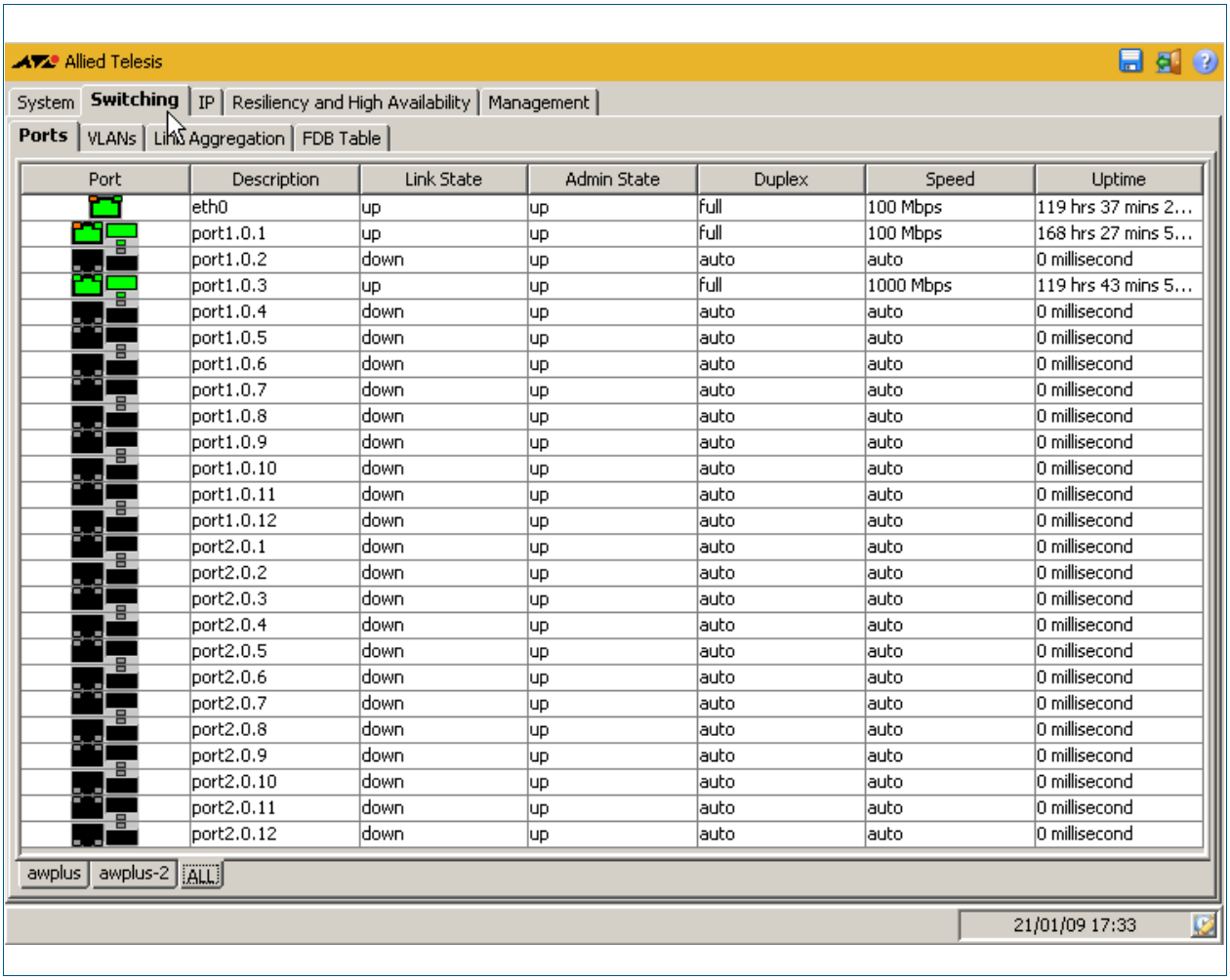
Menu Tab Figure C-20: Example showing the **Switching > Ports** menu tab



Description

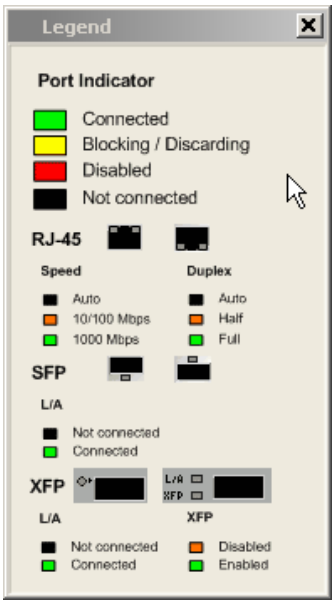
Label / Field / Button	Description
Ports	Displays port number, description of the port, link and administrative status, duplex mode, speed and uptime (in milliseconds) for the selected port.

Menu Tab Figure C-21: Example showing the **Switching > Ports > ALL** menu tab:



Port	Description	Link State	Admin State	Duplex	Speed	Uptime
	eth0	up	up	full	100 Mbps	119 hrs 37 mins 2...
	port1.0.1	up	up	full	100 Mbps	168 hrs 27 mins 5...
	port1.0.2	down	up	auto	auto	0 millisecond
	port1.0.3	up	up	full	1000 Mbps	119 hrs 43 mins 5...
	port1.0.4	down	up	auto	auto	0 millisecond
	port1.0.5	down	up	auto	auto	0 millisecond
	port1.0.6	down	up	auto	auto	0 millisecond
	port1.0.7	down	up	auto	auto	0 millisecond
	port1.0.8	down	up	auto	auto	0 millisecond
	port1.0.9	down	up	auto	auto	0 millisecond
	port1.0.10	down	up	auto	auto	0 millisecond
	port1.0.11	down	up	auto	auto	0 millisecond
	port1.0.12	down	up	auto	auto	0 millisecond
	port2.0.1	down	up	auto	auto	0 millisecond
	port2.0.2	down	up	auto	auto	0 millisecond
	port2.0.3	down	up	auto	auto	0 millisecond
	port2.0.4	down	up	auto	auto	0 millisecond
	port2.0.5	down	up	auto	auto	0 millisecond
	port2.0.6	down	up	auto	auto	0 millisecond
	port2.0.7	down	up	auto	auto	0 millisecond
	port2.0.8	down	up	auto	auto	0 millisecond
	port2.0.9	down	up	auto	auto	0 millisecond
	port2.0.10	down	up	auto	auto	0 millisecond
	port2.0.11	down	up	auto	auto	0 millisecond
	port2.0.12	down	up	auto	auto	0 millisecond

Legend Figure C-22: Example showing S**witching > Ports > Legend**:

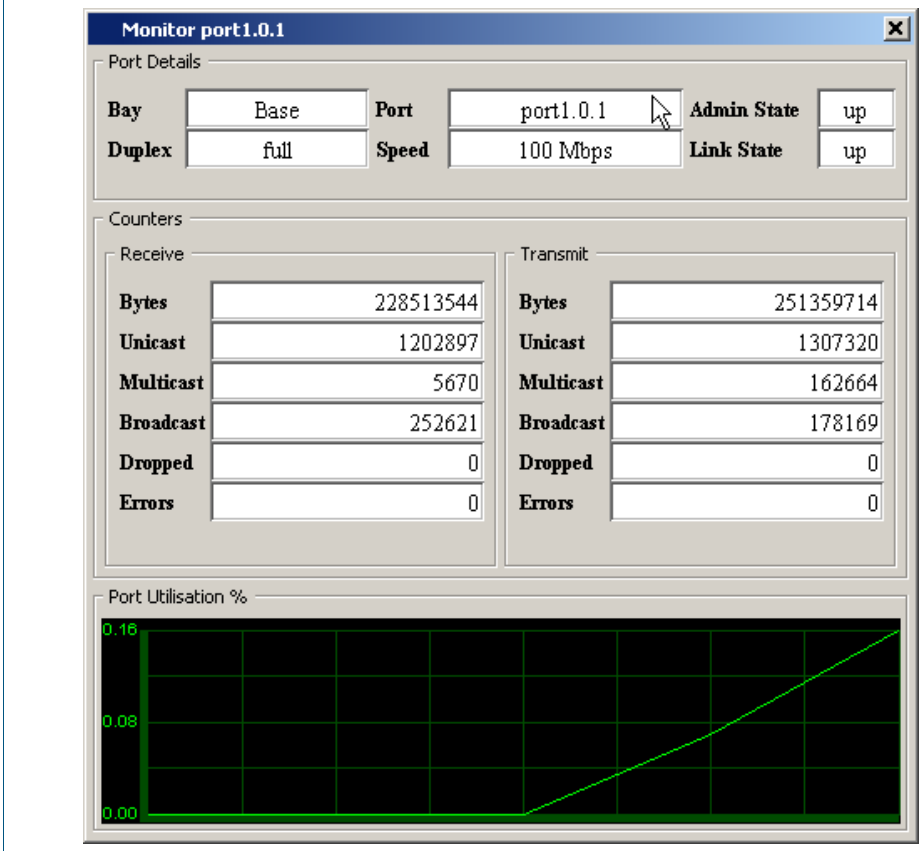


Switching > Ports > Monitor Port

The Switching > Ports > Monitor Port dialog allows you monitor port counters.

Configuration Dialog

Figure C-23: Example showing the **Switching > Ports > Monitor Port** dialog:



Description

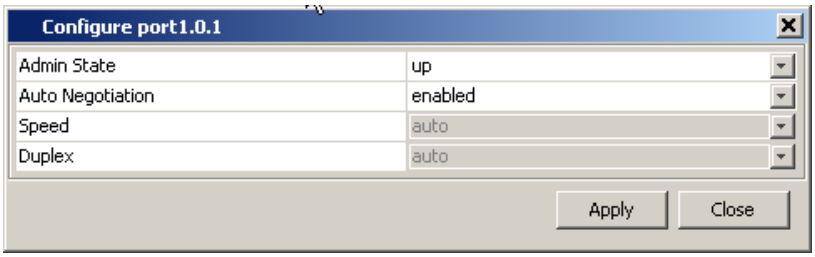
Label / Field / Button	Description
`Port Details`	Monitors the bay, port, duplex, speed, administrative state and link states for the selected port.
`Counters`	Monitors the counters for bytes received/transmitted, unicast packets received/transmitted, multicast packets received/transmitted, broadcast packets received/transmitted, dropped packets received/transmitted, and errors received/transmitted for the selected port.
`Port Utilisation%`	Monitors and graphs the usage percentage for the selected port.

Switching > Ports > Configure Port

The Switching > Ports > Configure Port dialog allows you configure Administrative State, Auto Negotiation, Speed and Duplex settings for the selected port.

Configuration Dialog

Figure C-24: Example showing the **Switching > Ports > Configure Port** dialog:



Description

Label / Field / Button	Description
`Admin State`	Select `up` or `down` from the drop down list in this dialog to specify the administrative state for the selected port.
`Auto Negotiation`	Select `disabled` or `enabled` from the drop down list in this dialog to specify auto negotiation for the selected port. Note that selecting `enabled` to enable `Auto Negotiation` will disable Speed and Duplex options, indicated by greyed out options.
`Speed`	Select `10 Mbps`, `100 Mbps`, `1000 Mbps`, `10 Gbps`, or `auto` from the drop down list in this dialog to specify the speed setting for the selected port. Note that the options for speed settings are only available if `Auto Negotiation` has been `disabled` for the selected port.
`Duplex`	Select `full`, `half`, or `auto` from the drop down list in this dialog to specify the duplex setting for the selected port. Note that the options for duplex settings are only available if `Auto Negotiation` has been `disabled` for the selected port.

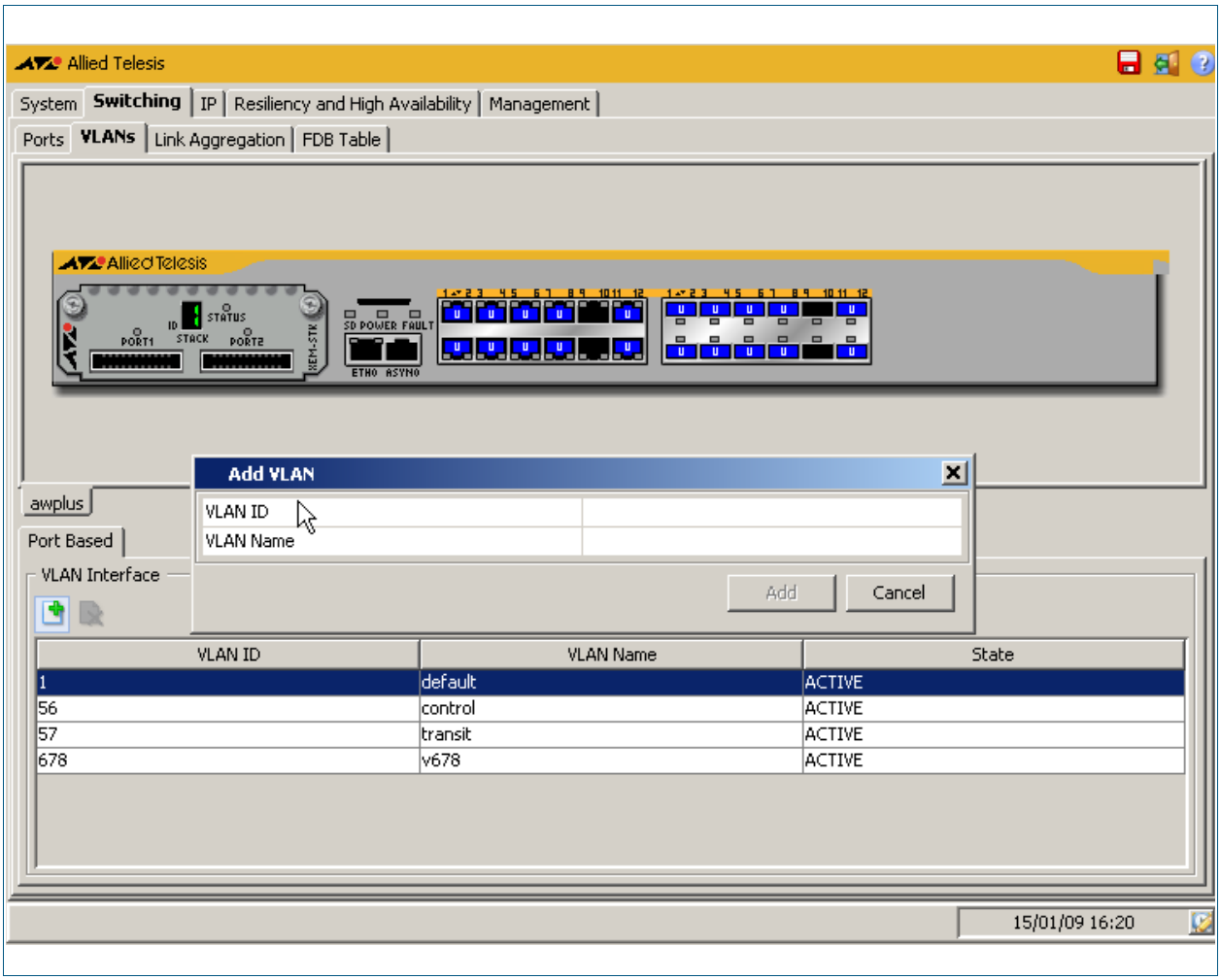
Switching > VLANs

The Switching > VLANs menu tab allows you to view, and configure Layer 2 properties:

- Right-clicking a port allows you to select a VLAN to be tagged or untagged for the port, or to remove a port from the VLAN.
- Define VLANs before assigning VLANs to ports on the front panel of the switch.
- Selecting the **+** icon (under the VLAN Interface label on the VLAN tab below the front panel illustration) allows you to add a VLAN by specifying the VLAN ID and VLAN Name.
- Selecting the **x** icon (under the VLAN Interface label below the front panel illustration) allows you to delete a VLAN (except for the default VLAN 1 that is assigned to all ports).

Note: For systems equipped and configured using VCStack there is a separate tab for each stack member with the system name displayed on each tab.

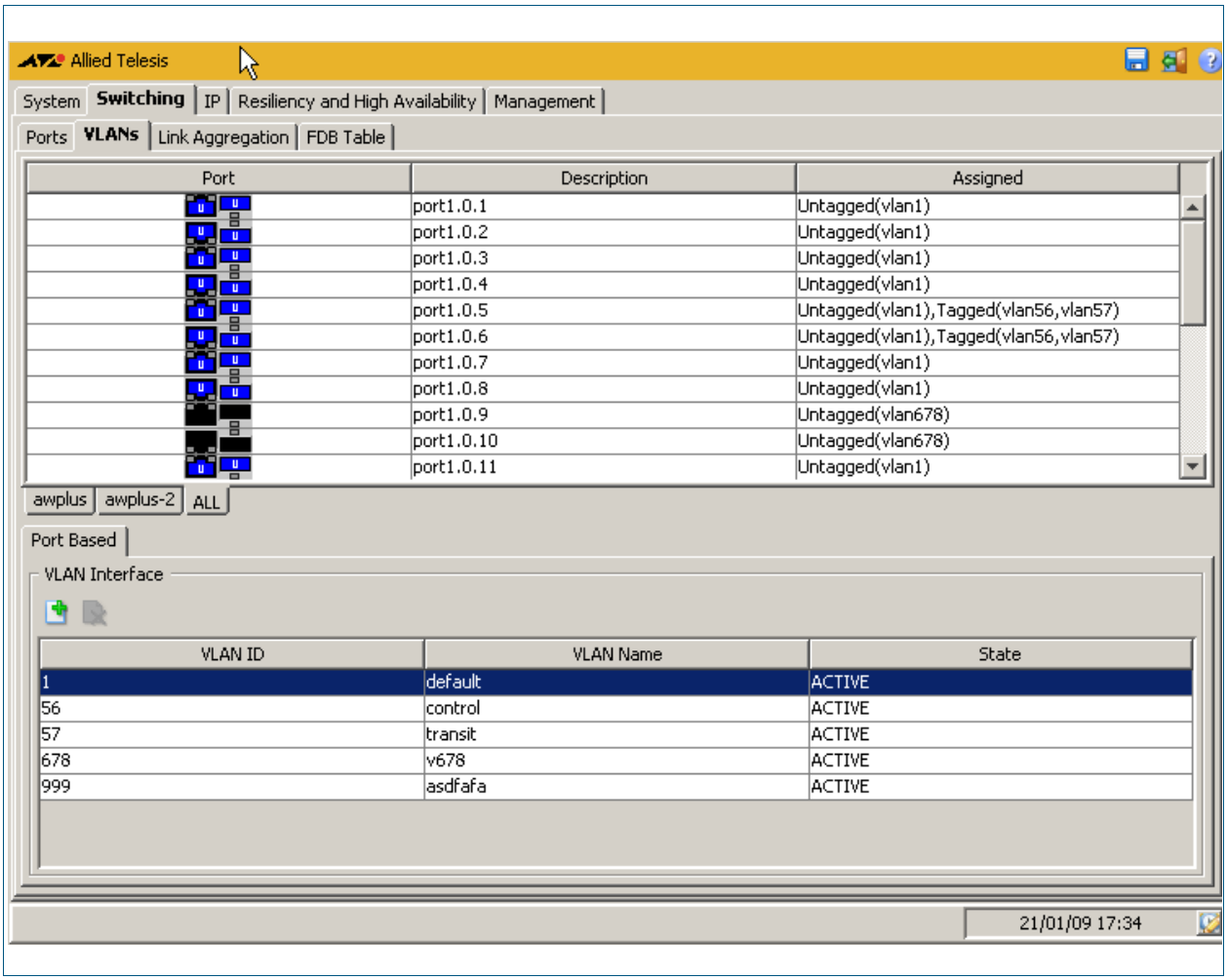
Menu Tab Figure C-25: Example showing the **Switching > VLANs** menu tab:



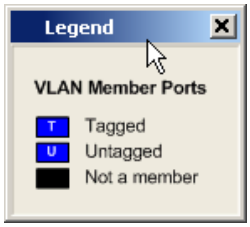
Description

Label / Field / Button	Description
`Port Based / VLAN ID`	The VID of the VLAN that is enabled or disabled in the range 1-4094.
`Port Based / VLAN Name`	The ASCII name of the VLAN with a maximum length of 32 characters.
`Port Based / State`	The state of the VLAN, either enabled ('ACTIVE' displayed) or disabled ('INACTIVE' displayed).

