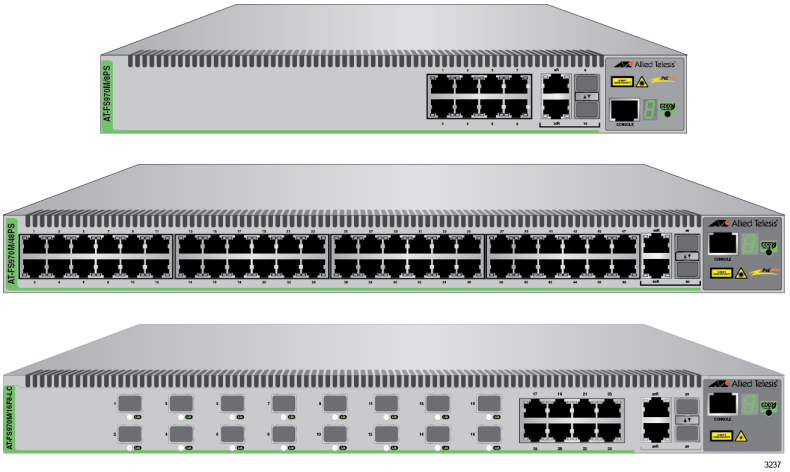
AT-FS970M Series

Fast Ethernet Switches

- AT-FS970M/8
- AT-FS970M/8PS
- AT-FS970M/8PS-E
- AT-FS970M/24C
- AT-FS970M/24PS
- AT-FS970M/48
- AT-FS970M/48PS
- AT-FS970M/16F8-LC



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Management Software Command Line Interface User's Guide

AlliedWare Plus Version 2.4.1.0

the solution : the network

613-002177 Rev. A

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3041 Orchard Parkway
San Jose, California 95134

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Preface

This is the command line management guide for the AT-FS970M Series of Fast Ethernet Switches. The instructions in this guide explain how to start a management session and how to use the commands in the AlliedWare Plus command line interface to view and configure the features of the switch.

For hardware installation instructions, refer to the AT-FS970M Series Fast Ethernet Switches Installation Guide.

This preface contains the following sections:

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This document uses the following conventions:

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Section I

Getting Started

This section contains the following chapters:

Chapter 1

AlliedWare Plus Command Line Interface

This chapter has the following sections:

Management Sessions

You can manage the switch locally or remotely. Local management is conducted through the Console port on the switch. Remote management is possible with a variety of management tools from workstations on your network.

Local Management

The switch has a Console port for local management of the unit. Local management sessions, which must be performed at the unit, hence the name “local,” are commonly referred to as out-of-band management because they are not conducted over your network.

The requirements for local management sessions are a terminal or a PC with a terminal emulator program and the RS-232 console management cable that comes with the switch. For modern PCs without a serial port, a USB-to-serial adapter and driver software is required.

Note
The initial management session of the switch must be from a local management session.

Remote Management

You can manage the switch remotely with the following software tools:

- Telnet client
- Secure Shell client
- Secure (HTTPS) or non-secure (HTTP) web browser
- SNMPv1, SNMPv2c, or SNMPv3 application

Management sessions performed with these tools are referred to as in-band management because the sessions are conducted over your network. Remote management sessions are generally more convenient than local management session because they can be performed from any workstation that has one of these software tools.

Table 1. Remote Software Tool Settings

Software Tool	Default Setting
Telnet	Enabled
Secure Shell Server	Disabled
HTTPS	Disabled
HTTP	Enabled (This tool is disabled by a factory reset of the switch.)

To support remote management, the switch must have a management IP address. For instructions on how to assign a management IP address to the switch, refer to "Adding a Management IP Address" on page 82.

Remote Telnet Management

The switch has a Telnet server that you can use to remotely manage the unit from Telnet clients on your management workstations. Remote Telnet sessions give you access to the same commands and the same management functions as local management sessions.

> **Note**
> Telnet remote management sessions are conducted in clear text, leaving them vulnerable to snooping. If an intruder captures the packet with your login name and password, the security of the switch will be compromised. For secure remote management, Allied Telesis recommends Secure Shell (SSH) or secure web browser (HTTPS).

Remote Secure Shell Management

The switch has an SSH server for remote management with an SSH client on a management workstation. This management method is similar to Telnet management sessions in that it gives you access to the same command line interface and the same functions. But where they differ is SSH management sessions are secure against snooping because the packets are encrypted, rendering them unintelligible to intruders who might capture them.

For instructions on how to configure the switch for SSH management, refer to Chapter 92, "Secure Shell (SSH) Server" on page 1447.

Web Browser Windows

The switch comes with a web browser server so that you can manage the unit using a web browser on a management workstation. The switch supports both encrypted (HTTPS) and non-encrypted (HTTP) web browser management sessions.

Simple Network Management Protocol

The switch supports remote SNMPv1, SNMPv2c and SNMPv3 management. This form of management requires an SNMP application, such as AT-View, and an understanding of management information base (MIB) objects.

The switch supports the following MIBs for SNMP management:

- atistackinfo.mib
- atiEdgeSwtich.mib
- RFC 1155 MIB
- RFC 1213 MIB-II
- RFC 1493 Bridge MIB
- RFC 1643 Ethernet MIB
- RFC 2096 IP Forwarding Table MIB
- RFC 2790 Host MIB
- RFC 2863 Interface Group MIB
- RFC 3176 sFlow MIB
- IEEE 802.1x 2010 MIB

The Allied Telesis managed switch MIBs (atistackinfo.mib and atiEdgeSwitch.mib) are available from the Allied Telesis web site.

Management Interfaces

The switch has two management interfaces:

- AlliedWare Plus command line
- Web browser windows

The AlliedWare Plus command line is available from local management sessions, and remote Telnet and Secure Shell management sessions. The web browser windows are available from remote web browser management sessions.

Local Manager Account

You must log on to manage the switch. This requires a valid user name and password. The switch comes with one local manager account. The user name of the account is “manager” and the default password is “friend”. The user name and password are case sensitive. This account gives you access to all management modes and commands.

The default manager account is referred to as “local” because the switch authenticates the user name and password itself. If more manager accounts are needed, you can add up to eight more local manager accounts. For instructions, refer to Chapter 86, “Local Manager Accounts” on page 1407.

Another way to create more manager accounts is to transfer the task of authenticating the accounts to a RADIUS or TACACS+ server on your network. For instructions, refer to Chapter 98, “RADIUS and TACACS+ Clients” on page 1509.

The initial and default switch configuration supports up to three management sessions at one time. The number of sessions can be configured using the SERVICE MAXMANAGER command. The maximum number of sessions is 3. See “SERVICE MAXMANAGER” on page 164.

AlliedWare Plus Command Modes

The AlliedWare Plus command line interface consists of a series of modes that are arranged in the hierarchy shown in Figure 1.