Menu Tab Figure C-26: Example showing the **Switching > VLANs > ALL** menu tab:



Legend Figure C-27: Example showing **Switching > VLANs > Legend**:

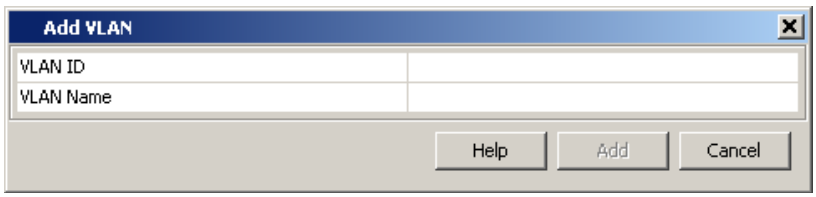


Switching > VLANs > Add VLAN

The Switching > VLANs > Add VLAN dialog allows you add a VLAN by specifying the VLAN ID and VLAN Name.

Configuration Dialog

Figure C-28: Example showing the **Switching > VLANs > Add VLAN** dialog:



Description

Label / Field / Button	Description
VLAN ID	Enter the VID of the VLAN that is enabled or disabled in the range <1-4094>.
VLAN Name	Enter the ASCII name of the VLAN with a maximum length of 32 characters.

Switching > Link Aggregation

The Switching > Link Aggregation menu tab allows you to view, and configure Layer 2 properties:

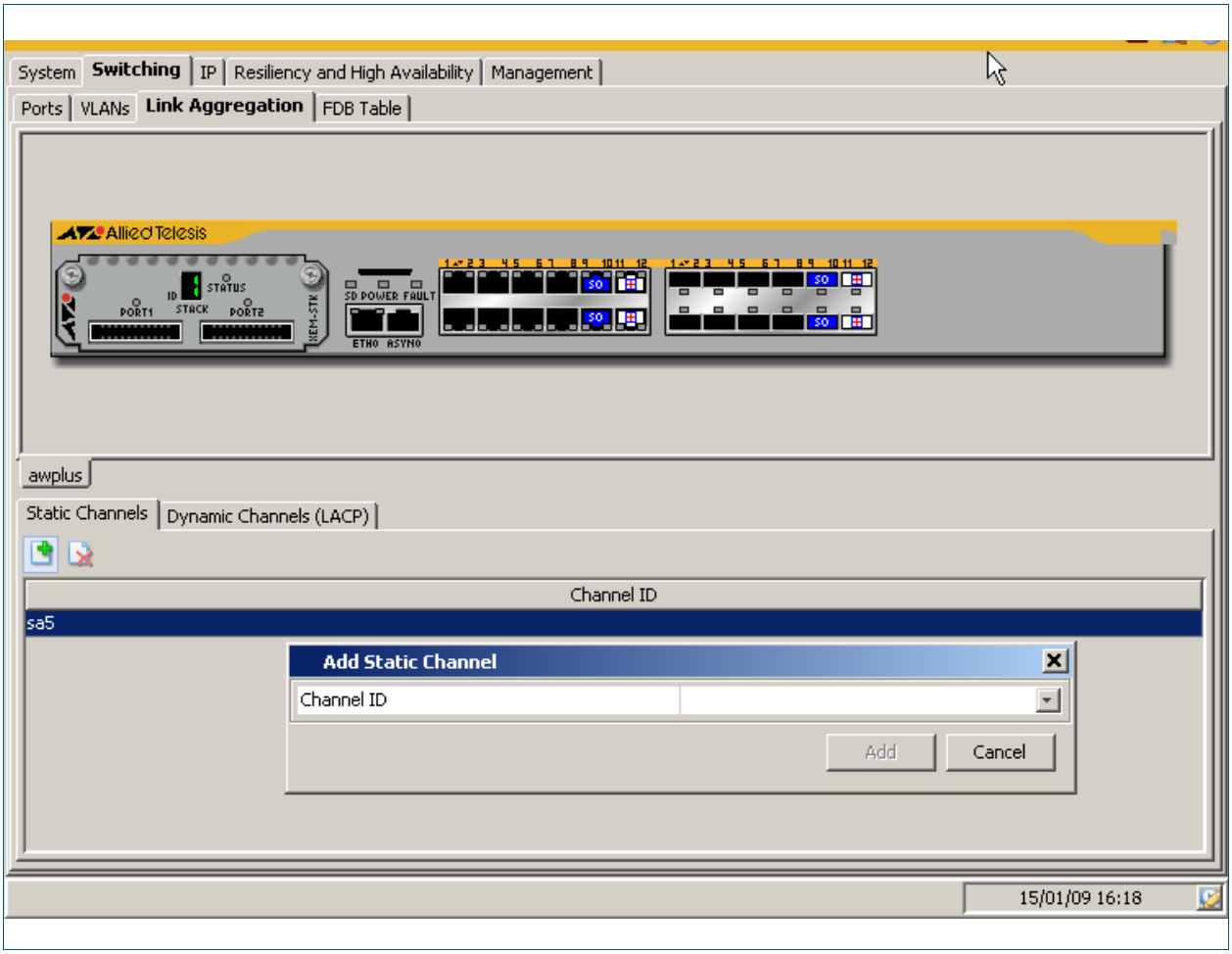
- Right-clicking a port allows you to select assign or remove the port to a Static Channel or a Dynamic Channel (LACP - Link Aggregation Control Protocol) group.
- Define Static Channel or Dynamic Channel (LACP) groups before assigning them to ports on the front panel of the switch.
- Selecting the + icon (located below the front panel illustration of your switch) allows you to add a Static Channel or Dynamic Channel (LACP) group by specifying the Channel ID.

Note: Up to 31 Static Channel groups and up to 99 Dynamic Channel (LACP) groups can be defined on a switch.

- Selecting the x icon (located below the front panel illustration of your switch) allows you to delete a Static Channel or Dynamic Channel (LACP) group.

Note: For systems equipped and configured using VCStack there is a separate tab for each stack member with the system name displayed on each tab.

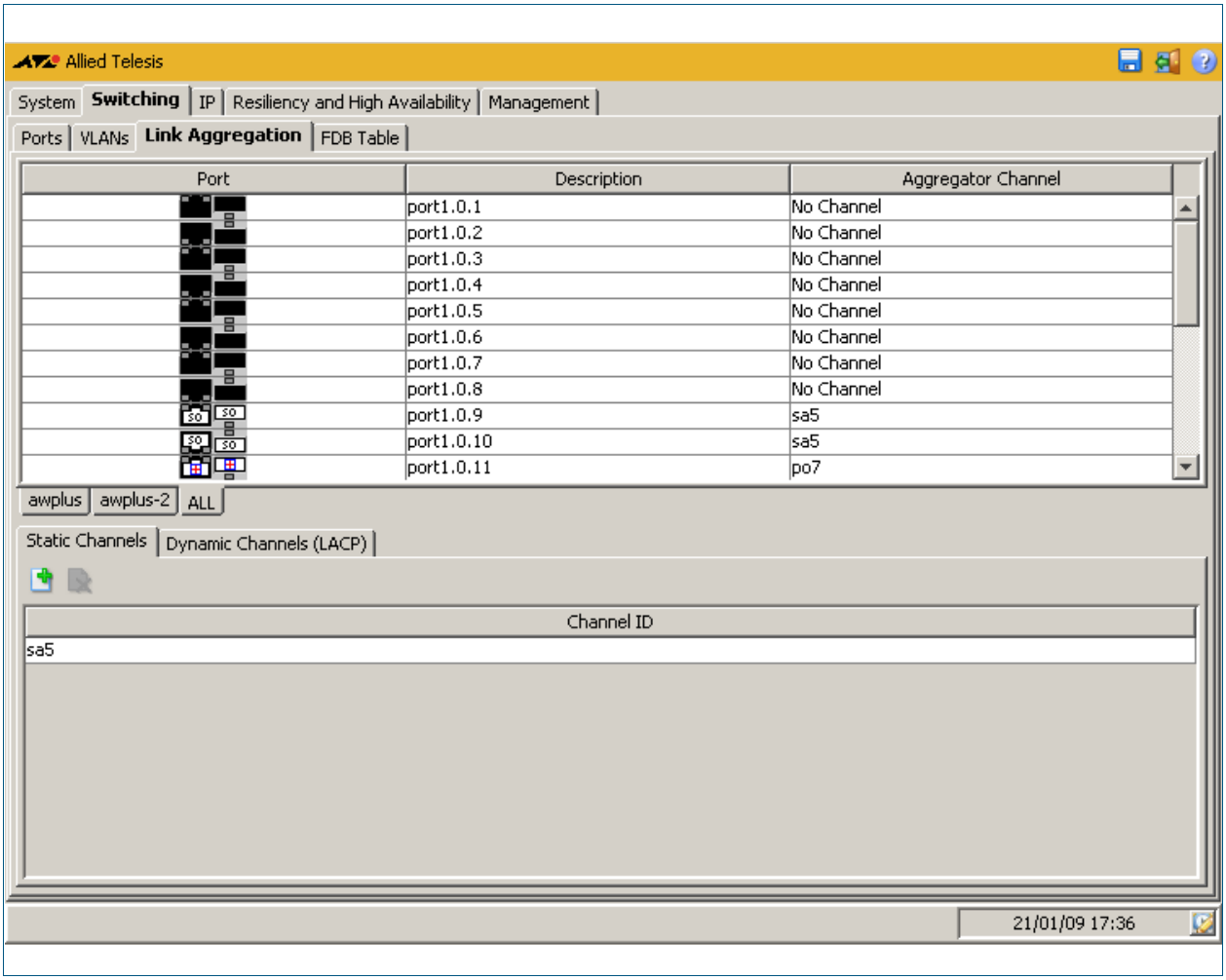
Menu Tab Figure C-29: Example showing the **Switching > Link Aggregation** menu tab:



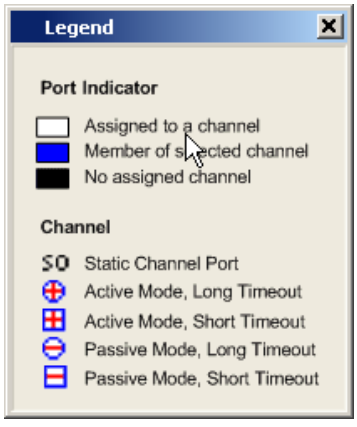
Description

Label / Field / Button	Description
`Static Channels`	Display or specify a static channel group number for an aggregated link. Up to 31 static channel groups can be created on the switch.
`Dynamic Channels (LACP)`	Display or specify a dynamic channel group number for an LACP link. Up to 99 dynamic channel groups can be created on the switch.

Menu Tab Figure C-30: Example showing the **Switching > Link Aggregation > ALL** menu tab:



Legend Figure C-31: Example showing **Switching > Link Aggregation > Legend**:

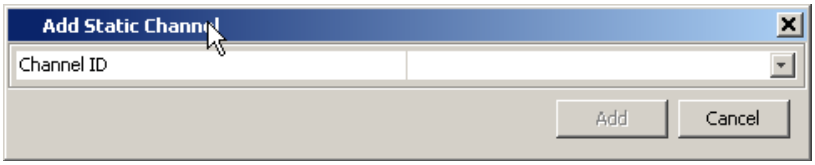


Switching > Link Aggregation > Add Static Channel

The Switching > Link Aggregation > Add Static Channel dialog allows you to assign the selected port to a Static Channel group.

Configuration Dialog

Figure C-32: Example showing the **Switching > Link Aggregation > Add Static Channel** dialog:



Description

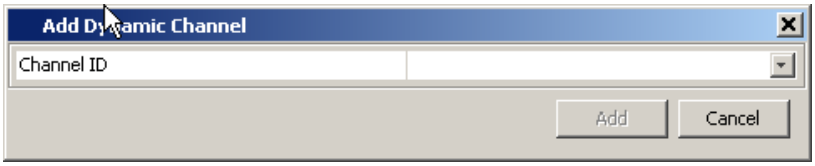
Label / Field / Button	Description
Channel ID	Specify a static channel group number for an interface. Up to 31 static channel groups can be created on the switch.

Switching > Link Aggregation > Add Dynamic Channel

The Switching > Link Aggregation > Add Dynamic Channel dialog allows you to assign the selected port to a Dynamic Channel (LACP) group.

Configuration Dialog

Figure C-33: Example showing **Switching > Link Aggregation > Add Dynamic Channel** dialog:



Description

Label / Field / Button	Description
Channel ID	Specify a dynamic (LACP) channel group number for an interface. Up to 99 dynamic (LACP) channel groups can be created on the switch.

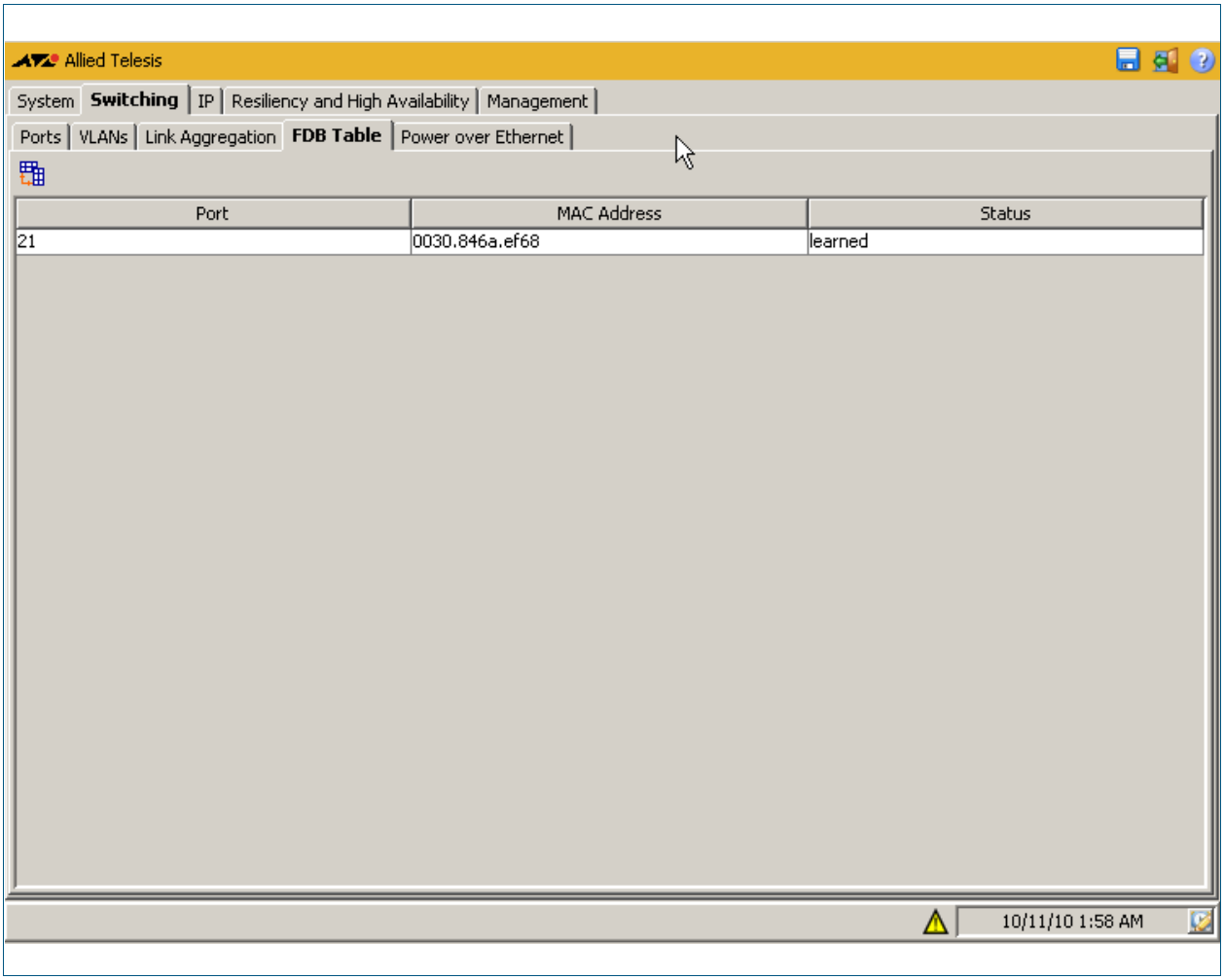
Switching > FDB Table

The Switching > FDB Table menu tab allows you to view the contents of the Layer 2 Forwarding Database Table.

You can change the FDB Table view to display horizontally or vertically by selecting the table view icon above the FDB Table.

You can also sort or rearrange the display of the FDB Table by Port, MAC Address, or Forwarding Status by selecting the relevant column or by dragging the relevant column respectively.

Menu Tab Figure C-34: Example showing the **Switching > FDB Table** menu tab:



Description

Label / Field / Button	Description
`FDB Table`	Displays the FDB (Forwarding Database) table for the switch that shows all the available ports, MAC addresses, and port status.

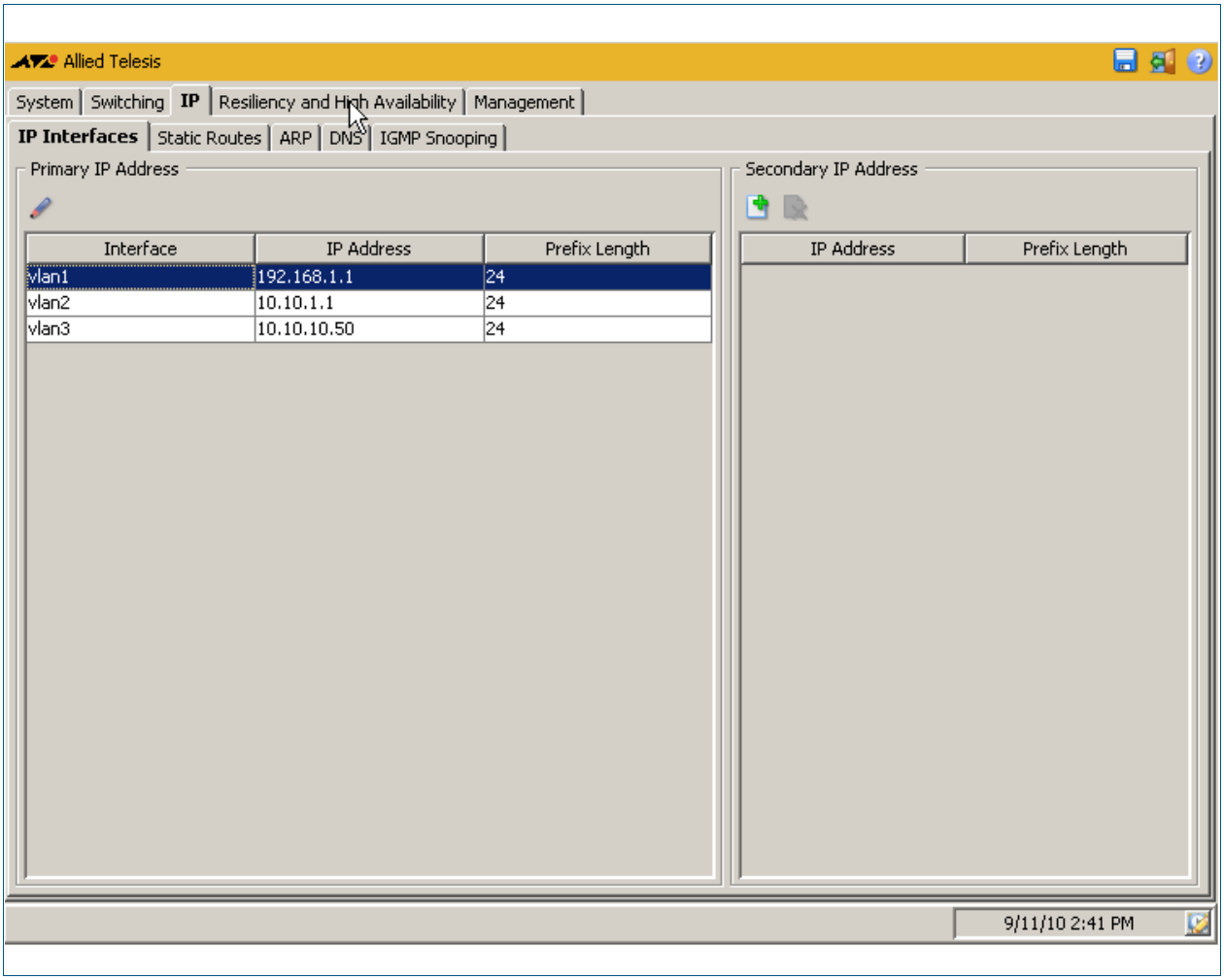
IP > IP Interfaces

The IP > IP Interfaces menu tab allows you to view and specify the Primary and Secondary IP Addresses for VLAN and management port interfaces.

Note: You may only define a Secondary IP Address for an interface after first defining its Primary IP Address.

- Select an interface then use the pen shaped icon under the Primary IP Address label to configure an IP address. You can delete an assigned Primary IP Address in the Configure Primary IP Address dialog as displayed after selecting the icon under Primary IP Address.
- Select an interface with a Primary IP Address already defined to configure a Secondary IP Address, using the **+** icon under the Secondary IP Address label.
- Remove a selected Secondary IP Address using the **x** icon under the Secondary IP Address label.

Menu Tab Figure C-35: Example showing the **IP > IP Interfaces** menu tab:



Description

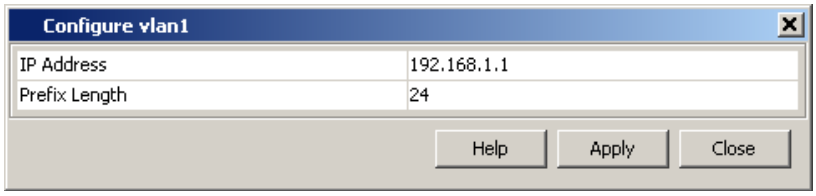
Label / Field / Button	Description
`Primary IP Address`	Displays and configures primary IP addressing for VLANs and management port interfaces that are defined on the switch and assigned to ports.
`Secondary IP Address`	Displays and configures secondary IP addressing for VLANs and management port interfaces that are defined on the switch and assigned to ports.

IP > IP Interfaces > Configure Primary IP Address

The IP > IP Interfaces > Configure Primary IP Address dialog allows you to configure a primary address with an IP address and a prefix length for the selected interface.

Configuration Dialog

Figure C-36: Example showing the **IP > IP Interfaces > Configure Primary IP Address** dialog:



Description

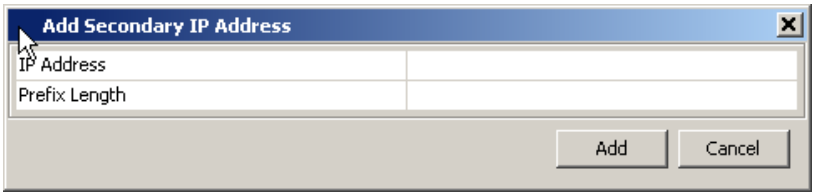
Label / Field / Button	Description
`IP Address`	Enter or remove an IPv4 Address in dotted decimal notation (i.e. A.B.C.D).
`Prefix Length`	Enter the Prefix for the IPv4 Address with the integer as used for slash notation (i.e. 24 instead of /24), not dotted decimal notation (i.e. 255.255.255.0).

IP > IP Interfaces > Add Secondary IP Address

The IP > IP Interfaces > Add Secondary IP Address dialog allows you to add a secondary address with an IP address and a prefix length for the selected interface (only if the selected interface already has a primary address configured).

Configuration Dialog

Figure C-37: Example showing the **IP > IP Interfaces > Add Secondary IP Address** dialog:



Description

Label / Field / Button	Description
`IP Address`	Enter an IPv4 Address in dotted decimal notation (i.e. `A.B.C.D`).
`Prefix Length`	Enter the Prefix for the IPv4 Address with the integer as used for slash notation (i.e. `24` instead of `/24`), not dotted decimal notation (i.e. `255.255.255.0`).

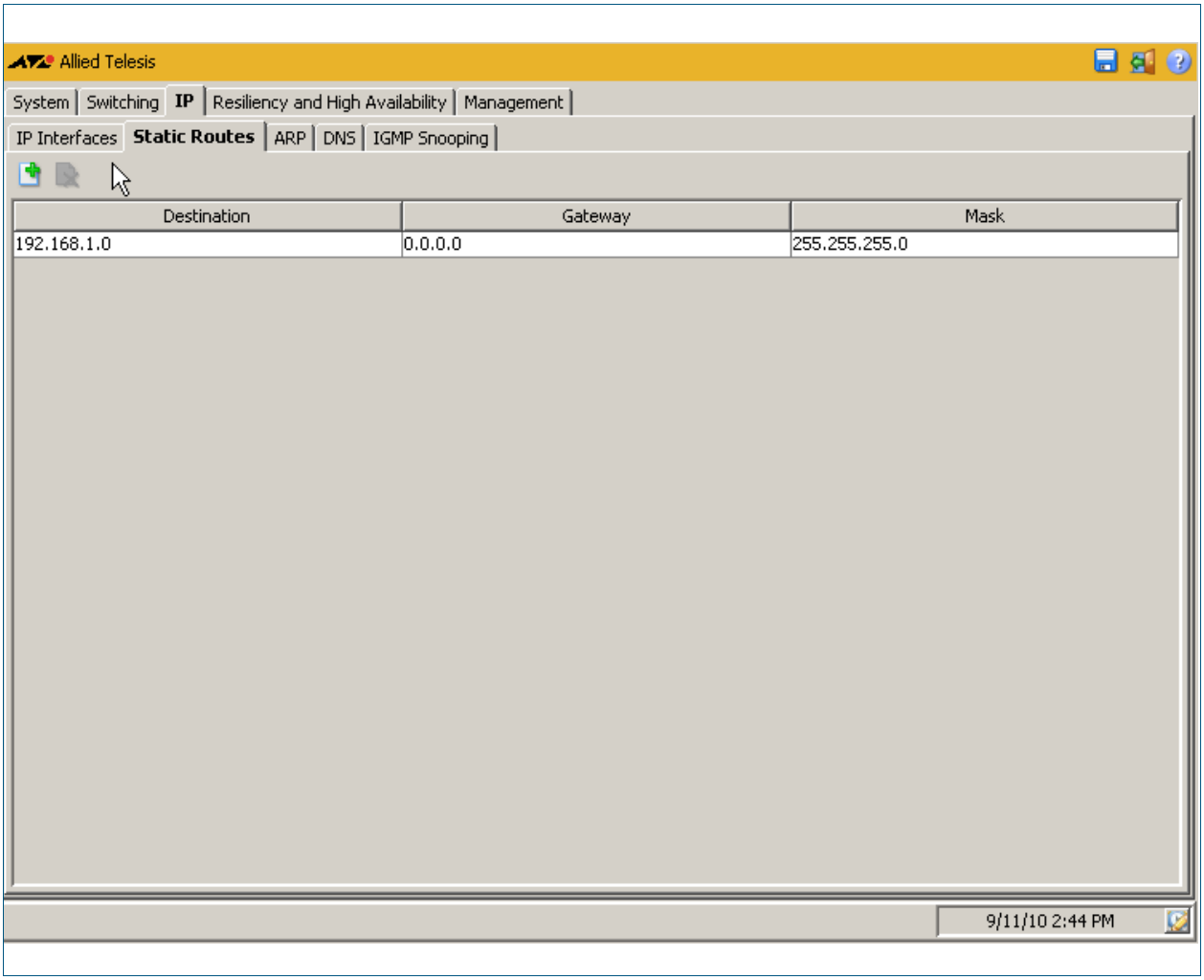
IP > Static Routes

The IP > Static Routes menu tab allows you to view, add, and delete static IP routes configured on the switch. Static routes are specified using destination IP addresses, masks, and gateways.

You can also sort or rearrange the display of the Static Routes by Destination, Gateway, or Mask by selecting the relevant column or by dragging the relevant column respectively.

- Selecting the + icon allows you to define a Static Route specifying destination and gateway IPv4 addresses with a dotted decimal format subnet mask.
- Selecting the x icon allows you to delete a defined Static Route.

Menu Tab Figure C-38: Example showing the **IP > Static Routes** menu tab:



Description

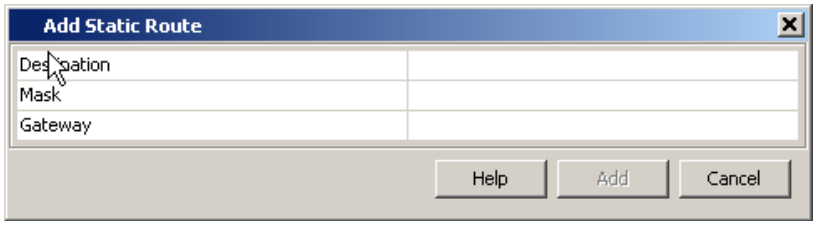
Label / Field / Button	Description
`Static Routes / Destination`	The IPv4 address of the destination subnet address.
`Static Routes / Gateway`	The IPv4 address of the gateway device.
`Static Routes / Mask`	The subnet mask in dotted decimal notation (for example, 255.255.255.0 instead of the slash notation /24).

IP > Static Routes > Add Static Route

The IP > Static Routes > Add Static Route dialog allows you to add a static IP routes on the switch. Static routes are specified using destination IP addresses, masks, and gateways.

Configuration Dialog

Figure C-39: Example showing the **IP > Static Routes > Add Static Route** dialog:



Description

Label / Field / Button	Description
`Destination`	Enter the IPv4 address of the destination subnet address.
`Mask`	Enter the subnet mask in dotted decimal notation (for example, 255.255.255.0 instead of the slash notation /24).
`Gateway`	Enter the IPv4 address of the gateway device.

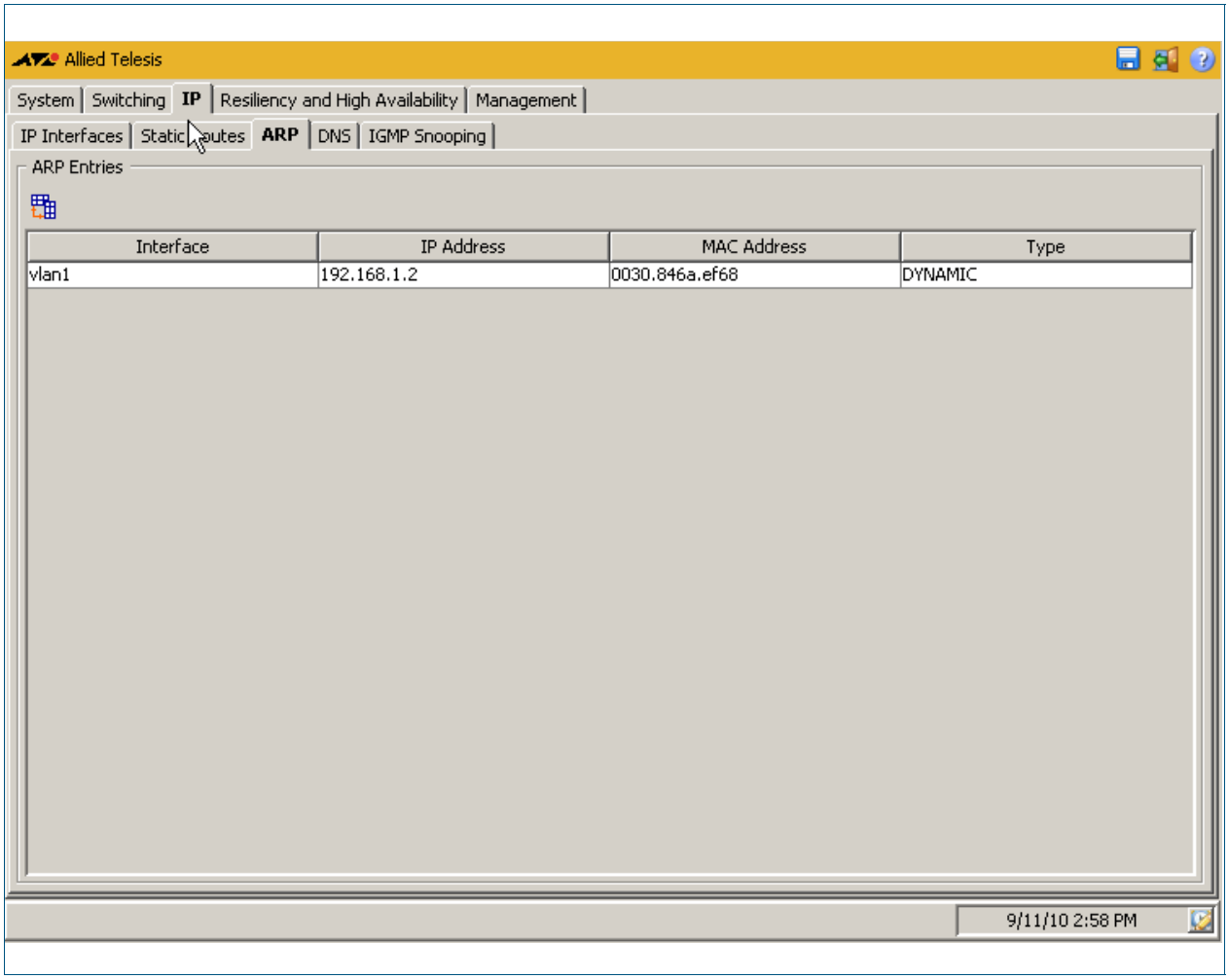
IP > ARP

The IP > ARP menu tab allows you to view the contents of the ARP (Address Resolution Protocol) Table.

You can change the ARP Entries view to display horizontally or vertically by selecting the table view icon above the ARP Entries.

You can also sort or rearrange the display of the ARP Entries by Interface, IP Address, MAC Address, or Type by selecting the relevant column or by dragging the relevant column respectively.

Menu Tab Figure C-40: Example showing the **IP > ARP** menu tab:



Description

Label / Field / Button	Description
`ARP Entries / Interface`	Interface over which the switch is accessed, usually a VLAN.
`ARP Entries / IP Address`	IP address of the network device this ARP entry maps to.

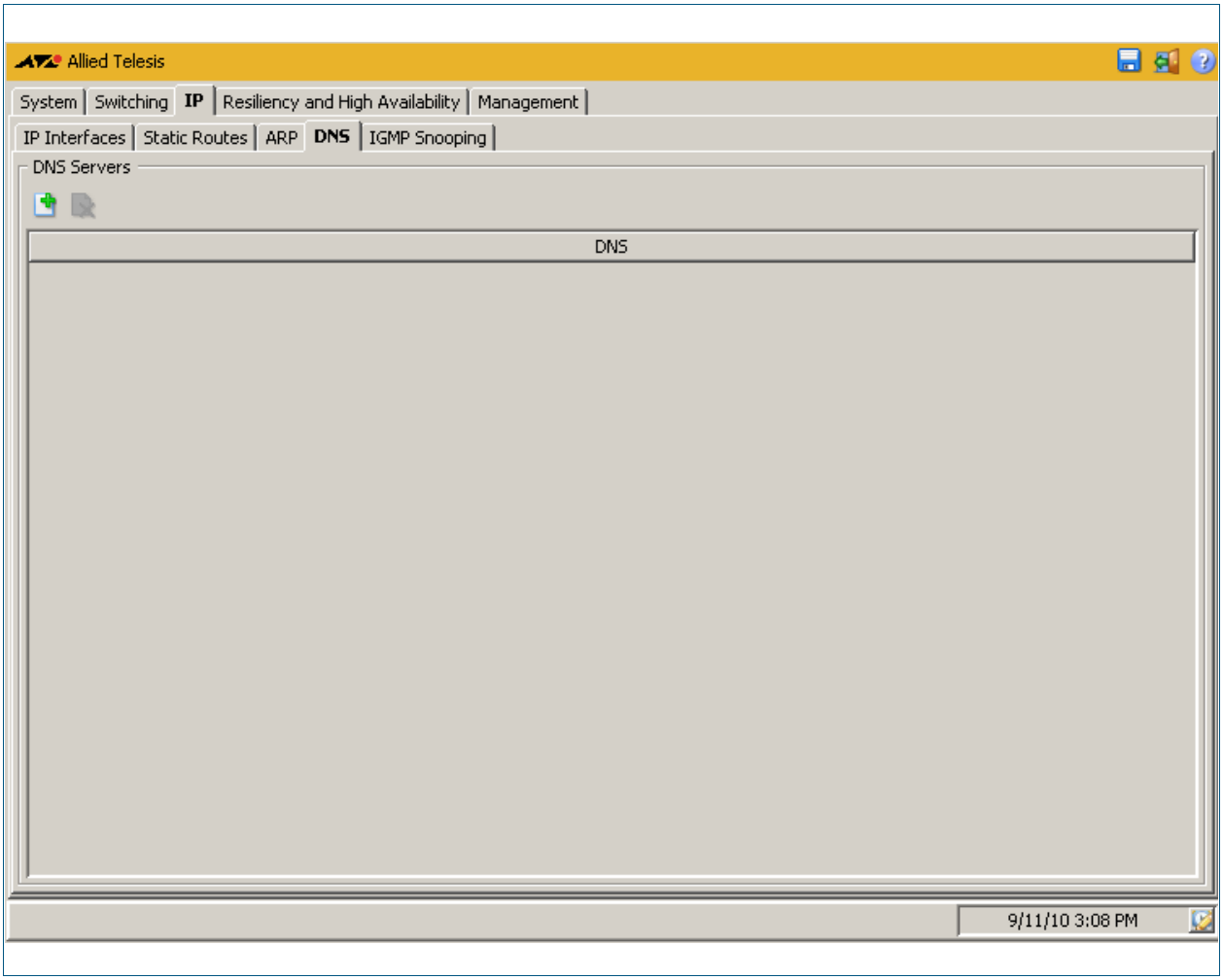
Label / Field / Button	Description(cont.)
ARP Entries / MAC Address	Hardware address of the switch in hexadecimal format HHHH.HHHH.HHHH.
ARP Entries / Type	Indicates whether the ARP entry is a Static or Dynamic ARP entry. Static ARP entries are added and dynamic ARP entries are learned.

IP > DNS

The IP > DNS menu tab allows you to display and configure DNS (Domain Name System) server entries for the switch.

- Selecting the + icon allows you to define a DNS Server specifying the IPv4 address.
- Selecting the x icon allows you to delete a defined DNS Server.

Figure C-41: Example showing the **IP > DNS** menu tab:



Description

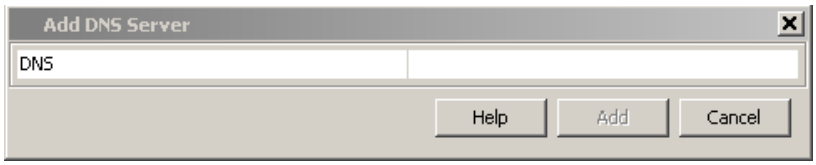
Label / Field / Button	Description
DNS	DNS Server IPv4 address.

IP > DNS > Add DNS Server

The IP > DNS > Add DNS Server dialog allows you to add DNS (Domain Name System) server entries for the switch.