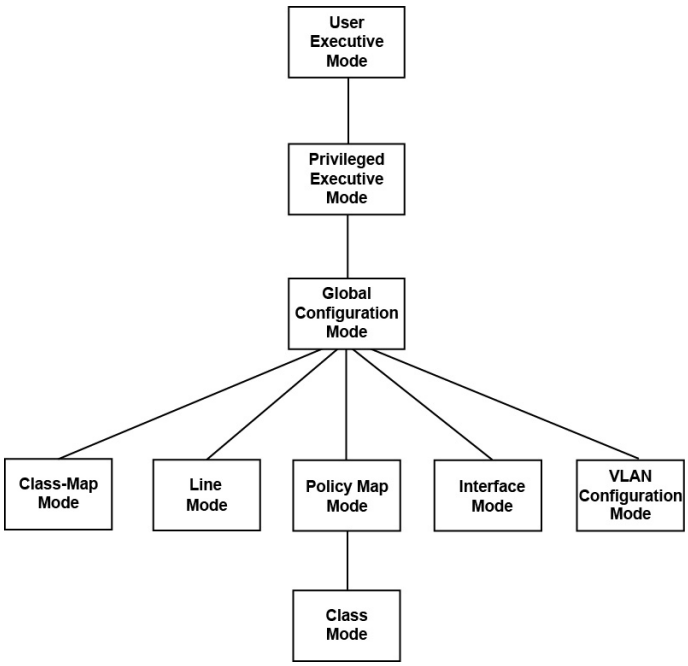

Figure 1. Command Modes

The modes have different commands and support different management functions. The only exceptions are the User Exec mode and the Privileged Exec mode. The Privileged Exec mode contains all the same commands as the User Exec mode, plus many more.

To perform a management function, you first have to move to the mode that has the appropriate commands. For instance, to configure the speeds and wiring configurations of the ports, you have to move to the Port Interface mode because the SPEED and POLARITY commands, which are used to configure the speed and wiring parameters, are stored in that mode.

Some management functions require that you perform commands from more than one mode. For instance, creating a new VLAN requires that you first go to the VLAN Configuration mode to initially create it and then to the Port Interface mode to designate the ports.

The modes, their command line prompts, and their functions are listed in Table 2 on page 60.

Note
By default, the mode prompts are prefixed with the “awplus” string. To change this string, use the HOSTNAME command. See “What to Configure First” on page 80.

Table 2. AlliedWare Plus Modes

Mode	Prompt	Function
User Exec mode	awplus>	❒ Displays the switch settings. ❒ Lists the files in the file system. ❒ Pings remote systems.
Privileged Exec mode	awplus#	❒ Displays the switch settings. ❒ Lists the files in the file system. ❒ Pings remote systems. ❒ Sets the date and time. ❒ Saves the current configuration. ❒ Downloads new versions of the management software. ❒ Restores the default settings. ❒ Renames files in the file system. ❒ Resets the switch.
Global Configuration mode	awplus (config)#	❒ Creates classifiers and access control lists. ❒ Creates encryption keys for remote HTTPS and SSH management. ❒ Activates and deactivates 802.1x port-based network access control. ❒ Assigns a name to the switch. ❒ Configures IGMP snooping. ❒ Sets the MAC address table aging timer. ❒ Enters static MAC addresses. ❒ Specifies the IP address of an SNTP server. ❒ Configures the RADIUS client. ❒ Sets the console timer.

Table 2. AlliedWare Plus Modes (Continued)

Mode	Prompt	Function
Console Line mode	awplus (config-line)#	❒ Sets the session timer for local management sessions. ❒ Activates and deactivates remote manager authentication.
Virtual Terminal Line mode	awplus (config-line)#	❒ Sets the session timers for remote Telnet and SSH management sessions. ❒ Activates and deactivates remote manager authentication.
Interface mode	awplus (config-if)#	❒ Configures port settings. ❒ Disables and enables ports. ❒ Configures the port mirror. ❒ Configures 802.1x port-based network access control. ❒ Creates static port trunks. ❒ Sets the load distribution method for static port trunks. ❒ Adds and removes ports from VLANs. ❒ Creates Quality of Service policies.
VLAN Configuration mode	awplus (config-vlan)#	❒ Creates VLANs.
Civic Location mode	awplus (config_civic)#	❒ Creates optional LLDP-MED civic location entries.
Coordinate Location mode	awplus (config_coord)#	❒ Creates optional LLDP-MED coordinate location entries.
DHCP Configuration mode	awplus (dhcp-config)#	❒ Configures DHCP service settings on the switch.

Moving Down the Hierarchy

To move down the mode hierarchy, you have to step through each mode in sequence. Skipping modes is not permitted.

Each mode has a different command. For instance, to move from the User Exec mode to the Privileged Exec mode, you use the ENABLE command. Some commands, like the INTERFACE PORT command, which is used to enter the Port Interface mode, require a value, such as a port number, a VLAN ID or a port trunk ID.

ENABLE Command

You use this command to move from the User Exec mode to the Privileged Exec mode. The format of the command is:

```
enable
```

```
awplus> enable
awplus#
```

Figure 2. ENABLE Command

CONFIGURE TERMINAL Command

You use this command to move from the Privileged Exec mode to the Global Configuration mode. The format of the command is:

```
configure terminal
```

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

Figure 3. CONFIGURE TERMINAL Command

CLASS-MAP Command

You use this command to move from the Global Configuration mode to the Class-Map mode, in which you create classifiers and flow groups for Quality of Service policies. The format of the command is:

```
class-map id_number
```

```
awplus(config)# class-map 256
awplus(config-cmap)#
```

Figure 4. CLASS-MAP Command

LINE CONSOLE 0 Command

You use this command to move from the Global Configuration mode to the Console Line mode to set the management session timer and to activate or deactivate remote authentication for local management sessions. The mode is also used to set the baud rate of the terminal port. The format of the command is:

```
line console 0
```

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

Figure 5. LINE CONSOLE Command

LINE VTY Command

You use this command to move from the Global Configuration mode to the Virtual Terminal Line mode to set the management session timer and to activate or deactivate remote authentication of manager accounts. The format of the command is:

```
line vty line_id
```

The range of the LINE_ID parameter is 0 to 9. For information on the VTY lines, refer to "VTY Lines" on page 79. This example enters the Virtual Terminal Line mode for VTY line 2:

```
awplus(config)# line vty 2
awplus(config-line)#
```

Figure 6. LINE VTY Command

POLICY-MAP Command

You use this command to move from the Global Configuration mode to the Policy Map mode where flow groups for Quality of Service policies are mapped to traffic classes. The format of the command is:

```
policy-map id_number
```

This example enters the Policy Map mode for the traffic class with the ID number 1:

```
awplus(config)# policy-map 1
awplus(config-pmap)#
```

Figure 7. POLICY-MAP Command

CLASS Command

You use this command to move from the Policy Map mode to the Class mode, to add flow groups to traffic classes for Quality of Service policies. The format of the command is:

```
class id_number
```

This example adds to a traffic class a flow group with the ID number 1:

```
awplus(config-pmap)# class 1
awplus(config-pmap-c)#
```

Figure 8. CLASS Command

INTERFACE Command - Dynamic Port Trunk

You use this command to move from the Global Configuration mode to the Dynamic Port Trunk Interface mode, to change the load distribution methods of static port trunks. You specify a trunk by its name of “po” followed by its ID number. You can specify only one static port trunk at a time. The format of the command is:

```
interface trunk_name
```