Configuration Dialog

Figure C-42: Example showing the **IP > DNS > Add DNS Server** dialog:



Description

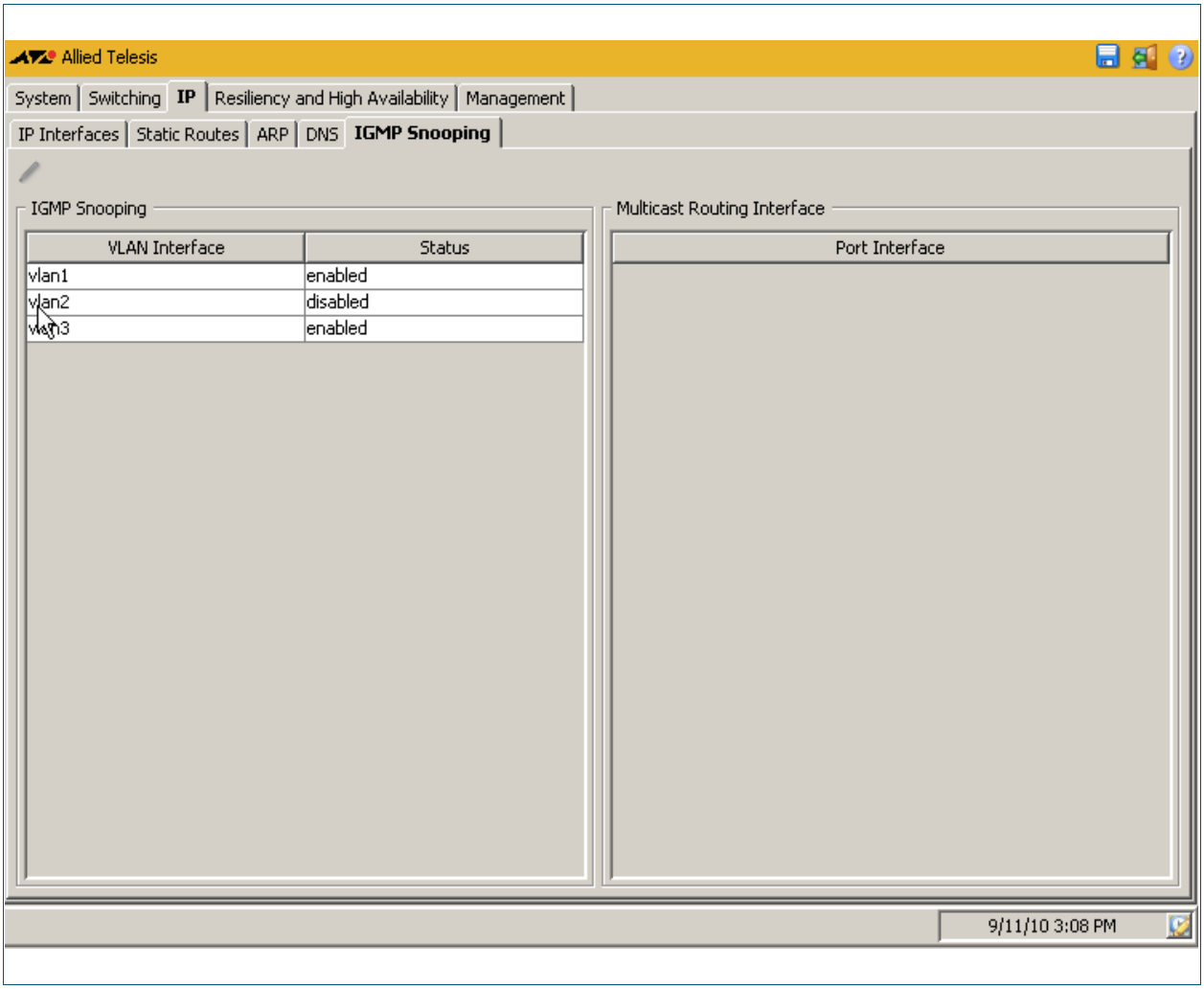
Label / Field / Button	Description
DNS	Enter an IPv4 address in dotted decimal notation (i.e. A.B.C.D) for the DNS (Domain Name System) Server you want to specify.

IP > IGMP Snooping

Menu Tab The IP > IGMP Snooping menu tab displays basic IGMP Snooping and Multicast Routing Interface information.

You can also configure IGMP Snooping on individual ports by selecting the VLAN interface that the port is a member of then clicking on the pen shaped icon to display the Configure IGMP Snooping dialog, where you can enable or disable IGMP snooping on desired ports.

Menu Tab Figure C-43: Example showing the **IP > IGMP Snooping** menu tab:



Description

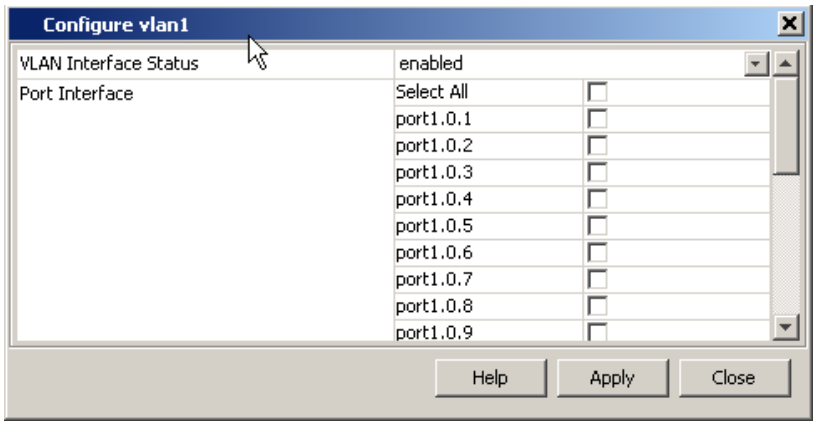
Label / Field / Button	Description
IGMP Snooping / IGMP Snooping	Displays and configures IGMP Snooping for a specified VLAN interface.
IGMP Snooping / Multicast Routing Interface	Displays and configures the specified port in the VLAN as a multicast router for IGMP Snooping.

IP > IGMP Snooping > Configure Interface

The IP > IGMP Snooping > Configure Interface dialog allows you to configure IGMP Snooping on individual ports. First select the VLAN interface that the port is a member of then enable or disable IGMP snooping on desired ports from this dialog.

Configuration Dialog

Figure C-44: Example showing the **IP > IGMP Snooping > Configure Interface** dialog:



Description

Label / Field / Button	Description
`VLAN Interface Status`	Displays whether the selected VLAN is enabled or disabled.
`Port Interface`	Select the check box for a given port to allocate it to the VLAN.

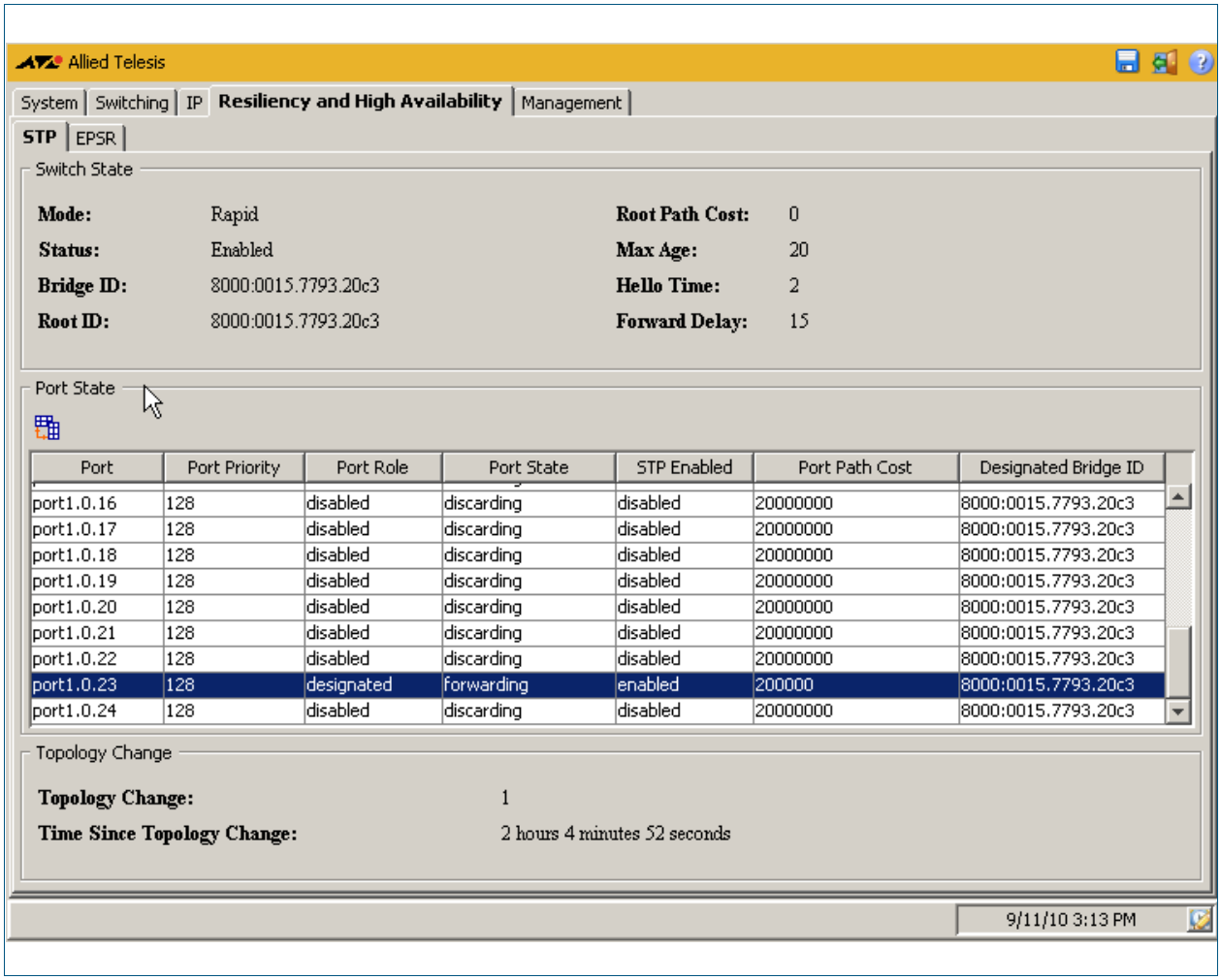
Resiliency and High Availability > STP

The Resiliency and High Availability > STP menu tab allows you to view the configuration and status of spanning tree data: for the switch as a whole and for each port.

You can also sort or rearrange the display of the Port State table by Port, Port Priority, Port State, Port Role, STP Enabled, Port Path Cost, or Designated Bridge ID by selecting the relevant column or by dragging the relevant column respectively.

Note: STP is not configurable through the GUI. Refer to the relevant STP chapters in the AlliedWare Plus™ Software Reference to configure STP using the CLI instead.

Menu Tab Figure C-45: Example showing the **Resiliency and High Availability > STP** menu tab:



Description: Switch State

Label / Field / Button	Description
Switch State / Mode	Spanning Tree Mode displayed: STP (Spanning Tree Protocol), Rapid (Rapid Spanning Tree Protocol - RSTP), or Multiple (Multiple Spanning Tree Protocol - MSTP).
Switch State / Status	Status of the Spanning Tree Mode: enabled or disabled.
Switch State / Bridge ID	Bridge ID, comprising the port priority followed by its MAC address.
Switch State / Root ID	Root Bridge ID, comprising the root priority followed by its MAC address.
Switch State / Root Path Cost	Sum of the costs for each path between the bridge port and the root bridge.
Switch State / Max Age	Time in seconds that the dynamic spanning tree configuration information is stored in the switch before it is discarded.
Switch State / Hello Time	Time in seconds between the transmission of switch spanning tree configuration information, when the switch is the Root Bridge of the spanning tree or is trying to become the Root Bridge.
Switch State / Forward Delay	Time in seconds to control how fast a port changes its spanning tree state when moving towards the forwarding state. This value is used only when the switch is acting as the root bridge. Note that Forward Delay, Max Age, and Hello Time are interrelated.

Description: Port State

Label / Field / Button	Description
Port State / Port	Switch port number in the format 'portX.Y.Z' where X is the switch, Y is the XEM, and Z is the individual switch port number.
Port State / Port Priority	The lower the port priority, the higher the likelihood of the port becoming part of the active network topology.
Port State / Port Role	Displays the port role as configured in the CLI with 'spanning-tree' commands, and shows either 'rootport', 'backup', 'disabled' or 'designated' port roles.
Port State / Port State	Displays the spanning tree state for the port as configured in the CLI with 'spanning-tree' commands. Indicates spanning tree states of: disabled, blocking, listening, learning, and forwarding.
Port State / STP Enabled	Displays whether spanning-tree is enabled or disabled. Spanning tree is enabled by default.
Port State / Port Path Cost	The cost of a path for the port that determines the total cost path. The lower the total cost, the higher the priority of the path.
Port State / Designated Bridge ID	The unique parent for each bridge that connects it to the next LAN on the path towards the root bridge.

Description: Topology Change

Label / Field / Button	Description
`Topology Change / Topology Change`	The number of STP Topology Changes that have occurred since the switch was rebooted.
`Topology Change / Time Since Topology Change`	The time in hours and seconds since the previous STP Topology Change occurred.

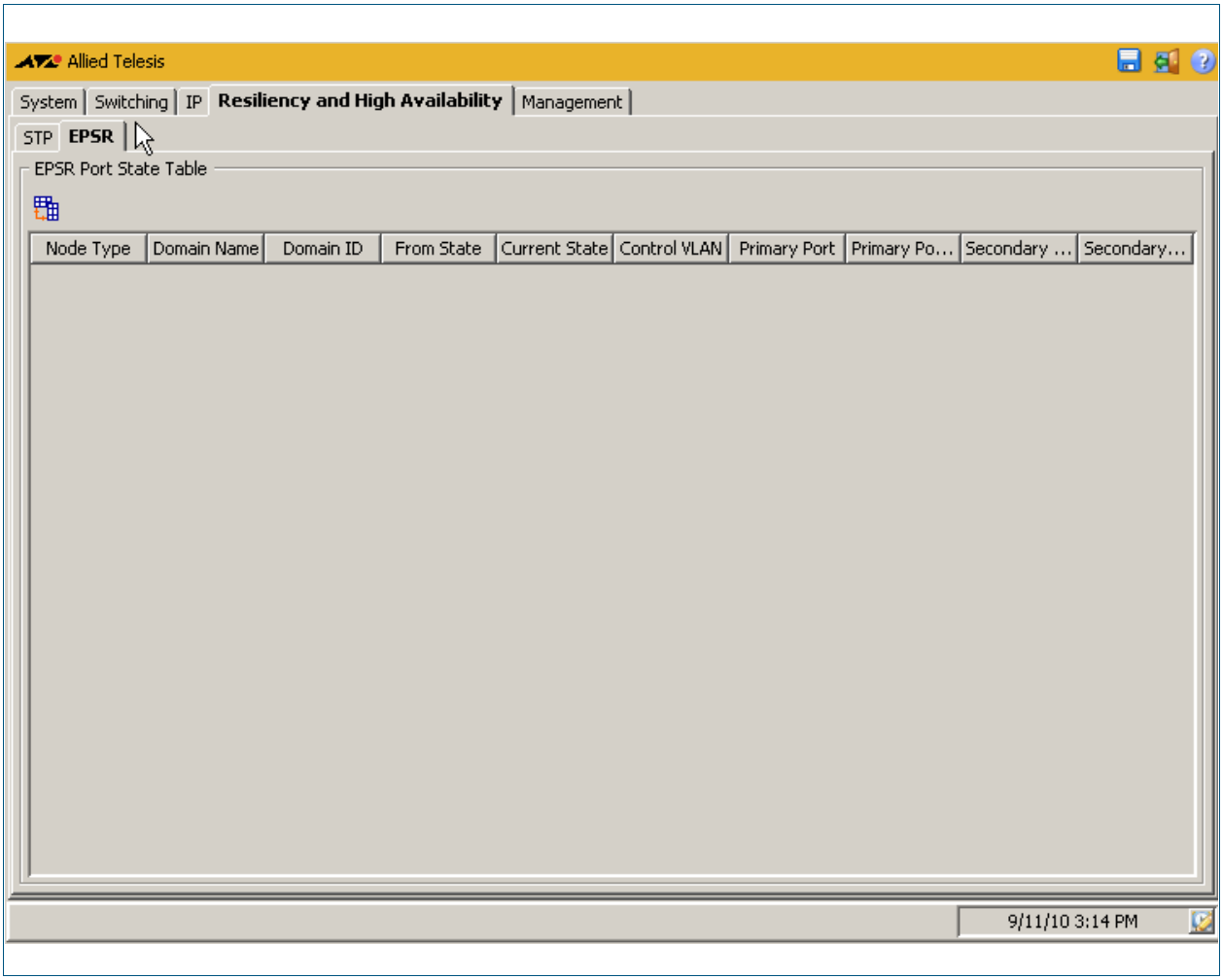
Resiliency and High Availability > EPSR

The Resiliency and High Availability > EPSR menu tab allows you to display the properties and status of any EPSR domains configured on the switch.

You can also sort or rearrange the display of the EPSR Port State table by Node Type, Domain Name, Domain ID, From State, Current State, Control VLAN, Primary Port, Primary Port Status, Secondary Port, or Secondary Port Status by selecting the relevant column or by dragging the relevant column respectively.

Note: EPSR is not configurable through the GUI. Refer to the relevant EPSR chapters in the AlliedWare Plus™ Software Reference to configure EPSR using the CLI instead.

Menu Tab Figure C-46: Example showing the **Resiliency and High Availability > EPSR** menu tab:



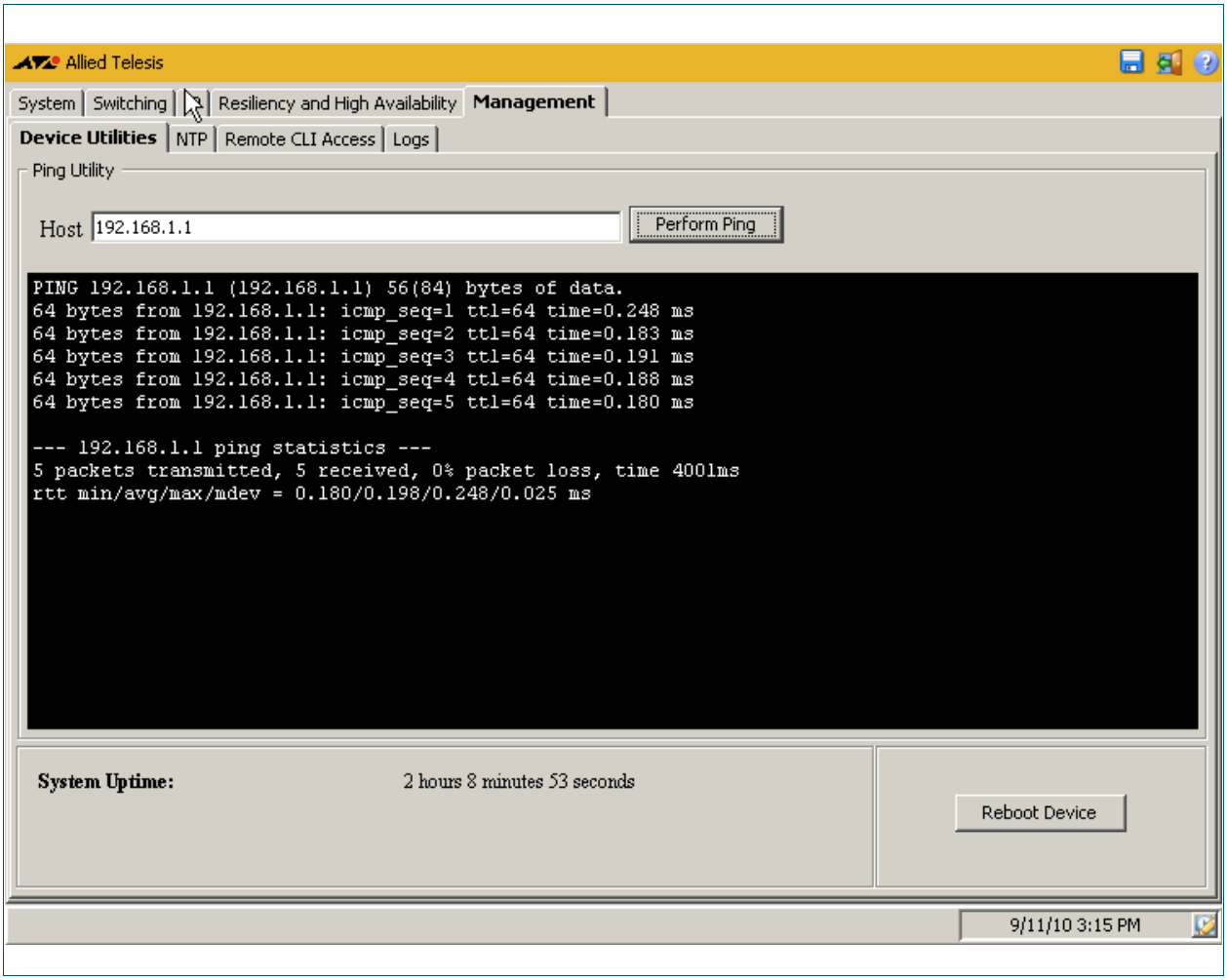
Description

Label / Field / Button	Description
EPSR Port State Table / Node Type	Displays master or transit node as configured in the CLI with the 'epsr mode' command.
EPSR Port State Table / Domain Name	Displays the domain name. A set of instances across a ring is called a domain.
EPSR Port State Table / Domain ID	Displays the assigned domain number for the domain name.
EPSR Port State Table / From State	Displays the From EPSR state as configured in the CLI with the 'epsr state' commands.
EPSR Port State Table / Current State	Displays the Current EPSR state as configured in the CLI with the 'epsr state' commands.
EPSR Port State Table / Control VLAN	Displays the control VLAN as configured in the CLI with the 'epsr mode controlvlan' command.
EPSR Port State Table / Primary Port	Displays the master node primary port interface name as configured in the CLI with the 'epsr mode primaryport' command.
EPSR Port State Table / Primary Port Status	Displays the master node primary port interface status: up or down.
EPSR Port State Table / Secondary Port	Displays the assigned secondary port interface name.
EPSR Port State Table / Secondary Port Status	Displays the assigned secondary port interface status: up or down.