This example enters the Port Trunk Interface mode for trunk ID 5:

```
awplus(config)# interface po5
awplus(config-if)#
```

Figure 9. INTERFACE TRUNK Command

INTERFACE Command - Ports

You use this command to move from the Global Configuration mode to the Interface mode where you configure the parameter settings of the ports and add ports to VLANs and Quality of Service policies. The format of the command is:

```
interface port
```

This example enters the Port Interface mode for port 21.

```
awplus(config)# interface port1.0.21
awplus(config-if)#
```

Figure 10. INTERFACE PORT Command - Single Port

You can configure more than one port at a time. This example enters the Port Interface mode for ports 11 to 15 and 22.

```
awplus(config)# interface port1.0.11-port1.0.15,port1.0.22
awplus(config-if)#
```

Figure 11. INTERFACE PORT Command - Multiple Ports

The INTERFACE PORT command is also located in the Port Interface mode itself, so that you do not have to return to the Global Configuration

mode to configure different ports. This example moves from the current Port Interface mode to the Port Interface mode for ports 7 and 10.

```
awplus(config-if)# interface port1.0.7,port1.0.10
awplus(config-if)#
```

Figure 12. INTERFACE PORT Command - Moving Between Port Interface Modes

INTERFACE Command - Static Port Trunk

You use this command to move from the Global Configuration mode to the Static Port Trunk Interface mode, to change the load distribution methods of static port trunks. You specify a trunk by its name of "sa" followed by its ID number. You can specify only one static port trunk at a time. The format of the command is:

`interface` *`trunk_name`*

This example enters the Static Port Trunk Interface mode for trunk ID 2:

```
awplus(config)# interface sa2
awplus(config-if)#
```

Figure 13. INTERFACE TRUNK Command

INTERFACE VLAN Command

You use this command to move from the Global Configuration mode to the VLAN Interface mode to assign the switch a management IP address. The format of the command is:

`interface vlan`*`vid`*

The VID parameter is the ID of an existing VLAN on the switch. This example enters the VLAN Interface mode for a VLAN that has the VID 12:

```
awplus(config)# interface vlan12
awplus(config-if)#
```

Figure 14. INTERFACE VLAN Command

Note
A VLAN must be identified in this command by its VID and not by its name.

VLAN DATABASE Command

You use this command to move from the Global Configuration mode to the VLAN Configuration mode, which has the commands for creating VLANs. The format of the command is:

`vlan database`

```
awplus(config)# vlan database
awplus(config-vlan)#
```

Figure 15. VLAN DATABASE Command

LOCATION CIVIC-LOCATION Command

You use this command to move from the Global Configuration mode to the Civic Location mode, to create LLDP civic location entries. The format of the command is:

`location civic-location` *id_number*

This example assigns the ID number 16 to a new LLDP civic location entry:

```
awplus(config)# location civic-location 16
awplus(config-civic)#
```

Figure 16. LLDP LOCATION CIVIC-LOCATION Command

LOCATION COORD-LOCATION Command

You use this command to move from the Global Configuration mode to the Coordinate Location mode, to create LLDP coordinate location entries. The format of the command is:

`location coord-location` *id_number*

This example assigns the ID number 8 to a new LLDP coordinate location entry:

```
awplus(config)# location coord-location 8
awplus(config-coord)#
```

Figure 17. LLDP LOCATION COORD-LOCATION Command

Moving Up the Hierarchy

There are four commands for moving up the mode hierarchy. They are the EXIT, QUIT, END and DISABLE commands.

EXIT and QUIT Commands

These commands, which are functionally identical, are found in nearly all the modes. They move you up one level in the hierarchy, as illustrated in Figure 18.

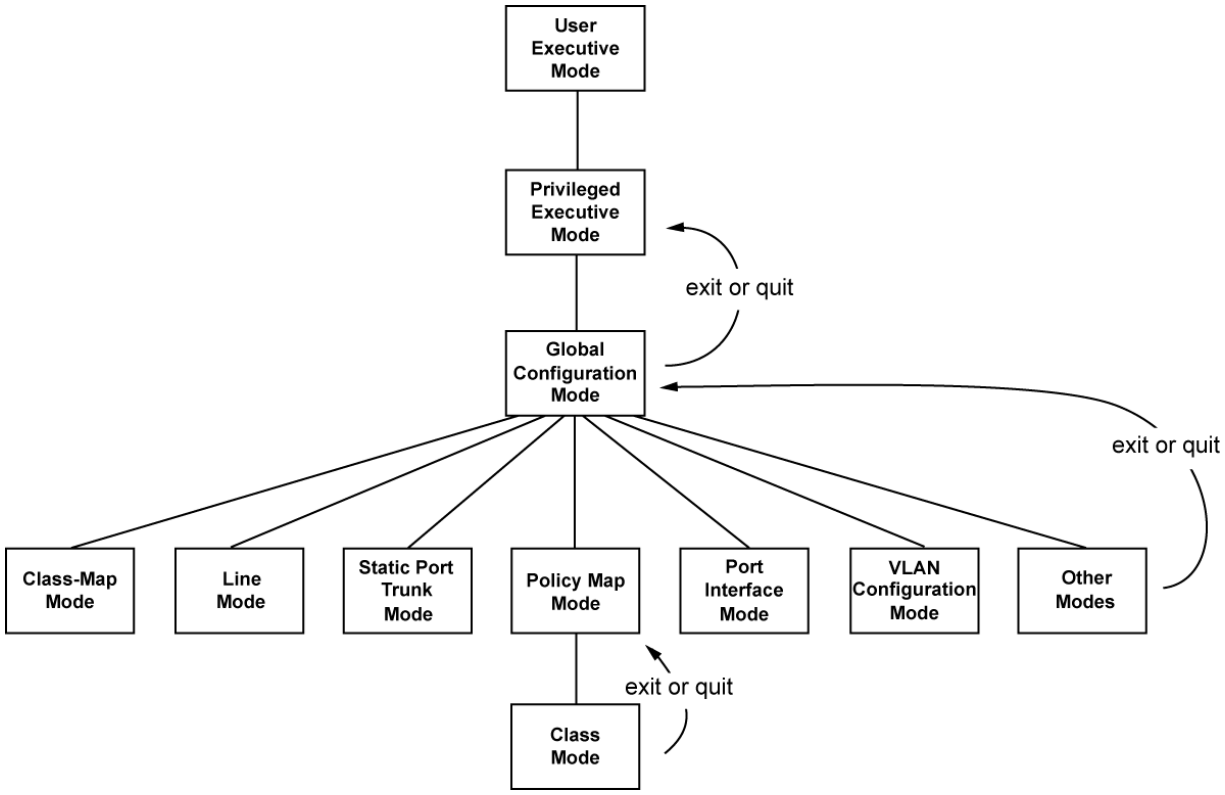

Figure 18. Moving Up One Mode with the EXIT and QUIT Command

END Command

After you have configured a feature, you may want to return to the Privileged Exec mode to verify your changes with the appropriate SHOW command. You can step back through the modes one at a time with the EXIT or QUIT command. However, the END command is more convenient because it moves you directly to the Privileged Exec mode from any mode below the Global Configuration mode.

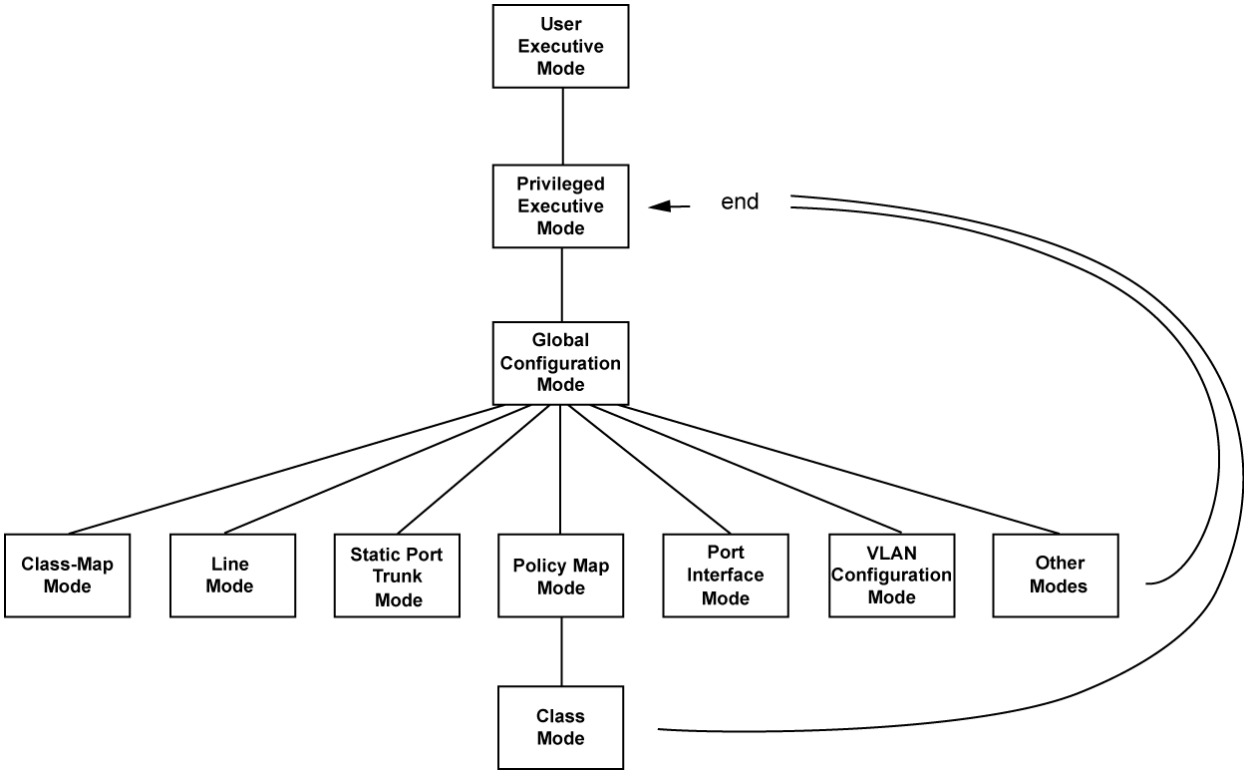

Figure 19. Returning to the Privileged Exec Mode with the END Command

DISABLE Command

To return to the User Exec mode from the Privileged Exec mode, use the DISABLE command.

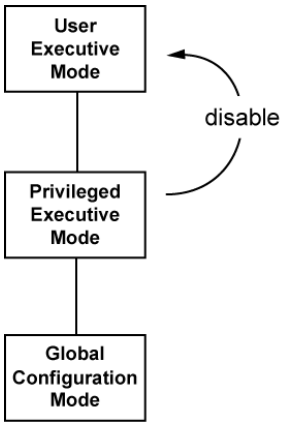

Figure 20. Returning to the User Exec Mode with the DISABLE Command

Port Numbers in Commands

The ports on the switch are identified in the commands with the PORT parameter. The parameter has the format shown in Figure 21.

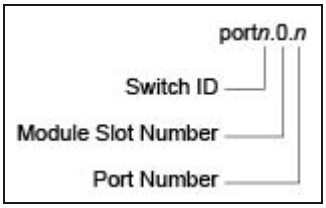

Figure 21. PORT Parameter in the Command Line Interface

The variables in the parameter are defined here:

- Switch ID: This number is used if the switch supports stacking. It is the switch's ID number in a stack. This number should always be 1 for AT-FS970M Series switches because they do not support stacking.
- Module Slot ID: This number is used for modular switches that have slots for networking modules. It is used to identify the networking modules by their slot numbers. This number should always be 0 for AT-FS970M Series switches because they are not modular switches.
- Port number: This is a port number.

Note
The correct format of the PORT parameter for AT-FS970M Series switches is PORT1.0.*n*.

Here are a few examples of the PORT parameter. This example uses the INTERFACE PORT command to enter the Port Interface mode for ports 12 and 18:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12,port1.0.18
awplus(config-if)#
```

You can also specify port ranges. This example displays the port settings for ports 21 to 23:

```
awplus# show interface port1.0.21-port1.0.23
```

Note that you must include the prefix "port1.0." in the last number of a range.

You can also combine individual ports and port ranges in the same command, as illustrated in these commands, which enter the Port Interface mode for ports 5 to 11 and ports 16 and 18:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5-port1.0.11,port1.0.16,
port1.0.18
awplus(config-if)#
```

Command Format

The following sections describe the command line interface features and the command syntax conventions.

Command Line Interface Features

The command line interface has these features:

- Command history - Use the up and down arrow keys.
- Keyword abbreviations - Any keyword can be recognized by typing an unambiguous prefix, for example, type "sh" and the software responds with "show."
- Tab key - Pressing the Tab key fills in the rest of a keyword automatically. For example, typing "sh" and then pressing the Tab key enters "show" on the command line.

Command Formatting Conventions

This manual uses the following command format conventions:

- `screen text font` - This font illustrates the format of a command and command examples.
- [ ] - Brackets indicate optional parameters.
- | - Vertical line separates parameter options for you to choose from.
- *Italics* - Italics indicate variables you have to provide.

Command Examples

Most of the command examples in this guide start at the User Exec mode and include the navigational commands. Here is an example that creates a new VLAN called Engineering with the VID 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 5 name Engineering
```

You do not have to return to the User Exec mode when you finish a management task. But it is a good idea to return to the Privileged Exec mode to confirm your changes with the appropriate SHOW command, before performing a new task.

Startup Messages

The switch generates the following series of status messages whenever it is powered on or reset. The messages can be viewed on the Console port with a terminal or a computer with a terminal emulator program.

```
CFE-NTSW-5.0.4 for BCM956218 (32bit,SP,BE,MIPS)
Build Date: Thu May 20 12:22:14 PDT 2010 (jwong@tiramisu)
Copyright (C) 2000-2008 Broadcom Corporation.