Management > Device Utilities

The Management > Device Utilities menu tab allows you to perform pings and reboot the switch from the GUI.

Menu Tab Figure C-47: Example showing the **Management > Device Utilities** menu tab:



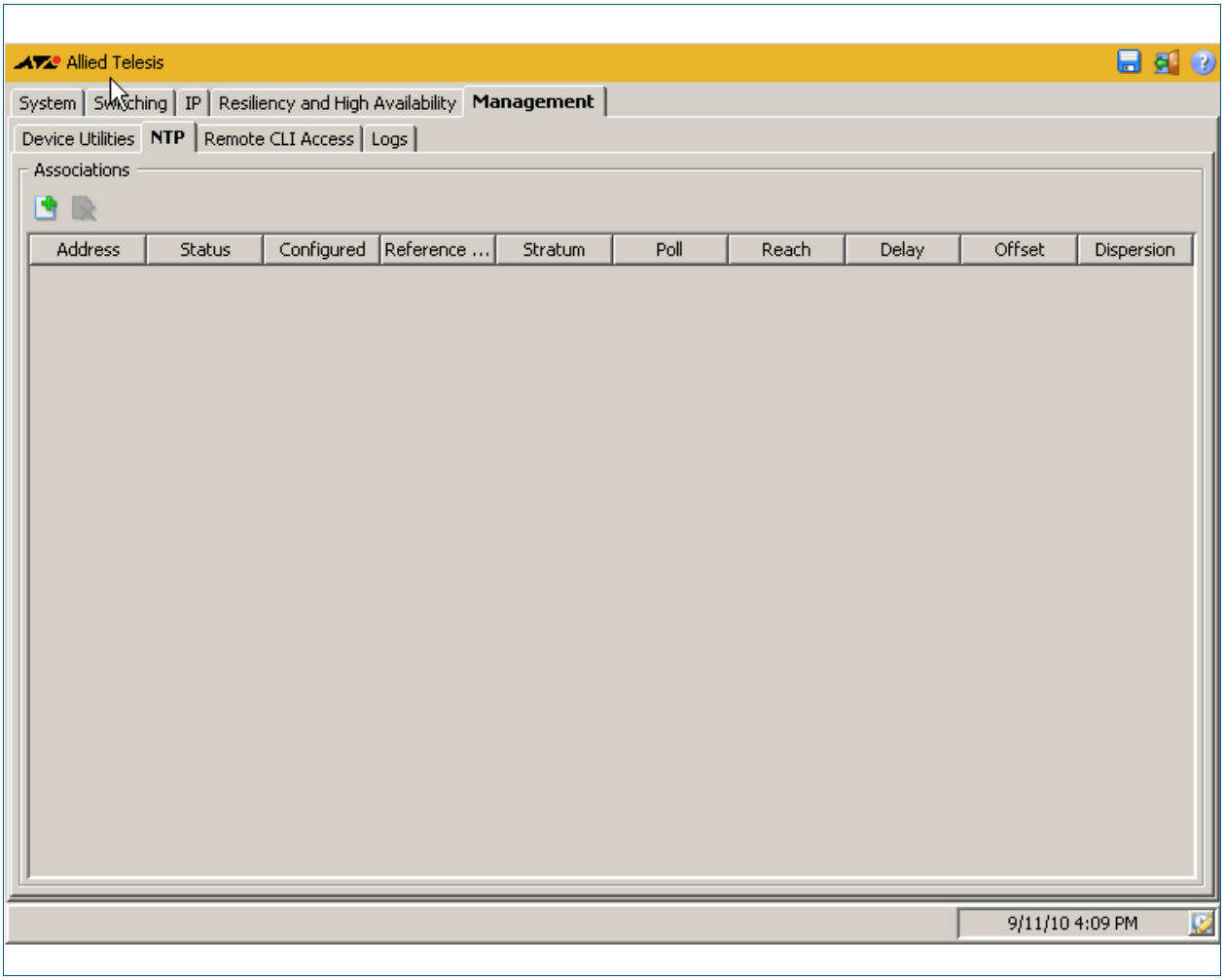
Description

Label / Field / Button	Description
`Ping Utility / Host`	Enter the IPv4 address or the URL that you want to ping in this field.
`Ping Utility / Perform Ping`	Select this button to ping the IPv4 address or URL that you entered in the Host field.
`System Uptime`	Displays the elapsed time since the last reboot in hours, minutes, and seconds.
`Reboot Device`	Select this button to reboot your switch. You will need to login to the GUI again after you reboot your switch. Rebooting closes all Telnet / SSH / SNMP sessions on your switch.

Management > NTP

The Management > NTP menu tab allows you to display and configure Network Time Protocol (NTP) peer configurations on the switch.

Menu Tab Figure C-48: Example showing the **Management > NTP** menu tab:



Description

Label / Field / Button	Description
`Associations / Address`	The NTP peer or NTP server IPv4 address.
`Associations / Status`	Indicates association status, and displays 'master(synced)'. 'master(unsynced)', 'selected', 'candidate', 'configured', or 'unknown'.
`Associations / Configured`	Indicates if the association is configured or not, and displays 'configured' or 'dynamic'.
`Associations / Reference Clock`	The IPv4 address for the reference clock.

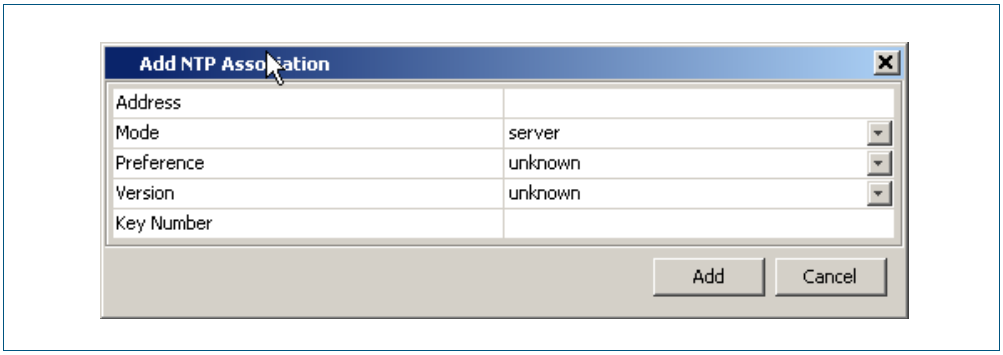
Label / Field / Button(cont.)	Description(cont.)
Associations / Stratum	The number of hops between the server and the accurate time source.
Associations / Poll	The time between NTP requests from the device to the server.
Associations / Reach	Shows whether or not the NTP server responded to the last request, which indicates the reachability of the NTP peer.
Associations / Delay	The round trip delay between the device and the server.
Associations / Offset	The difference between the device clock and the server clock, relative to the server clock, in milliseconds.
Associations / Dispersion	The lowest measure of error associated with peer offset based on delay.

Management > NTP > Add NTP Association

The Management > NTP > Add NTP Association dialog allows you configure Network Time Protocol (NTP) peer configurations on the switch.

Configuration Dialog

Figure C-49: Example showing the **Management > NTP > Add NTP Association** dialog:



Description

Label / Field / Button	Description
Address	Enter the NTP IPv4 address for the NTP peer or NTP server used.
Mode	Select one of the server or peer options from the drop down list to specify the NTP Mode used. When using NTP server mode, the NTP server will not accept updates from clients for updates to the server's time settings. The NTP server is configured to synchronize the NTP clients. When using NTP peer mode, each device shares its time information with the other, and each device can also provide time synchronization to the other.

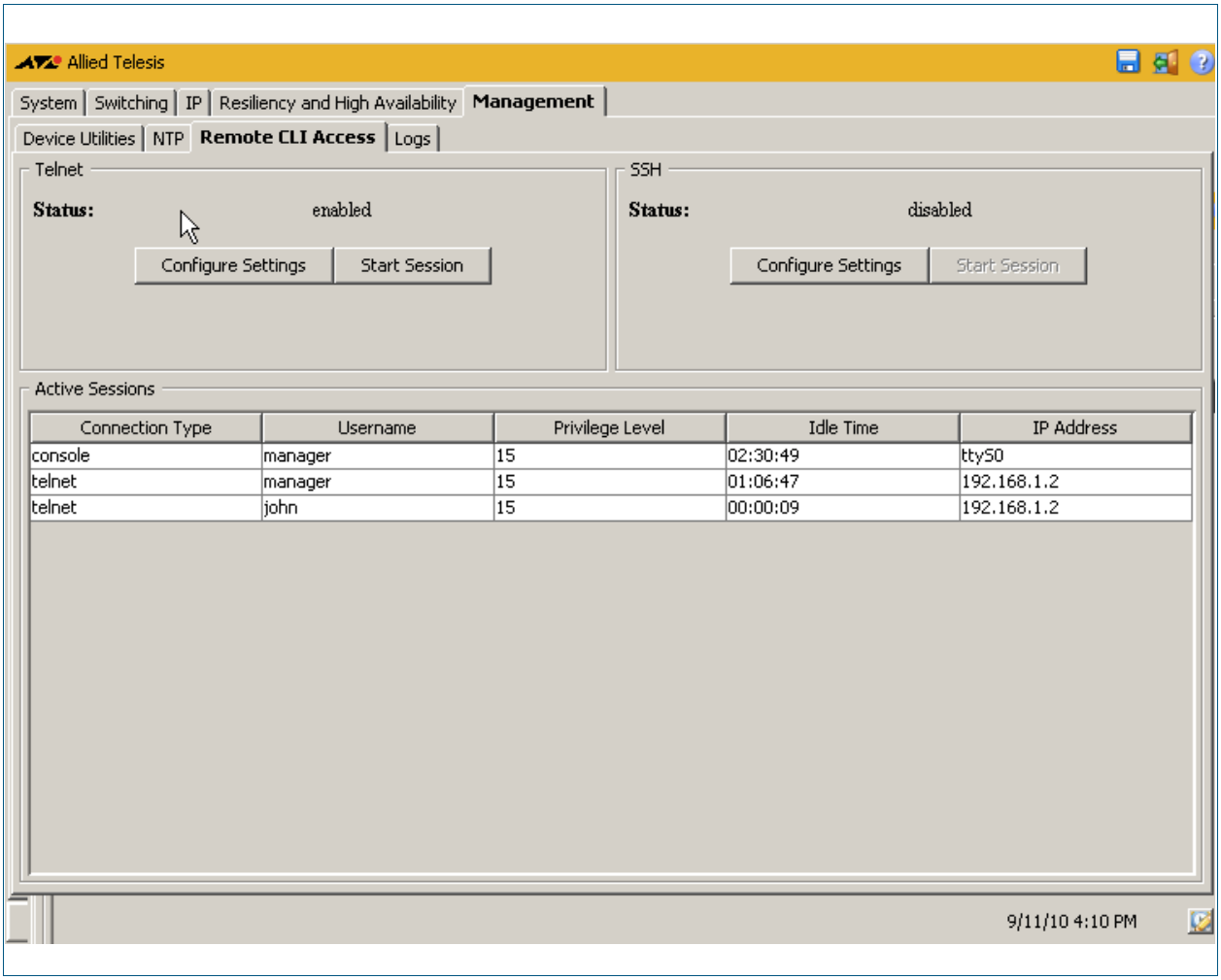
Label / Field / Button(cont.)	**Description**(cont.)
`Preference`	Select one of the `unknown`, `not preferred`, or `preferred` options from the drop down list to specify the NTP Preference used. NTP Preference is used to configure an NTP server, so the NTP server is given preference to synchronize the NTP clients.
`Version`	Select one of the `unknown`, `version 1`, `version 2`, `version 3`, or `version 3, version 4` options from the drop down list to specify the NTP Version used.
`Key Number`	Enter the NTP Key Number for NTP authentication, which allows NTP to authenticate the associations with other systems for security purposes. The NTP Key Number is an integer in the range <1-4294967295>. The MD5 (Message-Digest algorithm 5) key type is supported to encrypt the NTP Key Number used for authentication.

Management > Remote CLI Access

The Management > Remote CLI Access menu tab allows you to enable, disable and configure Telnet and SSH.

You can create Telnet or SSH connections to the switch, and you can view a list of all current active CLI sessions on the switch from this tab.

Menu Tab Figure C-50: Example showing the **Management > Remote CLI Access** menu tab:



Description

Label / Field / Button	Description
`Telnet / Status`	Displays the current Telnet status, either '`enabled`' or ''`disabled`'.
`Telnet / Configure Settings`	Configures the Telnet Status. Select '`enabled`' or '`disabled`' to configure the status of the Telnet server on the switch.
`Telnet / Start Session`	Starts a Telnet session to use the CLI. After starting a Telnet session you will need to login to the switch to use the CLI.
`SSH / Status`	Displays the current SSH status, either '`enabled`' or '`disabled`'.

Label / Field / Button(cont.)	**Description**(cont.)
SSH / Configure Settings	Configures the SSH Status. Select 'enabled' or 'disabled' to configure the status of the SSH server on the switch. Note that relevant certificates must be installed to initiate an SSH session.
SSH / Start Session	Starts a secure SSH session to use the CLI. After starting an SSH session you will need to login to the switch to use the CLI.

Description

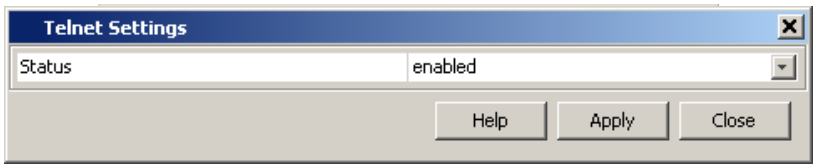
Label / Field / Button	Description
`Active Sessions / Connection Type`	A Console connection or a VTY connection.
`Active Sessions / Username`	Login name for a user.
`Active Sessions / Privilege Level`	The privilege set for a user for VTY or console connection. Privilege levels range from 0-15 with 15 the highest privilege level. Privilege levels are used in the CLI to enable or disable access to different configuration modes and commands. Privilege levels 0-14 only enables users to view system configuration and system behavior. Privilege level 15 enables users to globally configure all the interfaces on a switch.
`Active Sessions / Idle Time`	Time in seconds that the SSH Server waits to receive data from the SSH Client. The SSH Server disconnects when the Idle Time limit is reached.
`Active Sessions / IP Address`	The IPv4 address for the VTY connection.

Management > Remote CLI Access > Telnet Settings

The Management > Remote CLI Access > Telnet Settings dialog allows you to enable or disable Telnet.

Configuration Dialog

Figure C-51: Example showing **Management > Remote CLI Access > Telnet Settings** dialog:



Description

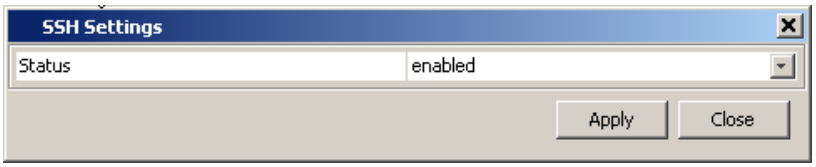
Label / Field / Button	Description
`Status`	Select `enabled` or `disabled` from the drop down list on this dialog to enable or disable Telnet respectively on the switch.

Management > Remote CLI Access > SSH Settings

The Management > Remote CLI Access > SSH Settings dialog allows you to enable or disable SSH.

Configuration Dialog

Figure C-52: Example showing the **Management > Remote CLI Access > SSH Settings** dialog:



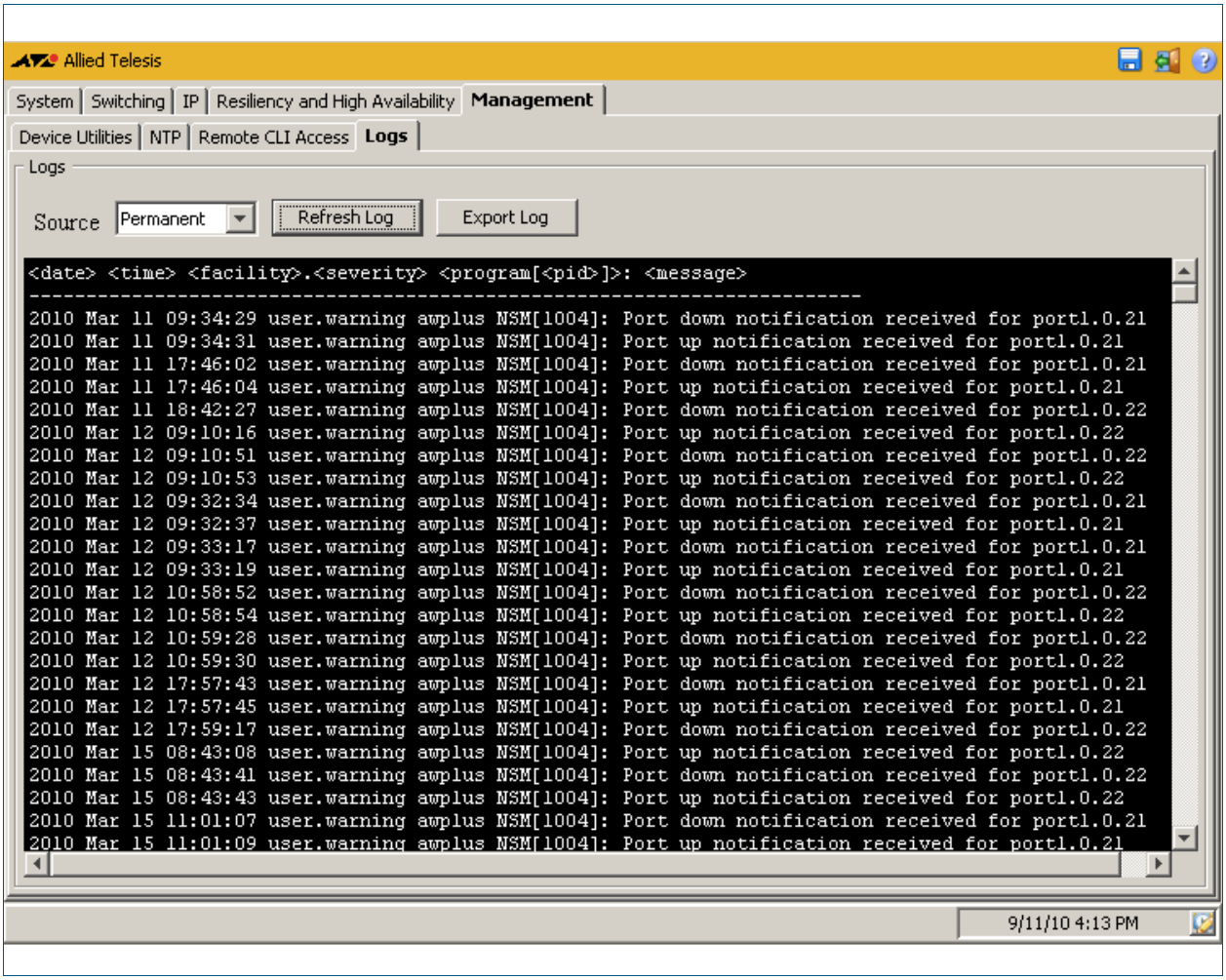
Description

Label / Field / Button	Description
`Status`	Select `enabled` or `disabled` from the drop down list on this dialog to enable or disable SSH respectively on the switch.

Management > Logs

The Management >Logs menu tab allows you to view the switch logs, and export the switch logs as .csv format files.

Menu Tab Figure C-53: Example showing the **Management > Logs** menu tab:



Description

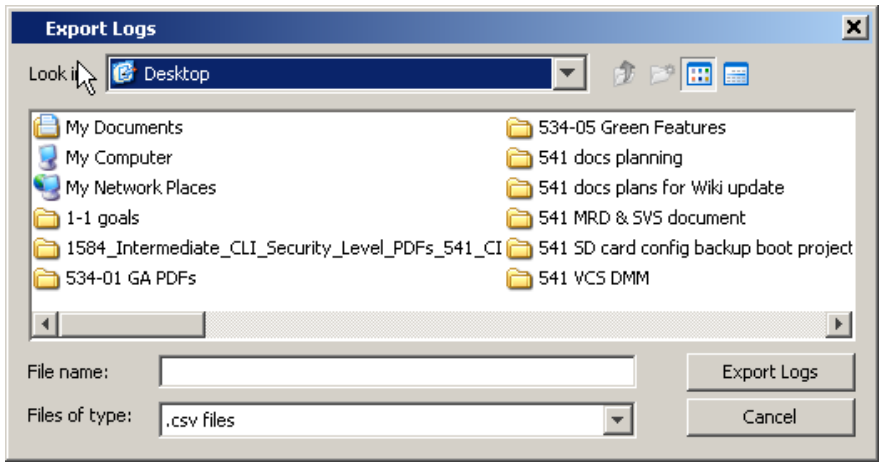
Label / Field / Button	Description
`Logs`	Display, select and export the available switch log files for troubleshooting use.
`Source`	Select the buffered log or the permanent log available on the switch to display or export to a .csv format file for use in a spreadsheet.
`Source / Refresh Log`	Select this button to display an updated buffered or permanent log.
`Source / Export Log`	Select this option to export the log to a .csv format file for use in a spreadsheet.

Management > Logs > Export Logs

The Management > Logs > Export Logs dialog allows you to export the switch logs as .csv format files.

Configuration Dialog

Figure C-54: Example showing the **Management > Logs > Export Logs** dialog:



Description

Label / Field / Button	Description
`File name:`	Enter the file name for the exported log file.
`Files of type:`	Select `.csv files` to export the log file as a comma separated file, so each column of the log file can be formatted in a spreadsheet.

Appendix D: Glossary

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Numerics

6to4 automatic tunneling

IPv6 transition is required to migrate from IPv4 to IPv6. One method to connect to the global IPv6 network over the existing IPv4 network is called 6to4 automatic tunneling. Although this method is called '6to4 tunneling', it does not involve discrete point-to-point tunnels. The 'tunneling' in '6to4 tunneling' refers to the fact that the IPv6 packets are encapsulated in IPv4 packets to be 'tunneled' across the IPv4 domain. Hence, '6to4 tunneling' is primarily a scheme for encapsulating IPv6 packets inside IPv4 headers.

For more information and a configuration example see "6to4 Automatic Tunnel Configuration" on page 28.2.

10BaseT

10 Mbps/baseband/twisted pair. The IEEE standard for twisted pair Ethernet.

802.1X

IEEE 802.1x is an IEEE Standard for port-based Network Access Control (NAC). It is part of the IEEE 802.1 group of networking protocols. It provides an authentication mechanism to devices wishing to attach to a LAN, either establishing a point-to-point connection or preventing it if authentication fails. It is used for securing wireless 802.11 access points and is based on the Extensible Authentication Protocol (EAP). Authentication is required on a per-port basis. The main components of an 802.1X implementation are:

- The authenticator - the port on this device that wishes to enforce authentication before allowing access to services that are accessible behind it.
- The supplicant - the port that wishes to access services offered by the authenticator's system. The supplicant may be a port on a PC or other device connected to this device.
- The authentication server - a device that uses the authentication credentials supplied by the supplicant, via the authenticator, to determine if the authenticator should grant access to its services.

See AAA and tri-authentication.

For a configuration example see "Configuring 802.1X" on page 62.2. For a sample configuration script see "Sample 802.1X Authentication Configuration" on page 66.7.

A

AAA

AAA is the collective title for the three related functions of Authentication, Authorization and Accounting. These function can be applied in a variety of methods with a variety of servers.

Authentication is performed in the following contexts:

- Login authentication of user shell sessions on the console port, and via telnet/SSH.
- 802.1X authentication of devices connecting to switch ports.
- MAC authentication of devices connecting to switch ports.
- Web-authentication of devices connecting to switch ports.

Accounting is performed in the following contexts:

- Accounting of console login sessions.
- Accounting of 802.1x authenticated connections.
- Accounting of MAC authenticated connections.
- Accounting of Web authenticated connections.

There are two types of servers that can be used:

- Local user database.
- RADIUS servers.

When 802.1X authentication, MAC authentication and Web-authentication are configured to run simultaneously on a switch port this is called tri-authentication.

For more information see Chapter 66, AAA Introduction and Configuration. For a configuration example see "Configuring AAA Login Authentication" on page 66.5. For sample 802.1x, MAC authentication and Web-authentication configuration scripts see "Sample Authentication Configurations" on page 66.7.

access-list

See ACL.

ACL

Access Control List. An ACL is one filter, or a sequence of filters, that are applied to an interface to either block, pass, or when using QoS, apply priority to, packets that match the filter definitions. ACLs are used to restrict network access by hosts and devices and to limit network traffic. See ACL sequence numbers and ACL types.

For more information see Chapter 55, Access Control Lists Introduction.

ACL sequence numbers

To help manage ACLs you can apply sequence numbers to filters. This allows you to remove filters from named and numbered ACLs without having to reconfigure an ACL. The ability to add sequence numbers to filters simplifies updates through the ability to position a filter within an ACL. When you add a new filter, you can specify a sequence number to position the filter in the ACL and you can also remove a current filter in an ACL by specifying a sequence number.

For more information see "ACL Filter Sequence Numbers" on page 55.15.

ACL types

ACLs are separated into two different types, software ACLs and hardware ACLs.

Hardware ACLs are applied directly to an interface, or are used for QoS classifications. They can be either named, or can use the following numeric ranges:

- 3000-3699 for Hardware IP ACLs
- 4000-4699 for Hardware MAC ACLs

For more information see "Defining Hardware IP ACLs" on page 55.6 and "Defining Hardware MAC ACLs" on page 55.5.

Software ACLs can be either named ACLs, using the standard or extended keyword followed by a text string, or they can use the following numeric ranges:

- 1-99
- 100-199
- 1300-1999
- 2000-2699

Software ACLs are used in features such as SNMP, IGMP, BGP and OSPF.

Active Master

The switch that manages the stack, or VCStack, also referred to as the Stack Master.

See Disabled Master for information about how this relates to Stack Master or Active Master.

Address resolution

The process of resolving and mapping hardware MAC addresses into their corresponding network layer IP addresses. Depending on the underlying network, address resolution may require broadcasts on a local network.

For more information see "ARP" on page D.4.

Adjacency

A state existing between two OSPF routers. These routers build their routing databases by exchanging link state advertisements, often termed hello messages. When a pair has completed the process, the routers are said to be "adjacent."

ARP

Address Resolution Protocol. ARP is used by your device to dynamically learn the Layer 2 address of devices in its networks. Most hosts also have a MAC physical address in addition to the assigned IP address. For Ethernet, this is a 6-byte, globally unique number. ARP enables your device to learn the physical address of the host that has a given IP address.

For more information see "Address Resolution Protocol (ARP)" on page 24.3.

AS

Autonomous System. A group of networks with a common routing infrastructure. An AS runs interior gateway protocols (IGPs) such as RIP and OSPF within its boundaries and uses exterior gateway protocols (EGPs) such as BGP to exchange routing information with other ASs.

ASCII

The *American Standard Code for Information Interchange*. A standard character-to-number encoding widely used within the computer industry.

ASIC

Application Specific Integrated Circuit. An integrated circuit (chip) manufactured to perform a specific function.

asynchronous

Transmission in which each character is sent individually. The time intervals between transmitted characters may be of unequal length. Transmission is controlled by start and stop elements before and after each character. See "synchronous" on page D.29

autonegotiation

Autonegotiation lets the port adjust its speed and duplex mode to accommodate the device connected to it. When the port connects to another autonegotiating device, they negotiate the highest possible speed and duplex mode for both of them.

autonomous system

See AS.

B

BGP

Border Gateway Protocol. BGP is an exterior gateway protocol that determines the best path in networks, performs optimal routing between multiple autonomous systems or domains, and exchanges routing information with other BGP systems. The RFCs 1771 (BGP4), 1654 (first BGP4 specification), and 1105, 1163, 1267 (older version of BGP) describe BGP and BGP4.

For more information see "BGP" on page 30.3. For configuration examples see "Enabling BGP Peers In The Same Autonomous System" on page 41.2, "Enabling BGP Between Different Autonomous Systems" on page 41.4, "Route Reflector" on page 41.5, "Confederations" on page 41.7, "BGP Authentication" on page 41.10, "Configuring BGP Graceful Reset" on page 41.12 and "Configuring BGP Graceful Restart" on page 41.14.

BGP filter types

There are four filter types that can be applied to the BGP updates being exchanged between BGP peers:

- Distribute filters - these use ACLs and look at the individual prefixes within an update message. If a prefix within the update message matches the filter criteria then that individual prefix is filtered out or accepted depending on what action the filter entry has been configured to carry out. Note that you cannot combine distribute filters and prefix filters.
- Path filters - these look at the AS-Path attribute in update messages. If the AS-Path attribute in the update matches the filter criteria then the whole update message is filtered out or accepted, depending on what action the filter entry has been configured to carry out.
- Prefix filters - these use prefix lists and look at the individual prefixes within an update message. If a prefix within the update message matches the filter criteria then that individual prefix is filtered out or accepted depending on what action the filter entry has been configured to carry out. Note that you cannot combine distribute filters and prefix filters.
- Route maps - these have a complex combination of match criteria and actions. They can be used to filter out routes and also to alter the attributes in update messages.

All these filter types can be used in incoming or outgoing directions. Therefore, all the filters can all be used to filter the update packets that are received from a peer, or the update packets which the router itself is sending to a peer.

BGP peers

Within the BGP protocol, the exchange of routing information is carried out between pairs of routers. Two routers create a TCP connection with each other, and exchange routing information as specific data packets within that TCP session. The routers at the ends of the TCP connection are referred to as BGP peers. Any given router can form peering relationships with multiple routers.

BGP updates

Once a router has established a BGP connection with a peer, it will start to exchange routing information with that peer. A BGP update message is the packet that is used to transfer the routing information.

BIST

Built In Self Test. A mechanism that permits the device to test itself.

Blackhole route

A blackhole route is a routing table entry that does not forward packets. A blackhole route is specified as an interface with an ip route command. Note that a blackhole route is also called a Null route.

B-MAC

Backbone MAC address.

BPDU

Bridge Protocol Data Unit. A spanning tree protocol initializing packet sent at configurable intervals to exchange information among bridges in the LAN.

For information on the standardized format for MSTP BPDU messages see "MSTP Bridge Protocol Data Units (BPDUs)" on page 18.17.

bridge

A device that connects two or more networks and forwards packets between them. Bridges function at the data link layer or Layer 2 of the OSI reference model. A bridge will filter, send or flood an incoming frame, base on the MAC address of that frame.

broadcast

One device sends out data that is intended to be received and processed by every device that it reaches.

broadcast domain

A section of an Ethernet network comprising all the devices that will receive broadcast packets sent by any device in the domain. Separated from the rest of the network by a Layer 3 switch.

BOOTP

Bootstrap Protocol. BOOTP is a UDP-based protocol that enables a booting host to dynamically configure itself without external interventions. A BOOTP server responds to requests from BOOTP clients for configuration information, such as the IP address the client should use.

B-TAG

Backbone TAG Field.

B-VID

Backbone VLAN ID (tunnel).

B-VLAN

Backbone VLAN (tunnel).

C

CHAP

Challenge Handshake Authentication Protocol. CHAP is an authentication method used by PPP servers to validate the identity of clients. CHAP verifies the identity of the client by using a three-way handshake, and the verification is based on a shared secret by the client and the server, such as the client's password.

CIST

Common and Internal Spanning Tree. The CIST is the default spanning tree instance of MSTP, i.e. all VLANs that are not members of particular MSTIs are members of the CIST. Also, an individual MST region can be regarded as a single virtual bridge by other MST regions. The spanning tree that runs between regions is the CIST. The CIST is also the spanning tree that runs between MST regions and Single Spanning Tree (SST) entities.

For more information see "Common and Internal Spanning Tree (CIST)" on page 18.15.

classification

In ACLs and QoS, classification is the process of filtering and marking. Filtering involves sorting your data into appropriate traffic types. Marking involves tagging the data so that downstream ports and routers can apply appropriate service policy rules. There are two reasons to classify data:

- To provide network security (security ACLs).
- To apply service quality criteria QoS.

The main application of security ACLs is to block undesired traffic. When using ACLs though QoS, the same classification and action abilities are available, but QoS has some additional fields that it can match on and also provides the ability to perform metering, marking and remarking on packets that match the filter definitions.

For more information on ACL classification see "Profile Limitations" on page 55.9. For more information on QoS classification see "Classifying your Data" on page 60.7.

class maps

Class maps are among the pivotal QoS components. They provide the means that associate the classified traffic with its appropriate QoS actions. They are the linking elements for the following functions:

- classification.
- policy mapping. See policy maps.
- aggregate policing and metering
- premarking.

The relationship between a class map and a policy map can be one-to-one or many-to-one.

For more information see "Class Maps" on page 60.7.

CLI

Command Line Interface. With three distinct modes, the CLI is very secure. In User exec mode you can view settings and troubleshoot problems but you cannot make changes to the system. In Privileged exec mode you can change system settings and restart the device. You can only make configuration changes in Global configuration mode, which reduces the risk of making accidental configuration changes.

For more information see "How to Work with Command Modes" on page 1.10 and "Commands Available in each Mode" on page 1.43.

C-MAC

Customer MAC Address.

collision domain

A physical region of a local area network (LAN) in which data collisions can occur.

continuous reboot prevention

The continuous reboot prevention feature allows the user to configure a switch to stop rebooting if the device gets into a cycle of continuous rebooting. The user can configure the time period, the maximum number of times the switch can reboot within the specified time period, referred to as the threshold, and the action to take if the threshold is exceeded.

For more information see "Continuous Reboot Prevention" on page 1.39.

Control Plane Prioritization

Control Plane Prioritization (CPP) allows you to allocate priorities to packet types to ensure minimum interruption to the flow of control information through the network. CPP stops the control plane from being flooded by traffic in the event of a network storm or Denial of Service (DoS) attack. This ensures maximal performance and prevents network outages. In addition, with CPP you can also limit the amount of traffic that flows to the CPU to ensure that performance of other services, such as the CLI, are not affected during network storms or DoS attacks.

For more information see the platform control-plane-prioritization rate command on page 15.24.

control VLAN

In EPSR, the VLAN over which all control messages are sent and received. EPSR never blocks this VLAN.

For more information see "Ring Components and Operation" on page 81.2.

CoS

Class of Service. CoS is a method for classifying traffic on a packet by packet basis using information in the type-of-service (ToS) byte to provide different service levels to different traffic. See QoS.

For more information see "CoS to egress queue premarking" on page 60.11.

cost

An indication of the overhead required to send packets across a certain interface.

CPP

Control Plane Prioritization. See Control Plane Prioritization.

C-TAG

Customer VLAN TAG.

C-VID

Customer VLAN ID.

C-VLAN

Customer VLAN.

D

data VLAN

In EPSR, a VLAN that needs to be protected from loops. Each EPSR domain has one or more data VLANs.

For more information see "Ring Components and Operation" on page 81.2.

designated bridge

Each bridge or LAN in the spanning tree, except the root bridge, has a unique parent, known as the designated bridge. Each LAN has a single bridge, called the designated bridge, that connects it to the next LAN on the path towards the root bridge.

For an overview of spanning tree operation see "Spanning tree operation" on page 18.2.

DHCP

Dynamic Host Configuration Protocol. A method of automatically allocating IP addresses. A DHCP server holds a pool of IP addresses from which it draws individual ones as it allocates them to users when they log on.

For more information see Chapter 85, Dynamic Host Configuration Protocol (DHCP) Introduction.

DHCP leasequery

The DHCP Leasequery protocol (RFC 4388) allows a device or process, for example a DHCP relay agent, to obtain IP address information directly from the DHCP server using DHCPLEASEQUERY messages.

For more information see "Enable DHCP Leasequery" on page 85.5.

DHCP lease probing

Probing is used by the DHCP server to check whether an IP address it wants to lease to a client is already being used by another host. Probing is configured on a per-DHCP pool basis.

For more information see "DHCP Lease Probing" on page 85.7.

DHCP Option 82

Enabling the DCHP Option 82 feature on the switch allows the switch to insert extra information into the DHCP packets that it is relaying. The information is stored in a specific optional field in the DHCP packet, namely, the agent-information field, which has option ID 82.

Note that the Option 82 agent information inserted by the DHCP snooping differs from the information added by DHCP Relay. The switch cannot be configured to use both the DHCP relay agent option and DHCP snooping.

For information about the Option 82 agent information added by DHCP Relay see "DHCP Relay Agent Option 82" on page 85.9.

For information about the Option 82 agent information inserted by DHCP snooping see "DHCP Option 82" on page 77.4.

DHCP relay agents

DHCP relay agents pass BOOTP and DHCP messages between servers and clients. Networks where the DHCP or BOOTP server does not reside on the same IP subnet as its clients need the intermediate routers to act as relay agents.

For information on how to configure the DHCP relay agent see "DHCP Relay Agent Introduction" on page 85.8.

DHCP snooping

DHCP snooping provides an extra layer of security on the switch via dynamic IP source filtering. DHCP snooping filters out traffic received from unknown, or 'untrusted' ports, and builds and maintains a DHCP snooping database.

With DHCP snooping, IP sources are dynamically verified, and filtered accordingly. IP packets that are not sourced from recognized IP addresses can be filtered out. This ensures the required traceability.

For more information see Chapter 77, DHCP Snooping Introduction and Configuration. For a configuration example see "Configure DHCP Snooping" on page 77.10.

Digital Diagnostics Monitoring (DDM)

Modern optical SFP transceivers support Digital Diagnostics Monitoring (DDM) functions. This feature allows you to monitor real-time parameters of the SFP, such as optical output power, optical input power, temperature, laser bias current, and transceiver supply voltage. Additionally, RX LOS (Loss of Signal) is shown when the received optical level is below a preset threshold. Monitoring these parameters allows you to check on the health of all installed SFPs or a specific SFP transceiver. See also Trouble-shoot fiber and pluggable issues in Getting Started.

SFP transceivers that support DDM display the following output from the show system pluggable detail and the show system pluggable diagnostics commands for monitoring SFPs:

- Diagnostic Calibration: Specifies whether the pluggable supports DDM Internal Calibration. Internal is displayed if the pluggable supports DDM Internal Calibration.
- Power Monitoring: Displays the received power measurement type, which can be either OMA (Optical Module Amplitude) or Avg (Average Power) measured in µW.

For further information about the DDM feature on the switch for installed SFP transceivers, see the show system pluggable detail command and the show system pluggable diagnostics command in Chapter 8, System Configuration and Monitoring Commands. See also Digital Optical Monitoring (DOM). Note DOM is for XFP pluggable transceivers only.