Initializing Arena.
Initializing Devices.
Board : AT-FS970M/8
CPU type 0x2901A: 266MHz
Total memory: 0x8000000 bytes (128MB)

Total memory used by CFE:  0x87EB8000 - 0x87FFFBE0 (1342432)
Initialized Data:          0x87EFA324 - 0x87EFCAF0 (10188)
BSS Area:                  0x87EFCAF0 - 0x87EFDBE0 (4336)
Local Heap:                0x87EFDBE0 - 0x87FFDBE0 (1048576)
Stack Area:                0x87FFDBE0 - 0x87FFFBE0 (8192)
Text (code) segment:       0x87EB8000 - 0x87EF9B6F (269167)
Boot area (physical):      0x07E77000 - 0x07EB7000
Relocation Factor:         I:E82B8000 - D:E82B8000

Resetting uart to 9600 baud.
 Press Ctrl-C to stop auto boot..........3...2...1...
Loader:elf Filesys:raw Dev:flash0.os-Linux File:ATI Options:(null)
Loading: 0x80001000/42538636 0x8289268c/96724 Entry at 0x80230860
Starting program at 0x80230860


Starting...

           _______________   ____

       /\ \            / /______\

      /   \ \_      __/ /| ______ |

    /      \ |     |  /  | ______ |

  /         \ \   / /     \ ____ /

/_______/\____\ \/ /_____________/

Allied Telesis Inc.Mounting Filesystems...
Starting SNMP...
Starting MainTask...
```

Figure 22. Startup Messages

```
Initializing System ................................ done!
Initializing Board ................................. done!
Initializing Serial Interface ...................... done!
Initializing Timer Library ......................... done!
Initializing IPC ................................... done!
Initializing Event Log ............................. done!
Initializing Switch Models ......................... done!
Initializing File System ........................... done!
Initializing Database .............................. done!
Initializing Configuration ......................... done!
Initializing AW+ CLI ............................... done!
Initializing Drivers ............................... done!
Initializing Port Statistics ....................... done!
Initializing Port .................................. done!
Initializing Trunk ................................. done!
Initializing Port Security ......................... done!
Initializing LACP .................................. done!
Initializing PORT VLAN ............................. done!
Initializing Port Mirroring ........................ done!
Initializing Telnet ................................ done!
Initializing Snmp Service .......................... done!
Initializing Web Service ........................... done!
Initializing Monitor ............................... done!
Initializing STP ................................... done!
Initializing SPANNING TREE ......................... done!
Initializing L2_MGMT ............................... done!
Initializing LLDP_RX ............................... done!
Initializing LLDP_TX ............................... done!
Initializing GARP .................................. done!
Initializing GARP Post Init Task ................... done!
Initializing IGMPSnoop ............................. done!
Initializing SYS_MGMT .............................. done!
Initializing SWITCH_MGMT ........................... done!
Initializing L2APP_MGMT ............................ done!
Initializing SNMP_MGMT ............................. done!
Initializing Authentication ........................ done!
Initializing TCPIP ................................. done!
Initializing Default VLAN  ......................... done!
Initializing ENCO .................................. done!
Initializing PKI ................................... done!
Initializing PortAccess ............................ done!
Initializing PAAcctRcv ............................. done!
Initializing SSH ................................... done!
Initializing IFM ................................... done!
Initializing IFMV6 ................................. done!
Initializing RTM ................................... done!
```

Figure 23. Startup Messages (continued)

```
Initializing FTAB ................................ done!
Initializing FTABV6 .............................. done!
Initializing ACM ................................. done!
Initializing Filter .............................. done!
Initializing L3_MGMT ............................. done!
Initializing L3APP_MGMT .......................... done!
Initializing SFLOW ............................... done!
Initializing NTP ................................. done!
Initializing CPU_HIST ............................ done!
Initializing EStacking ........................... done!
Initializing MGMT_MGMT ........................... done!

Loading configuration file "boot.cfg"  ....... done!
```

Figure 24. Startup Messages (continued)

Chapter 2

Starting a Management Session

This chapter has the following sections:

Note
You must do the initial configuration of the switch from a local management session.

Starting a Local Management Session

To start a local management session on the switch, perform the following procedure:

1. Connect the management cable that comes with the switch to the Console port with the RJ-45 connector, as shown in Figure 25.

The Console port is located on the front panel of the AT-FS970M switch.

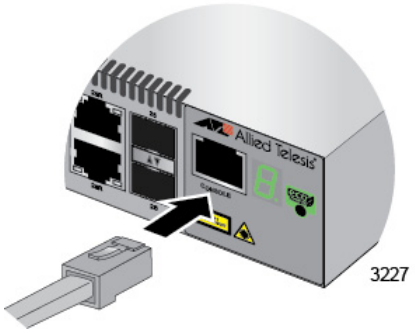

Figure 25. Connecting the Management Cable to the Console Port

2. Connect the other end of the cable to an RS-232 port on a terminal or PC with a terminal emulator program.
3. Configure the terminal or terminal emulator program as follows:
   - Baud rate: 9600 bps (The baud rate of the Console Port is adjustable from 1200 to 115200 bps. The default is 9600 bps.)
   - Data bits: 8
   - Parity: None
   - Stop bits: 1
   - Flow control: None

   Note
   The port settings are for a DEC VT100 or ANSI terminal, or an equivalent terminal emulator program.

4. Press Enter.

   You are prompted for a user name and password.

5. Enter a user name and password. If this is the initial management session of the switch, enter “manager” as the user name “friend” as the password. The user name and password are case sensitive.

The local management session has started when the AlliedWare Plus command line prompt, shown in Figure 26 is displayed.

```
awplus>
```

Figure 26. AlliedWare Plus Command Line Prompt

Starting a Remote Telnet or SSH Management Session

Here are the requirements for remote management of the switch from a Telnet or SSH client on your network:

- You must assign the switch a management IP address. To initially assign the switch an address, use a local management session. For instructions, refer to “What to Configure First” on page 80 or Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.
- The workstation that has the Telnet or SSH client must be a member of the same subnet as the management IP address on the switch, or must have access to it through routers or other Layer 3 devices.
- If the workstation with the Telnet or SSH client is not a member of the same subnet as the management IP address, you must also assign the switch a default gateway. This IP address needs to specify an interface on a router or other Layer 3 routing device that is the first hop to the subnet where the client resides. The default gateway must be a member of the same subnet as the management IP address. For instructions, refer to “What to Configure First” on page 80 or Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.
- For remote SSH management, you must create an encryption key pair and configure the SSH server on the switch. For instructions, see Chapter 92, “Secure Shell (SSH) Server” on page 1447. The factory configuration includes a default random key. When you initially connect to the switch, most SSH clients will flag the new key and ask you to accept it.

To start a remote Telnet or SSH management session, perform the following procedure:

1. In the Telnet or SSH client on your remote management workstation, enter the management IP address of the switch.

   Prompts are displayed for a user name and password.

2. Enter a user name and password of a management account on the switch. The switch comes with one management account. The user name is “manager” and the password is “friend”. User names and passwords are case sensitive.

   The management session starts and the command line interface prompt is displayed, as shown in Figure 26 on page 77.

VTY Lines

The switch has ten VTY (virtual teletypewriter) lines. Each line supports one remote Telnet or SSH management session. The switch allocates the lines, which are numbered 0 to 9, in ascending order, beginning with line 0, as remote sessions are initiated.

The VTY lines cannot be reserved for particular remote workstations because the switch allocates them as needed. Line 0 is assigned by the switch to a new remote session if there are no other active remote sessions. Or, if there is already one active management session, a new session is assigned line 1, and so on.

You can adjust these three parameters on the individual lines:

- Management session timer - This timer is used by the switch to end inactive management sessions, automatically. This protects the switch from unauthorized changes to its configuration sessions should you leave your workstation unattended during a management session. For instructions on how to set this timer, refer to "Configuring the Management Session Timers" on page 134.
- Number of SHOW command scroll lines - You can specify the number of lines that SHOW commands display at one time on your screen. Refer to "LENGTH" on page 106 to set this parameter.
- Remote authentication of management accounts - You can toggle on or off remote authentication of management accounts on the individual VTY lines. Lines use local authentication when remote authentication is turned off. For background information, refer to Chapter 98, "RADIUS and TACACS+ Clients" on page 1509.

What to Configure First

Here are a few suggestions on what to configure during your initial management session of the switch. The initial management session must be a local management session from the Console port on the switch. For instructions on how to start a local management session, refer to “Starting a Local Management Session” on page 76.

Creating a Boot Configuration File

The first thing you should do is create a boot configuration file in the switch’s file system and mark it as the active boot configuration file. This file is used by the switch to store your configuration changes. It should be noted that a boot configuration file contains only those parameter settings that have been changed from their default values on the unit. So, assuming the switch is just out of its shipping container, the file, when you create it, contains about 20 lines.

The quickest and easiest way to create a new boot configuration file and to designate it as the active file is with the BOOT CONFIG-FILE command, located in the Global Configuration mode. Here is the format of the command:

```
boot config-file filename.cfg
```

The name of the new boot configuration file, which is specified with the FILENAME parameter, can be from 1 to 16 alphanumeric characters, not including the extension “.cfg.” The filename cannot contain spaces and the extension must be “.cfg.”

Here is an example that creates a new boot configuration file called “switch1.cfg:”

```
awplus> enable
awplus# configure terminal
awplus(config)# boot config-file switch1.cfg
```

When you see the message “Operation successful,” the switch has created the file and marked it as the active boot configuration file. To confirm the creation of the file, return to the Global Configuration mode and enter the SHOW BOOT command:

```
awplus(config)# exit
awplus# show boot
```

Figure 27 on page 81 is an example of the display.

```
Current software: v2.2.1.1
Current boot image: v2.2.1.1
Default boot config: boot.cfg
Current boot config: switch1.cfg (file exists)
```

Figure 27. SHOW BOOT Command

The name of your new active boot configuration file is displayed in the "Current boot config" field.

Changing the Login Password

To protect the switch from unauthorized access, you should change the password of the manager account. The password is set with the USERNAME command in the Global Configuration. Here is the format of the command.

`username` *`username`* `password` *`password`*

Both the user name and the password are case sensitive. The password can consist of 1 to 16 alphanumeric characters including punctuation and printable special characters. Spaces are not permitted.

This example of the command changes the password of the manager account to "clearsky2a:

```
awplus> enable
awplus# configure terminal
awplus(config)# username manager password clearsky2a
```

Note
Write down the new password and keep it in a safe and secure location. If you forget the manager password, you cannot manage the switch if there are no other management accounts on the unit. In this case, contact Allied Telesis Technical Support for assistance.

For instructions on how to create additional management accounts, refer to Chapter 86, "Local Manager Accounts" on page 1407.

Assigning a Name to the Switch

The switch will be easier to identify if you assign it a name. The switch's name is displayed in the screen banner when you log on and replaces the "awplus" in the command line prompt.

A name is assigned to the switch with the HOSTNAME command in the Global Configuration mode. Here is the format of the command:

`hostname` *`name`*

A name can consist of up to 39 alphanumeric characters. Spaces, punctuation, special characters, and quotation marks are *not* permitted.

This example assigns the name “Engineering_sw2” to the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# hostname Engineering_sw2
Engineering_sw2(config)#
```

Adding a Management IP Address

You must assign the switch a management IP address to use the features in Table 27 on page 296. Here are the requirements:

- You can assign multiple IPv4 addresses to VLANs on the switch, including the Default_VLAN. Then you can use any of these IPv4 addresses to manage the switch.
- You can assign only one IPv6 address to a VLAN on the switch. Then you must use this IPv6 address to manage the switch.
- A management IP address must be assigned to a VLAN on the switch. It can be any VLAN, including the Default_VLAN. For background information on VLANs, refer to Chapter 62, “Port-based and Tagged VLANs” on page 927.
- The network devices (that is, syslog servers, TFTP servers, etc.) must be members of the same subnet as a management IP address or have access to it through the default gateway.
- The switch must also have a default gateway if the network devices are not members of the same subnet as the management IP address. The default gateway specifies the IP address of a router interface that represents the first hop to the subnets or networks of the network devices.
- A default gateway address, if needed, must be a member of the same subnet as a management IP address.
- The switch can have one IPv4 default gateway and one IPv6 gateway.

Note
The following examples illustrate how to assign a management IPv4 address to the switch. For instructions on how to assign an IPv6 address, refer to Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.

The IP ADDRESS command in the VLAN Interface mode command adds a management IPv4 address to the switch. This example of the command assigns the management IPv4 address 149.82.112.72 and a subnet mask of 255.255.255.0 to the Default_VLAN, which has the VID 1. The switch is also assigned the default gateway 149.82.112.18:

Table 3. Adding a Management Address: Example 1

awplus> enable	Move to the Privileged Exec mode.
awplus# configure terminal	Move to the Global Configuration mode.
awplus(config)# interface vlan1	Use the INTERFACE VLAN command to move to the VLAN Interface mode of the Default_VLAN.
awplus(config-if)# ip address 149.82.112.72/24	Assign the management IPv4 address to the switch using the IP ADDRESS command. The mask is a decimal number that represents the number of bits, from left to right, that constitute the network portion of the address. For example, the decimal masks 16 and 24 are equivalent to masks 255.255.0.0 and 255.255.255.0, respectively.
awplus(config-if)# exit	Return to the Global Configuration mode.
awplus(config)# ip route 0.0.0.0/0 149.82.112.18	Assign the default gateway to the switch using the IP ROUTE command.
awplus(config)# exit	Return to the Privileged Exec mode.
awplus# show ip route	Verify the new management IPv4 address and default gateway with the SHOW IP ROUTE command.

This example assigns the management IPv4 address to a new VLAN called Tech_Support, with the VID 5. The VLAN will consist of the untagged ports 5,6, and 23. The management IPv4 address and default route of the switch will be assigned by a DHCP server on the network:

Table 4. Adding a Management IP Address: Example 2

awplus> enable	Move to the Privileged Exec mode.
awplus# configure terminal	Move to the Global Configuration mode.
awplus(config)# vlan database	Enter the VLAN Configuration mode.
awplus(config-if)# vlan 5 name Tech_Support	Create the new VLAN with the VLAN command.
awplus(config-if)# exit	Return to the Global Configuration mode.
awplus(config)# interface port1.0.5, port1.0.6,port1.0.23	Enter the Port Interface mode for ports 5, 6, and 23.

Table 4. Adding a Management IP Address: Example 2

`awplus(config-if)# switchport access vlan 5`	Add the ports as untagged ports to the VLAN with the SWITCHPORT ACCESS VLAN command.
`awplus(config-if)# exit`	Return to the Global Configuration mode.
`awplus(config)# interface vlan5`	Use the INTERFACE VLAN command to move to the VLAN Interface mode of VLAN 5.
`awplus(config-if)# ip address dhcp`	Activate the DHCP client on the switch with the IP ADDRESS DHCP command.
`awplus(config-if)# end`	Return to the Global Configuration mode.
`awplus# show ip interface`	Verify the management IP address on the switch.
`awplus# show ip route`	Verify the new management IPv4 address and default gateway.

Saving Your Changes

To permanently save your changes in the active boot configuration file, use the WRITE command in the Privileged Exec mode:

```
awplus# write
```

You can also update the active configuration file with the COPY RUNNING-CONFIG STARTUP-CONFIG command, also located in the Global Configuration mode. It is just more to type.

Ending a Management Session

To end a management session, go to either the Privileged Exec mode or the User Exec mode. From the Privileged Exec mode, enter either the EXIT or LOGOUT to end a management session:

```
awplus# exit
```

or

```
awplus# logout
```

From the User Exec mode, enter either the EXIT or LOGOUT command to end a management session:

```
awplus> exit
```

or

```
awplus> logout
```

Chapter 3

Basic Command Line Management

This chapter contains the following sections:

Clearing the Screen

If your screen becomes cluttered with commands, you can start fresh by entering the CLEAR SCREEN command in the User Exec or Privileged Exec mode. If you are in a lower mode, you have to move up the mode hierarchy to one of these modes to use the command. Here is an example of the command from the Port Interface mode:

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

Displaying the On-line Help

The command line interface has an on-line help system to assist you with the commands. The help system is displayed by typing a question mark.

Typing a question mark at a command line prompt displays all the keywords in the current mode. This example displays all the keywords in the VLAN Configuration mode.

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# ?
  convert          Convert vlan
  do               To run exec commands in config mode
  end              End current mode and down to privileged mode
  exit             End current mode and down to previous mode
  help             Description of the interactive help system
  no               Negate a command or set its defaults
  private-vlan     Private-vlan
  quit             End current mode and down to previous mode
  vlan             Add, delete, or modify values associated
  with a single VLAN
```

Figure 28. Displaying the Keywords of a Mode

Typing a question mark after a keyword displays any additional keywords or parameters. This example displays the available parameters for the FLOWCONTROL command in the Port Interface mode.

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# flowcontrol ?
  both             Flow control on send and receive
  receive          Flow control on receive
  send             Flow control on send
```

Figure 29. Displaying Subsequent Keywords of a Keyword

Note
You must type a space between the keyword and the question mark. Otherwise, the on-line help system simply displays the previous keyword.

Typing a question mark at the point in a command where a value is required displays a value's class (that is, integer, string, etc.). The example in Figure 30 on page 90 displays the class of the value for the HOSTNAME command in the Global Configuration mode.

```
awplus> enable
awplus# configure terminal
awplus(config)# hostname ?
  <STRING:sysName>
```

Figure 30. Displaying the Class of a Parameter

Saving Your Configuration Changes

To permanently save your changes to the parameter settings on the switch, you must update the active boot configuration file. This is accomplished with either the WRITE command or the COPY RUNNING-CONFIG STARTUP-CONFIG command, both of which are found in the Privileged Exec mode. When you enter either of these commands, the switch copies its running configuration into the active boot configuration file for permanent storage.

To update the active configuration file, enter:

```
awplus# write
```

or

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

Note
Parameter changes that are not saved in the active boot configuration file are discarded when the switch is powered off or reset.

Ending a Management Session

To end a management session, go to either the Privileged Exec mode or the User Exec mode. From the Privileged Exec mode, enter either the EXIT or LOGOUT to end a management session:

```
awplus# exit
```

or

```
awplus# logout
```

From the User Exec mode, enter either the EXIT or LOGOUT command to end a management session:

```
awplus> exit
```

or

awplus> logout

Chapter 4

Basic Command Line Management Commands

The basic command line commands are summarized in Table 5.

Table 5. Basic Command Line Commands

Command	Mode	Description
“? (Question Mark Key)” on page 95	All modes	Displays the on-line help.
“CLEAR SCREEN” on page 97	User Exec and Privileged Exec	Clears the screen.
“CONFIGURE TERMINAL” on page 98	Privileged Exec	Moves you from the Privileged Exec mode to the Global Configuration mode.
“COPY RUNNING-CONFIG STARTUP-CONFIG” on page 99	Privileged Exec	Updates the active boot configuration file with the current settings from the switch.
“DISABLE” on page 100	Privileged Exec	Returns you to the User Exec mode from the Privileged Exec mode.
“DO” on page 101	Global Configuration	Performs Privileged Exec mode commands from the Global Configuration mode.
“ENABLE” on page 103	User Exec	Moves you from the User Exec mode to the Privileged Exec mode.
“END” on page 104	All modes below the Global Configuration mode	Returns you to the Privileged Exec mode.
“EXIT” on page 105	All modes except the User Exec and Privileged Exec	Moves you up one mode.
“LENGTH” on page 106	Console Line and Virtual Terminal Line	Specifies the maximum number of lines the SHOW commands display at one time on the screen.
“LOGOUT” on page 108	User Exec	Ends a management session.

Table 5. Basic Command Line Commands (Continued)

Command	Mode	Description
“QUIT” on page 109	All modes except the User Exec and Privileged Exec	Moves you up one mode.
“WRITE” on page 110	Privileged Exec	Updates the active boot configuration file with the current settings of the switch.

? (Question Mark Key)

Syntax

?

Parameters

None

Modes

All modes

Description

Use the question mark key to display on-line help messages. Typing the key at different points in a command displays different messages:

- Typing "?" at a command line prompt displays all the keywords in the current mode.
- Typing "?" after a keyword displays the available parameters.

Note
You must type a space between a keyword and the question mark. Otherwise, the on-line help returns the previous keyword.

- Typing "?" after a keyword or parameter that requires a value displays a value's class (i.e. integer, string, etc.).

Examples

This example displays all the keywords in the Port Interface mode for port 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# ?
```

This example displays the parameters for the SHOW keyword in the User Exec mode and the Privileged Exec mode:

```
awplus> enable
awplus# show ?
```

This example displays the class of the value for the SPANNING-TREE HELLO-TIME command in the Global Configuration mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree hello-time ?
```

CLEAR SCREEN

Syntax

```
clear screen
```

Parameters

None

Modes

User Exec and Privileged Exec modes

Description

Use this command to clear the screen.

Example

```
awplus# clear screen
```

CONFIGURE TERMINAL

Syntax

```
configure terminal
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to move from the Privileged Exec mode to the Global Configuration mode.

Example

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

COPY RUNNING-CONFIG STARTUP-CONFIG

Syntax

```
copy running-config startup-config
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to update the active boot configuration file with the switch's current configuration, for permanent storage. When you enter the command, the switch copies its parameter settings into the active boot configuration file. The switch saves only those parameters that are not at their default settings.