Digital Optical Monitoring (DOM)

Modern optical XFP transceivers support Digital Optical Monitoring (DOM) functions. This feature allows you to monitor real-time parameters of the XFP, such as optical output power, optical input power, temperature, laser bias current, and transceiver supply voltage. Additionally, RX LOS (Loss of Signal) is shown when the received optical level is below a preset threshold. Monitoring these parameters allows you to check on the health of all installed XFPs or a specific XFP transceiver. See also Trouble-shoot fiber and pluggable issues in Getting Started.

XFP transceivers that support DOM display the following output from the show system pluggable detail and the show system pluggable diagnostics commands for monitoring XFPs:

- Diagnostic Calibration: Specifies whether the pluggable supports DOM Internal Calibration. Internal is displayed if the pluggable supports DOM Internal Calibration.
- FEC BER support: Specifies whether the FEC (Forward Error Correction) coder can generate a BER (Bit Error Rate) signal to tune the XFP transceiver if DOM is supported.

For further information about the DOM feature on the switch for installed XFP transceivers, see the show system pluggable detail command and the show system pluggable diagnostics command in Chapter 8, System Configuration and Monitoring Commands. See also Digital Diagnostics Monitoring (DDM). Note DDM is for SFP and SFP+ pluggable transceivers.

Disabled Master

The Disabled Master is a variant of the Stack Master or Active Master and is used with the DMM (Disabled Master Monitoring)feature. The Disabled Master has the same configuration as the Stack Master or Active Master, but has all its switchports disabled. The Disabled Master is only used is the stack separates into two stubs. By having all switchports disabled, the Disabled Master avoids potentially detrimental network connectivity problems from having two Stack Masters or Active Masters having the same configuration. The Stack Master's or Active Master's ports are unaffected by the Disabled Master's ports, so the Stack Master or Active Master continues to forward traffic normally.

For information about the Disabled Master and the Disabled Master Monitoring feature, see the Disabled Master Monitoring (DMM) section in Chapter 102, Stacking Introduction and the stack disabled-master-monitoring command in Chapter 103, Stacking Commands.

DLF

Destination Lookup Failure. DLF is the event of receiving a unicast Ethernet frame with an unknown destination address.

DMM (Disabled Master Monitoring)

The Disabled Master Monitoring (DMM) features checks the status of the Active Master via the Stack Resiliency Link. If the Active Master fails then the Disabled Master changes state to Active Master. A Disabled Master has the same configuration as the Active Master, but has all links shutdown. This change in state for the Disabled Master to become the Active Master allows traffic forwarding to continue on the VCStack.

For information about the Disabled Master and the Disabled Master Monitoring feature, see the Disabled Master Monitoring (DMM) section in Chapter 102, Stacking Introduction and the stack disabled-master-monitoring

DNS

Domain Name System. DNS allows you to access remote systems by entering human-readable device host names rather than IP addresses. DNS works by creating a mapping between a device name, such as www.alliedtelesis.com, and its IP address. These mappings are held on DNS servers. The benefits of DNS are that domain names:

- Can map to a new IP address if the host's IP address changes.
- Are easier to remember than an IP address.
- Allow organizations to use a domain name hierarchy that is independent of any IP address assignment.

For more information see "Domain Name System (DNS)" on page 24.8.

DNS Relay

DNS Relay provides the presence of a local virtual DNS server on your AlliedWare Plus™ device which can service DNS lookup requests sent to it from local hosts. The DNS Relay will usually relay the requests to an external, or upstream, DNS server.

For more information see "DNS Relay" on page 24.10.

DoS

Denial of Service. A generic term for attacks that reduce or stop the operation of a network.

DSCP value

The Differentiated Services Code Point within the TOS field of an IP packet header. This is a 6-bit number in the range 0-63.

duplex mode

See full duplex and half duplex.

dynamic channel group

A dynamic channel group also known as a LACP channel group, an etherchannel, or a LACP aggregator, enables a number of ports to be dynamically combined to form a single higher bandwidth logical connection. See LACP.

For an more information see "Link Aggregation Control Protocol (LACP)" on page 20.2. For a configuration example see "Configuring an LACP Channel Group" on page 20.5.

Dynamic Link Failover

Dynamic Link Failover (Host Attach) is a versatile feature that enables devices that do not support link aggregation to form multiple active links by using triggers and scripts. You can customize Dynamic Link Failover to suit almost any situation, from a simple redundant backup link to multiple active links capable of basic load-sharing.

E

EAP

Extensible Authentication Protocol. EAP carries out the authentication exchange between the supplicant and the authentication server.

etherchannel

See dynamic channel group.

Ethernet Protection Switching Ring

See EPSR.

EPSR

EPSR (Ethernet Protection Switching Ring) operates on physical rings of switches (note, not on meshed networks). When all nodes and links in the ring are up, EPSR prevents a loop by blocking data transmission across one port. When a node or link fails, EPSR detects the failure rapidly and responds by unblocking the blocked port so that data can flow around the ring. The EPSR components are:

- EPSR domain
- master node
- transit node
- ring port
- primary port
- secondary port
- control VLAN
- data VLAN

For more information and example configurations see Chapter 81, EPSR Introduction and Configuration.

EPSR domain

A protection scheme for an Ethernet ring that consists of one or more data VLANs and a control VLAN.

For more information see “Ring Components and Operation” on page 81.2.

EGP

Exterior Gateway Protocol. EGP is an obsolete protocol that has been replaced by BGP. Not to be confused with the general term exterior gateway protocol.

egress

Outgoing packet process.

exterior gateway protocol

A protocol that distributes routing information to devices that connect separate autonomous systems (ASs).

F

FDB

Forwarding Database.

FIB

Forwarding Information Base. The RIB (Routing Information Base) populates the FIB with the best route to each destination. When your device receives an IP packet, and no filters are active that would exclude the packet, it uses the FIB to find the most specific route to the destination. If your device does not find a direct route to the destination, and no default route exists, it discards the packet and sends an ICMP message to that effect back to the source.

For more information see "RIB and FIB Routing Tables" on page 31.4.

full duplex

When a port is in full duplex mode, the port transmits and receives data simultaneously. See half duplex.

G

Guest VLAN

If 802.1X authentication has been configured on access ports in the network, you might still want to provide limited network access to those users whose devices do not have 802.1x supplicant enabled, or who have unrecognized authentication credentials. The mechanism to achieve this is known as a Guest VLAN. The idea is that if the users device fails 802.1X authentication, or is not even performing any 802.1X authentication, then its connection port can be put into the guest VLAN.

For more information see "Guest VLAN Enhancements" on page 64.10 and the auth guest-vlan command on page 65.9. For a configuration example see "Configuring a Guest VLAN" on page 64.3.

H

half duplex

When a port is in half duplex mode, the port transmits or receives but not both at the same time. See full duplex.

hardware ACLs

See ACL types.

I

ICMP

Internet Control Message Protocol. ICMP allows networking devices to send information and control messages to other devices or hosts.

For more information see “Internet Control Message Protocol (ICMP)” on page 24.12.

ICMPv6

Internet Control Message Protocol Version 6. ICMPv6 is an implementation of ICMP for IPv6.

For more information see “The Internet Control Message Protocol (ICMPv6)” on page 26.7.

IGMP

Internet Group Management Protocol. IGMP is a communications protocol that hosts use to indicate that they are interested in receiving a particular multicast stream.

IGMP querier or router

A device in a subnetwork that is the coordinator for all multicast streams and IGMP membership information. Each subnet only has one active querier.

IGMP snooper

A device that spies on IGMP messages to create flow efficiencies by ensuring that multicast data streams are only sent to interested ports. A snooper can decide on the best path to send multicast packets at Layer 2 but does not initiate any IGMP communications.

For a configuration example see “IGMP Snooping and Querier configuration example” on page 48.5.

IGP

Interior Gateway Protocol. A routing protocol used within an autonomous system (AS).

ingress

Incoming packet process.

interior gateway protocol

See IGP.

IP directed broadcast

An IP directed broadcast is an IP packet whose destination address is a broadcast address for some IP subnet, but originates from a node that is not itself part of that destination subnet. When a directed broadcast packet reaches a switch that is directly connected to its destination subnet, the packet is flooded as a broadcast on the destination subnet. IP directed broadcast is enabled and disabled per VLAN interface. When enabled a directed broadcast packet is forwarded to an enabled VLAN interface if received on another subnet.

IP helper

The IP Helper feature allows the switch to receive UDP broadcasts on one subnet, and forward them as broadcasts or unicasts into another subnet, so a client can use an application which uses UDP broadcast (such as Net-BIOS) when the client and server are located in different subnets. The IP Helper feature forwards UDP broadcast network traffic to specific hosts on another subnet and/or to the broadcast address of another subnet. When the IP Helper feature is enabled on a VLAN interface, the UDP broadcast packets received on the interface are processed for forwarding out through another interface into another subnet.

IRDP

ICMP Router Discovery Protocol. If this feature in configured, the device sends router advertisements periodically and in response to router solicitations. ICMP Router Discovery messages let routers automatically advertise themselves to hosts.

For more information see "ICMP Router Discovery Protocol (IRDP)" on page 24.13.

I-SID

Extended Service ID.

ISP

Internet Service Provider. An organization that offers its customers access to the Internet. The ISP connects its customers using a data transmission technology, such as dial-up or DSL etc.

I-TAG

Extended Service TAG.

L

LACP

Link Aggregation Control Protocol. LACP allows bundling of several physical ports to form a single logical channel providing enhanced performance and redundancy. The aggregated channel is viewed as a single link to each switch. The spanning tree views the channel as one interface and not as multiple interfaces. When there is a failure in one physical port, the other ports stay up and there is no disruption. LACP does not interoperate with devices that use Port Aggregation Protocol (PAgP).

For an more information see "Link Aggregation Control Protocol (LACP)" on page 20.2.

LACP aggregator

See dynamic channel group.

LACP channel group

See dynamic channel group.

LAG

See Link Aggregation Group.

Layer 3 switch

A Layer 3 switch is an optimized combination of routing software and specialized hardware. The software uses traditional methods (static routing commands, and routing protocols) to build up a table of the best routes to network destinations, and then writes them into a set of registers in the specialized forwarding hardware. The hardware then forwards packets, based on their Layer 3 address content, at very high data rates, using the values that are written into the registers.

Link Aggregation Group

A Link Aggregation Group is a collection of bundled switch ports for an aggregated link. Link aggregation is the bonding together of two or more data channels into a single channel that appears as single logical link of higher bandwidth increasing link performance and reliability.

For an more information see "Link Aggregation Control Protocol (LACP)" on page 20.2.
For a configuration example see "Configuring an LACP Channel Group" on page 20.5

Link Local Addresses

A Link Local Address is an IP (Internet Protocol) address that is only used for communications in the local network, or for a point-to-point connection. Routing does not forward packets with link-local addresses. IPv6 requires a link-local address is assigned to each interface, which has the IPv6 protocol enabled, and when addresses are assigned to interfaces for routing IPv6 packets.

Note that link-local addresses are retained in the system until they are negated by using the no variant of the command that established them. See the ipv6 enable command for more information.

Also note that the link-local address is retained in the system if the global address is removed using another command, which was not used to establish the link-local address. For example, if a link local address is established with the ipv6 enable command then it will not be removed using a no ipv6 address command.

LLDP

Link Layer Discovery Protocol. LLDP is a Layer 2 protocol that enables Ethernet network devices, such as switches and routers, to transmit and/or receive device-related information to or from directly connected devices on the network, and to store such information learned about other devices. LLDP is a link level ("one hop") protocol; LLDP information can only be sent to and received from devices that are directly connected to each other, or connected via a hub or repeater. Advertised information is not forwarded on to other devices on the network.

For more information see Chapter 90, LLDP Introduction and Configuration.
For configuration examples see "Configuring LLDP" on page 90.11.

LLDPDU

LLDP Data Unit. See LLDP advertisements.

LLDP advertisements

LLDP transmits advertisements as packets called LLDP Data Units (LLDPDUs). An LLDPDU consists of a set of Type-Length-Value elements (TLV), each of which contains a particular type of information about the device or port transmitting it.

LLDP-MED

Link Layer Discovery Protocol Media Endpoint Discovery. LLDP-MED is an enhancement to IEEE's 802.1AB LLDP, adding media and IP telephony-specific messages that can be exchanged between the network and endpoint devices.

For more information see "LLDP-MED" on page 90.3, "LLDP-MED: Location Identification TLV" on page 90.7 and "LLDP-MED Operation" on page 90.9. For the procedure to configure LLDP-MED see "Configure LLDP-MED" on page 90.14.

Local RADIUS Server

Local RADIUS Server provides a user authentication service feature.

For more information and configuration examples see Chapter 72, Local RADIUS Server Introduction and Configuration.

LSA

Link State Advertisement. OSPF sends link-state advertisements (LSAs) to all other routers within the same hierarchical area. Data on attached interfaces, metrics used, and other variables, are included in OSPF LSAs. As OSPF routers accumulate link-state data, they use the Shortest Path First (SPF) algorithm to calculate the shortest path to each node.

M

MAC address learning

A key optimization in Ethernet switching is that the flooding of unicast traffic is minimized. This is based on switches knowing which port to forward traffic to for given destination MAC addresses. Switches achieve this by the simple process of noting on which ports packets arrive from given MAC addresses, as those will be the ports to which return packets to those MAC addresses will need to be forwarded. This process is referred to as MAC address learning.

MAC authentication

The way that MAC-based authentication works is that when the supplicant device starts sending packets, the authenticating switch will extract the source MAC address from the packets, and send a RADIUS request that uses this MAC address as the username and password in the request. See AAA and tri-authentication.

For a sample configuration script see "Sample MAC Authentication Configuration" on page 66.8.

master node

In EPSR, the controlling node for a domain, responsible for polling the ring state, collecting error messages, and controlling the flow of traffic in the domain.

Master node states are:

- Complete - the state when there are no link or node failures on the ring.
- Failed - the state when there is a link or node failure on the ring. This state indicates that the master node received a Link-Down message or that the failover timer expired before the master node's secondary port received a Health message.

For more information see "Ring Components and Operation" on page 81.2.

MD5

Message Digest 5 authentication algorithm.

metering

See policing.

metric

The sum of all the costs along the path to a given destination. See cost.

MLD

Multicast Listener Discovery. MLD is used to exchange membership status information between IPv6 routers that support multicasting and members of multicast groups on a network segment. Host membership in a multicast group is reported by individual member hosts, and membership status is periodically polled by multicast routers.

MLD snooping

MLD snooping is a feature whereby a Layer 2 switch listens to or "snoops" the MLD messages passing through the switch or from member hosts and multicast routers. The purpose of MLD snooping is to provide efficient Layer 2 multicast forwarding, by sending only to hosts that have expressed an interest in receiving the multicast data.

For more information see Chapter 54, MLD Snooping Introduction and Commands.

MSTI

Multiple Spanning Tree Instance. MSTP enables the grouping and mapping of VLANs to different spanning tree instances. An MST Instance (MSTI) is a particular set of VLANs that are all using the same spanning tree.

For more information see "Multiple Spanning Tree Instances (MSTI)" on page 18.12.

MSTP

Multiple Spanning Tree Protocol. MSTP is similar to Rapid Spanning Tree Protocol (RSTP) - it provides loop resolution and rapid convergence. However it also has the extra advantage of making it possible to have different forwarding paths for different multiple spanning tree instances. This enables load balancing of network traffic across redundant links. A device running MSTP is compatible with other devices running RSTP or STP.

For more information see "Multiple Spanning Tree Protocol (MSTP)" on page 18.11. For a configuration example see "Configuring MSTP" on page 18.19.

MSTP Regions

An MST region is a set of interconnected switches that all have the same values for the following MST configuration identification elements:

- MST configuration name - the name of the MST region.
- Revision level - the revision number of configuration.
- Configuration Digest - the mapping of which VLANs are mapped to which MST instances.

Each of the MST instances created are identified by an MSTI number. This number is locally significant within the MST region. Therefore, an MSTI will not span across MST regions.

For more information see "MSTP Regions" on page 18.13.

multicast

One device sends out data that is intended to be received and processed by a selected group of the devices it reaches.

N

NAC

Network Access Control. NAC provides unprecedented control over user access to the network in order to mitigate threats to network infrastructure. NAC uses 802.1X port-based authentication with standards-compliant dynamic VLAN assignment, to assess a user's adherence to the network's security policies, and either grant authentication or offer remediation. NAC also supports alternatives to 802.1x port-based authentication, such as Web-authentication to enable guest access, and MAC authentication for end points that do not have an 802.1x supplicant. Furthermore, if multiple users share a port then multi-authentication can be used and a Guest VLAN can be configured to provide a catch-all for users without an 802.1x supplicant.

For more information see Chapter 62, 802.1X Introduction and Configuration and Chapter 64, Authentication Introduction and Configuration.

NAS

Network Access Server. A NAS is a single point of access to a remote resource. The client connects to the NAS. The NAS then connects to another resource asking whether the client's supplied credentials are valid. Based on that answer the NAS then allows or disallows access to the resource. The NAS contains no information about what resources clients can connect to or what client credentials are valid. The NAS sends the credentials the client supplied to a resource which then validates the client.

next hop

IP routing involves forwarding packets from one router to the next, until they reach their destination. Routers do not need to know the full path to a packet's destination, they just need to know the next router to forward the packet on to. This 'next router' is referred to as the next hop of an IP route.

Nested VLAN

See VLAN double tagging.

NTP

Network Time Protocol. NTP is a protocol for synchronizing the time clocks on a collection of network devices using a distributed client/server mechanism.

For more information see Chapter 83, NTP Introduction and Configuration.

Null route

A null route is a routing table entry that does not forward packets. A null route is specified as an interface with an ip route command. Note that a null route is also called a Blackhole route.

O

OSPF

Open Shortest Path First. A link-state routing protocol, OSPF is an interior gateway protocol (IGP) that uses the Shortest Path First (SPF) Dijsktra algorithm.

For more information see Chapter 37, OSPF Introduction and Configuration. For configuration examples see "Enabling OSPF on an Interface" on page 37.10, "Setting priority" on page 37.12, "Configuring an Area Border Router" on page 37.14, "Redistributing Routes Into OSPF" on page 37.15, "OSPF Cost" on page 37.16, "Configuring Virtual Links" on page 37.19 and "OSPF Authentication" on page 37.21.

P

PAP

Password Authentication Protocol. PAP is an authentication protocol that uses a password and is used by PPP to validate users before allowing them to access server resources. PAP transmits plain text ASCII passwords over the network so it is not secure.

PIM-DM

Protocol Independent Multicast - Dense Mode. PIM-DM is a data-driven multicast routing protocol, which builds source-based multicast distribution trees that operate on the Flood-and-Prune principle. It requires unicast-reachability information, but does not depend on a specific unicast routing protocol. PIM-DM is a significantly less complex protocol than PIM-SM. PIM-DM works on the principle that it is probable that any given multicast stream will have at least one downstream listener. PIM-DM is ideal where many hosts subscribe to receive multicast packets, so most of the PIM Routers receive and forward all multicast packets.

For more information see Chapter 52, PIM-DM Introduction and Configuration. For a configuration example see "PIM-DM Configuration" on page 52.4.

PIM-SM

Protocol Independent Multicast - Sparse Mode. PIM-SM provides efficient communication between members of sparsely distributed groups - the type of groups that are most common in wide-area internetworks. PIM-SM is designed on the principle that several hosts wishing to participate in a multicast conference does not justify flooding the entire internetwork with periodic multicast traffic. PIM-SM is designed to limit multicast traffic so that only those routers interested in receiving traffic for a particular group receive the traffic.

For more information see Chapter 50, PIM-SM Introduction and Configuration. For configuration examples see "Static Rendezvous Point configuration" on page 50.7, "Dynamic Rendezvous Point configuration" on page 50.9 and "Bootstrap Router configuration" on page 50.11.

ping

Ping tests the connectivity between two network devices to determine whether each network device can "see" the other device.

ping-of-death attack

A type of attack on a computer that involves sending a malformed or otherwise malicious ping to a network device.

ping polling

Ping polling is used to ensure that a device is still present, live, and contactable in the network by periodically sending a packet to an IP address and waiting for a response. Configurable actions can be performed if responses are no longer arriving.

For more information see Chapter 98, Ping Polling Introduction and Configuration. For how to configure ping polling see "Configuring Ping Polling" on page 98.4.

policing

In QoS, once you have set-up your classification and created your class maps, you can start conditioning your traffic flows. One tool used for traffic conditioning is the policer (or meter). The principle of policing is to measure the data flow that matches the definitions for a particular class-map; then, by selecting appropriate data rates, allocate the flows into one of three categories, Red Yellow or Green. You then decide what action to apply to the Red, Yellow and Green data. See premarking.

For more information see "Policing (Metering) Your Data" on page 60.15.

policy maps

Policy maps are the means by which you apply your class maps to physical switch ports. A policy map can be assigned to several ports, but a port cannot have more than one policy map assigned to it. See QoS.

For more information see "Policy Maps" on page 60.10.

port bit map

An efficient method for the storage of a list of ports. Each port is represented by a single bit in a 32-bit or 64-bit value.

port mirroring

Port mirroring enables traffic being received and transmitted on a switch port to be sent to another switch port, the mirror port, usually for the purposes of capturing the data with a protocol analyzer. The mirror port is the only switch port that does not belong to a VLAN, and therefore does not participate in any other switching. Before the mirror port can be set, it must be removed from all trunk groups and all VLANs except the default VLAN.

PPP

Point-to-Point Protocol. A data link protocol used to establish a direct connection between two networking nodes. PPP can provide connection authentication and transmission encryption. PPPoE (Point-to-Point Protocol over Ethernet) is used over broadband connections as is PPPoA (Point-to-Point Protocol over ATM) with DSL.

premarking

In QoS, premarking relates to adding QoS markers to your incoming data traffic before it is metered. QoS markers can be applied at both the link layer (within the CoS field), and at the network layer (within the DSCP field). See policing.

For more information see "Premarking Your Traffic" on page 60.11.

primary port

In EPSR, a ring port on the master node. This port determines the direction of the traffic flow, and is always operational.

For more information see "Ring Components and Operation" on page 81.2.

provisioning

Stack member provisioning is the pre-configuration of stack member position ready for insertion at a later time. Provisioning enables a network administrator to pre-configure vacant stack member capacity within a VCStack, ready to be hot-swapped in at a later time. Later, when the stack member switch is physically added, its configuration is automatically applied with the minimum network disruption.

For more information see "Provisioning (Stack Members)" on page 102.20.

proxy ARP

Proxy ARP allows hosts that do not support routing (i.e. they have no knowledge of the network structure) to determine the physical addresses of hosts on other networks.

For more information see "Proxy ARP" on page 24.4.

PSU

Power Supply Unit.

Q

Query Solicitation

Query Solicitation minimizes the loss of multicast data after a topology change on networks that use EPSR or spanning tree (STP, RSTP, or MSTP) for loop protection. Without Query Solicitation, when the underlying link layer topology changes, multicast data flow can stop for up to several minutes, depending on which port goes down and how much of the IGMP query interval remained at the time of the topology change. Query Solicitation greatly reduces this disruption.

For more information see "Query Solicitation" on page 48.7.

QoS

Quality of Service. QoS enables you to both prioritize traffic and limit its available bandwidth. The concept of QoS is a departure from the original networking protocols, in which all traffic on the Internet or within a LAN had the same available bandwidth. Without QoS, all traffic types are equally likely to be dropped if a link becomes oversubscribed. This approach is now inadequate in many networks, because traffic levels have increased and networks often carry time-critical applications such as streams of real-time video data. QoS also enables service providers to easily supply different customers with different amounts of bandwidth. Configuring Quality of Service involves two separate stages:

- Classifying traffic into flows, according to a wide range of criteria. Classification is performed by the switch's class maps.
- Acting on these traffic flows.

For more information see Chapter 60, Quality of Service (QoS) Introduction.

Quality of Service

See QoS.

R

RADIUS

Remote Authentication Dial-In User Service. RADIUS is a networking protocol that provides centralized AAA (Authentication Authorization and Accounting) management for clients to a network. RADIUS is a client/server protocol that runs in the application layer, using UDP (User Datagram Protocol) for data transport. RADIUS authenticates users before granting them access to network resources and can account for the usage of network resources.

For more information see Chapter 68, RADIUS Introduction and Configuration. For configuration examples see "RADIUS Configuration Examples" on page 68.14.

redistribute

Advertise routes learnt from one routing protocol into another routing protocol.

Remote Network MONitoring

See RMON.

resiliency link

In VCStack, an extra, out-of-band, data link between stack members. In the event of loss of communication across the stacking connection, the stack members can determine the status of other members via communication on the resiliency link. This assists the stack members in deciding the correct course of action when communication on the stack is lost.

For more information see "Stack Resiliency Link" on page 102.14.

RIB

Routing Information Base. The RIB records all the routes that your device has learnt. Your device uses the RIB to advertise routes to its neighbor devices and to populate the FIB (Forwarding Information Base).

For more information see "RIB and FIB Routing Tables" on page 31.4.

ring port

In EPSR, a port that connects the node to the ring. On the master node, each ring port is either the primary port or the secondary port. On transit nodes, ring ports do not have roles.

For more information see "Ring Components and Operation" on page 81.2.

RIP

Routing Information Protocol. A simple distance vector IPv4 routing protocol, RIP is an Interior Gateway Protocol (IGP) that uses hop counts as its metrics. Given a choice of routes, RIP uses the route that takes the lowest number of hops. If multiple routes have the same hop count, RIP chooses the first route it finds.The AlliedWare Plus™ RIP module supports RFCs 1058 and 1723; the RIPv2 module supports more fields in the RIP packets, and supports security authentication features.

For more information see "RIP" on page 30.2. For configuration examples see "Enabling RIP" on page 33.2, "Specifying the RIP Version" on page 33.4, "RIPv2 Authentication (Single Key)" on page 33.6, "RIPv2 Text Authentication (Multiple Keys)" on page 33.8 and "RIPv2 md5 authentication (Multiple Keys)" on page 33.12.

RIPng

Routing Information Protocol next generation. RIPng is a simple distance vector IPv6 routing protocol. It determines the number of hops between the destination and your device, where one hop is one link. Given a choice of routes, RIPng uses the route that takes the lowest number of hops. If multiple routes have the same hop count, RIPng chooses the first route it finds. RIPng is an extension of RIPv2 to support IPv6.

For configuration examples see "Enabling RIPng" on page 35.2 and "Troubleshooting RIPng Adjacency" on page 35.5.

RIPv6

See RIPng.

RMON

Remote Network MONitoring. RMON was developed by the IETF to support monitoring and protocol analysis of LANs with a focus on Layer 1 and 2 information in networks. RMON is an industry standard that provides the functionality in network analyzers. An RMON implementation operates in a client/server model. Monitoring devices (or 'probes') contain RMON agents that collect information and analyze packets. The probes are servers and the Network Management applications that communicate with them are clients.

For more information see Chapter 93, RMON Introduction and Configuration. For a configuration example see "RMON Configuration Example" on page 93.3.

Roaming Authentication

Roaming Authentication improves the usability of network security by enabling users to move within the network without requiring them to re-authenticate each time they move. If a supplicant (client device) moves from one wireless access point to another wireless access point, and the wireless access points are connected to different ports, then the switch (authenticator) recognizes that the supplicant has been authenticated and accepts the supplicant without requiring re-authentication.

For more information see "Roaming Authentication" on page 64.4.

root bridge

A single bridge is selected to become the spanning tree's unique root bridge. This is the device that advertises the lowest Bridge ID. Each bridge is uniquely identified by its Bridge ID, which comprises the bridge's root priority (a spanning tree parameter) followed by its MAC address.

For an overview of spanning tree operation see "Spanning tree operation" on page 18.2.

root path cost

A spanning tree property. Each port connecting a bridge to a LAN has an associated cost, called the root path cost. This is the sum of the costs for each path between the particular bridge port and the root bridge. The designated bridge for a LAN is the one that advertises the lowest root path cost. If two bridges on the same LAN have the same lowest root path cost, then the switch with the lowest bridge ID becomes the designated bridge.

For an overview of spanning tree operation see "Spanning tree operation" on page 18.2.

route-map

A mechanism for filtering IP routes and changing their attributes.

RSTP

Rapid Spanning Tree Protocol. RSTP is an evolution of the Spanning Tree Protocol (STP) which provides for faster spanning tree convergence after a topology change. A device running RSTP is compatible with other devices running STP.

For more information see "Rapid Spanning Tree Protocol (RSTP)" on page 18.8. For a configuration example see "Configuring RSTP" on page 18.9.

S

SCP

Secure Copy Protocol. SCP allows for secure file transfer to and from the switch, protecting your network from unwanted downloads and unauthorized file copying.

For more information see "Copying with Secure Copy (SCP)" on page 6.16.

script

A script is a sequence of commands stored as a plaintext file on a file subsystem accessible to the device, such as Flash memory. Each trigger may reference multiple scripts and any script may be used by any trigger. When an event activates a trigger, the trigger executes the scripts associated with it in sequence. One script is executed completely before the next script begins.

See Dynamic Link Failover.

SD card

Secure Digital card.

SDHC card

Secure Digital High Capacity card.

secondary port

In EPSR, a second ring port on the master node. This port remains active, but blocks all protected VLANs from operating unless the ring fails. Similar to the blocking port in an STP/RSTP instance.

For more information see "Ring Components and Operation" on page 81.2.

sFlow

sFlow®[1] is an industry standard technology for monitoring high speed switched networks. It provides the ability to monitor traffic in data networks containing switches and routers.

1. sFlow® is a registered trademark belonging to InMon Corp, San Francisco, CA.

For more information see Chapter 100, sFlow Introduction and Configuration. For how to configure sFlow see "Configuring sFlow on your Switch" on page 100.6.

sFlow agent

A network employing sFlow typically comprises a number of network (sFlow) agents that accumulate sampled data and traffic counter information. The agents then forward this data to a collector. The collector then analyses the information supplied by its agents in order to compile and display statistical profiles of the network and its traffic. The sFlow feature on your switch provides the sFlow agent capability.

For more information see "The sFlow Agent" on page 100.3.

sFlow collector

The sFlow collector receives traffic samples and counter information from a number of sFlow agents. These samples are received as a series of UDP datagrams. From the data contained within these datagrams, the collector is able to provide statistical and or graphical information of network traffic.

For more information see "The sFlow Collector" on page 100.5.

SFTP

SSH File Transfer Protocol. SFTP provides a secure way to copy files onto your device from a remote device.

For more information see "Copying with SSH File Transfer Protocol (SFTP)" on page 6.16.

software ACLs

See ACL types.

spanning tree

A loop free portion of a network topology. The network topology is dynamically pruned to provide only one path for any packet. See STP, RSTP and MSTP.

Spanning Tree Protocol Root Guard

See STP Root Guard.

SSH

Secure Shell. SSH is a network protocol that uses strong authentication and encryption for remote access across a nonsecure network. SSH provides sessions between a host running a SSH server and a machine with a SSH client.

For more information see Chapter 74, Secure Shell (SSH) Introduction. For how to configure a SSH server see "Configuring the SSH Server" on page 74.4. For how to configure a SSH client see "Configuring the SSH Client" on page 74.9.

stack

See VCStack.

Stack Master

The switch that manages the stack, or VCStack, also referred to as the Active Master.

See Disabled Master for information about how this relates to Stack Master or Active Master.

stack member

An individual switch that is part of a VCStack.

S-TAG

Service VLAN TAG.

static aggregator

See static channel group.

static channel group

A static channel group, also known as a static aggregator, enables a number of ports to be manually configured to form a single logical connection of higher bandwidth. By using static channel groups you increase channel reliability by distributing the data path over more than one physical link.

storm-control

Storm-control enables you to specify the threshold level for broadcasting, multicast, or destination lookup failure (DLF) traffic for a port. Storm-control limits the specified traffic type to the specified threshold.

For more information see "Storm-control" on page 14.16.

storm protection

Storm protection uses QoS mechanisms to classify on traffic likely to cause a packet storm (broadcast and multicast). With QoS storm protection, several actions are possible when a storm is detected:

- You can disable the port physically.
- You can disable the port logically.
- You can disable the port for a particular VLAN.

For more information see "Storm Protection" on page 60.33.

STP

Spanning Tree Protocol. STP is the original bridge protocol defined by IEEE standard 802.1D-1988. It creates a single spanning tree over a network.

For more information see "Spanning Tree Protocol (STP)" on page 18.5. For a configuration example see "Configuring STP" on page 18.6.

STP Root Guard

Spanning Tree Protocol Root Guard. STP Root Guard designates which devices can assume the role of root bridge in an STP network. This stops an undesirable device from taking over this role, where it could either compromise network performance or cause a security weakness.

See the spanning-tree guard root command on page 19.43.

subnet address

A subnet portion of an IP address. In a subnetted network, the host portion of an IP address is split into a subnet portion and a host portion using an address or subnet mask.

subnet mask

A bit mask used to select bits from an Internet address for subnet addressing. The mask is 32 bits long and selects the network portion of the Internet address and one or more bits of the local portion. Sometimes called address mask.

switch instance

A single switch chip with its associated ports, internal data interfaces, hardware tables, and packet buffer memory.

S-VID

Service VLAN ID.

S-VLAN

Service VLAN.

synchronous

Transmission in which the data characters and bits are transmitted at a fixed rate with the transmitter and receiver synchronized. This eliminates the need for start-stop elements, as in asynchronous transmission, but requires a flag character to be transmitted when there is no data to transmit. See “asynchronous” on page D.5

T

TACACS+

TACACS+ (Terminal Access Controller Access-Control System Plus) provides a method for securely managing multiple network access points from a single management service. TACACS+ is a TCP-based access control protocol that allows a device to forward a user's username and password to an authentication server to determine whether access can be allowed. In addition to this authentication service, TACACS+ can also provide authorization and accounting services. One of the features of TACACS+ is the ability to separate authentication, authorization and accounting so that these functions can be provided independently on separate servers.

For information on the AlliedWare Plus implementation of TACACS+, see Chapter 70, TACACS+ Introduction and Configuration and Chapter 71, TACACS+ Commands.

TCN

Topology Change Notification.

thrash limiting

MAC address thrashing occurs when MAC addresses move rapidly between one or more ports or trunks, for example, due to a network loop. Thrash limiting enables you to apply actions to a port when thrashing is detected. It is supported on all port types and also on aggregated ports.

For more information see "Thrash Limiting" on page 14.18

TLV

Type-Length-Value. A single LLDPDU contains multiple TLVs. TLVs are short information elements that communicate complex data, such as variable length strings, in a standardized format. Each TLV advertises a single type of information, such as its device ID, type, or management addresses. See LLDP advertisements.

traceroute

Traceroute is used to discover the route that packets pass between two systems running the IP protocol. Traceroute sends an initial UDP packets with the Time To Live (TTL) field in the IP header set starting at 1. The TTL field is increased by one for every subsequent packet sent until the destination is reached. Each hop along the path between two systems responds with a TTL exceeded packet (ICMP type 11) and from this the path is determined.

transit node

In EPSR, nodes other than the master node in the domain.

Transit node states are:

- Idle - the state when EPSR is first configured, before the master node determines that all links in the ring are up. In this state, both ports on the node are blocked for the data VLAN. From this state, the node can move to Links Up or Links Down.
- Links Up - the state when both the node's ring ports are up and forwarding. From this state, the node can move to Links Down.
- Links Down - the state when one or both of the node's ring ports are down. From this state, the node can move to Preforwarding.
- Pre-forwarding - the state when both ring ports are up, but one has only just come up and is still blocked to prevent loops. From this state, the transit node can move to Links Up if the master node blocks its secondary port, or to Links Down if another port goes down.

For more information see "Ring Components and Operation" on page 81.2.

tri-authentication

Authentication commands enable you to specify three different types of device authentication: 802.1X authentication, MAC authentication, and Web-authentication. All three types can be configured to run simultaneously on a switch port. The simultaneous configuration and authentication of all three types on a port is called tri-authentication.

For a configuration example see "Tri-Authentication Configuration" on page 64.2.

trigger

A trigger is an ordered sequence of scripts that is executed when a certain event occurs. Each trigger may reference multiple scripts and any script may be used by any trigger. When an event activates a trigger, the trigger executes the scripts associated with it in sequence. One script is executed completely before the next script begins.

See Dynamic Link Failover.

Type-Length-Value

See TLV.

U

unicast

Two individual devices hold a conversation just between themselves.

V

VCStack

A group of two or more switches operating as a single switch. See Virtual Chassis Stacking.

VCStack Fast Failover

VCStack Fast Failover provides absolutely minimal network downtime in the event of a problem with the stack.

See the reboot rolling command on page 103.7.

VID

VLAN Identifier or VLAN ID. When you create a VLAN you give it a numerical VID which is included in VLAN-tagged Ethernet frames to and from this VLAN.

Virtual Chassis Stacking

Virtual Chassis Stacking (VCStack™) is the name given to two or more Allied Telesis switches that are configured to operate as a single switch. From a configuration and management point of view, it is as though the switches are just one device with a seamless transition from the ports of one stack member to the ports of the next.

For more information see Chapter 102, Stacking Introduction.

VLAN classification

A packet can be allocated VLAN membership based on its protocol, subnet, or port.

VLAN double tagging

VLAN double tagging is used operate a number of private Layer 2 networks within a single public Layer 2 network. A VLAN double tagging implementation consists of the following port types:

- Provider ports - these connect to a service provider's Layer 2 network
- Customer edge ports - these connect to a customer's private Layer 2 network

For more information see "VLAN Double Tagging (VLAN Stacking)" on page 16.5. For a configuration example see "Configuring double-tagged VLANs" on page 16.6.

VLAN ID

See VID.

VLAN Identifier

See VID.

VLAN stacking

See VLAN double tagging.

VLAN tag

IEEE standard 802.1q defines an additional 4 byte tag field that can be inserted immediately following the MAC address, plus any routing fields present. This field contains a 12 bit VLAN identifier, commonly referred to as the VLAN tag. The VLAN tag is used to determine which VLAN a given frame should be forwarded to.

Other tags included in the 802.1q tag field is a Tag Protocol Identifier tag, and a Type of Service tag used to determine data priority.

Voice VLAN

Voice VLAN automatically separates voice and data traffic into two different VLANS. This automatic separation places delay-sensitive traffic into a voice-dedicated VLAN, which simplifies QoS configurations.

For more information see "Voice VLAN" on page 90.3.

VoIP

Voice over Internet Protocol. Enables the delivery of voice communications over IP networks such as the Internet or other packet-switched networks instead of over traditional telephony circuits.

VRF

Virtual Routing and Forwarding. VRF is used with the VRF-Lite feature, where multiple routing and forwarding instances can separately reside within a single x900 series switch.

VRF-Lite

Virtual Routing and Forwarding Lite (VRF-Lite) provides a cut back (lightweight) version of the full VRF capability that is used to create large-scale Virtual Private Networks (VPNs). VRF-Lite enables a global routing domain and eight separate VRF routing instances to reside within a single x900 series switch.

VPN

Virtual Private Network (VPN) is a private customer network that exists as part of a larger public or private network infrastructure. Each customer network can operate as a totally isolated entity within the network suppliers infrastructure that operates to its own management policies and rules.

VRID

Virtual Router Identifier.

VRRP

Virtual Router Redundancy Protocol. VRRP combines two or more physical switches into a logical grouping called a virtual router. The physical switches then operate together to provide a single logical gateway for hosts on the LAN. If the master fails, the other devices assume the virtual IP address.

For more information see Chapter 79, VRRP Introduction and Configuration. For configuration examples see “Configuration examples” on page 79.9.

W

Web-authentication

The switch sends a login screen to the client webbrowser which must be authenticated before access is granted to the network. See AAA and tri-authentication.

For a sample configuration script see “Sample Web-Authentication Configuration” on page 66.9.

wildcard mask

A subnet mask in which bits set to 0 indicate an exact match and bits set to 1 indicate ‘don’t care’.

X

XEM

High Speed Expansion Module.