> **Note**
> Parameter changes that are not saved in the active boot configuration file are discarded when the switch is powered off or reset.

To view the name of the active boot configuration file, see "SHOW BOOT" on page 602.

This command is equivalent to "WRITE" on page 110.

Example

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

DISABLE

Syntax

```
disable
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to return to the User Exec mode from the Privileged Exec mode.

Example

The following command returns the software to the User Exec mode:

```
awplus# disable
awplus>
```

DO

Syntax

do *command*

Parameter

command
Specifies the Privileged Exec mode command to perform. Refer to the Description for the list of supported commands.

Mode

Global Configuration mode

Description

Use this command to perform Privileged Exec mode commands from the Global Configuration mode. You may use the command to perform some, but not all, of the Privileged Exec mode commands. Here are the only Privileged Exec mode commands that are supported with the DO command:

- ERASE STARTUP-CONFIG
- PING
- REBOOT
- RELOAD
- SHOW INTERFACE
- SHOW INTERFACE STATUS
- SHOW IP IGMP
- SHOW IP IGMP HOSTLIST
- SHOW IP IGMP ROUTERLIST
- SHOW IP IGMP SNOOPING
- SHOW IP INTERFACE
- SHOW IP ROUTE
- SHOW IPV6 INTERFACE
- SHOW MAC ADDRESS-TABLE
- SHOW RUNNING-CONFIG
- SHOW SPANNING-TREE

- SHOW SYSTEM
- WRITE

Examples

This example performs the SHOW INTERFACE command for port 4 from the Global Configuration mode:

```
awplus(config)# do show interface port1.0.4
```

This example pings a network device:

```
awplus(config)# do ping 149.11.123.45
```

ENABLE

Syntax

```
enable
```

Parameters

None

Mode

User Exec mode

Description

Use this command to move from the User Exec mode to the Privileged Exec mode.

Example

The following command moves the prompt from the User Exec mode to the Privileged Exec mode:

```
awplus> enable
awplus#
```

END

Syntax

```
end
```

Parameters

None

Mode

All modes below the Global Configuration mode.

Description

Use this command to return to the Privileged Exec mode.

Example

The following command returns the prompt to the Privileged Exec mode:

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

EXIT

Syntax

```
exit
```

Parameters

None

Mode

All modes

Description

Use this command to move down one mode in the mode hierarchy in all modes except the User Exec and Privileged Exec modes. Using the EXIT command in the User Exec and Privileged Exec modes terminates the management session.

Example

The following example moves the prompt from the Global Configuration mode to the Privileged Exec mode:

```
awplus(config)# exit
awplus#
```

LENGTH

Syntax

```
length value
```

Parameters

value
: Specifies the maximum number of lines that the SHOW commands display at one time on the screen. The range is 0 to 512 lines. Use the value 0 if you do not want the SHOW commands to pause.

Mode

Console Line and Virtual Terminal Line modes

Description

Use this command to specify the maximum number of lines the SHOW commands display at one time on the screen during local or remote management sessions. You can set different values for the local and remote management methods. To set this parameter for local management sessions, enter the command in the Console Line mode. To set this parameter for the ten VTY lines for remote Telnet and SSH sessions, enter the same command in the Virtual Terminal Line modes. Each VTY line can have a different setting.

The default value is 20 lines for the console port. For the VTY lines, the default value is negotiated with the VTY ports.

Examples

This example sets the maximum number of lines to 25 for local management sessions:

```
awplus> enable
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# length 25
```

This example sets the maximum number of lines to 15 for VTY line 0:

```
awplus> enable
awplus# configure terminal
awplus(config)# line vty 0
awplus(config-line)# length 15
```

This example returns the number of lines to the default setting for local management sessions:

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

LOGOUT

Syntax

```
logout
```

Parameters

None

Mode

User Exec and Privileged Exec modes

Description

Use this command to end a management session.

> **Note**
> Entering the EXIT command in either the User Exec or Privileged Exec mode also ends a management session.

Example

This example shows the sequence of commands to logout starting from the Global Configuration mode:

```
awplus(config)# exit
awplus# disable
awplus> logout
```

QUIT

Syntax

```
quit
```

Parameters

None

Mode

All modes except the User Exec and Privileged Exec modes.

Description

Use this command to move up one mode in the mode hierarchy. This command is almost identical to the EXIT command. The difference is that unlike the EXIT command, the QUIT command cannot be used to end a management session.

Example

This example uses the QUIT command to return to the Privileged Exec mode from the Global Configuration mode:

```
awplus(config)# quit
awplus#
```

WRITE

Syntax

```
write
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to update the active boot configuration file with the switch's current configuration, for permanent storage. When you enter the command, the switch copies its parameter settings into the active boot configuration file. The switch saves only those parameters that are not at their default settings.

> **Note**
> Parameter changes that are not saved in the active boot configuration file are discarded when the switch is powered off or reset.

To view the name of the active boot configuration file, see "SHOW BOOT" on page 602.

This command is equivalent to "COPY RUNNING-CONFIG STARTUP-CONFIG" on page 99.

Example

```
awplus# write
```

Chapter 5

Temperature and Fan Control Overview

Overview

The switch monitors the environmental status, such as temperature and voltage, and the status of fan modules. Checking this information helps you to identify potential hardware issues before they become problems.

To check the switch's environmental and saving energy status, and turn on and off the port LEDs, use the following commands:

Displaying the System Environmental Status

The switch monitors the environmental status of the switch and any attached PSU, XEM, or expansion option. The environmental status covers information about temperatures, fans, and voltage. To display this information, go to User Exec or Privileged Exec mode and enter the command:

```
awplus# show system environment
```

Figure 31 shows an example of the information the command displays. The columns are described in "SHOW SYSTEM ENVIRONMENT" on page 119.

```
Environment Monitoring Status

-------------------------------------------------------
Switch Model: AT-FS970M/48PS
-------------------------------------------------------
ID  Sensor (Units)      Reading  Status
-------------------------------------------------------
 0  Temp (Degrees C)    37       Normal
 1  Fan 1 (RPM)         3467     Normal
 2  PSU 1               On       Normal
 3  PSU 2               Off      Off
-------------------------------------------------------
```

Figure 31. SHOW SYSTEM ENVIRONMENT Command

Note
Switches that do not contain fan controllers will not display temperature readings.

Controlling Eco-Mode LED

AlliedWare Plus products provide an Eco-Mode LED control to conserve additional power on the port LEDs. The Eco-Mode LED is an eco-friendly feature that turns off the port LEDs when they are not necessary. To enable Eco-Mode LED control, enter the command:

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

To disable Eco-Mode LED control,

```
awplus(config)# no ecofriendly led
```

Chapter 6

Temperature and Fan Control Commands

The temperature and fan control commands are summarized in Table 6.

Table 6. Temperature and Fan Control Commands

Command	Mode	Description
“ECOFRIENDLY LED” on page 116	Global Configuration	Turns off the port LEDs on the switch to save power.
“NO ECOFRIENDLY LED” on page 117	Global Configuration	Turns on the port LEDs on the switch.
“SHOW ECOFRIENDLY” on page 118	Privileged Exec	Displays the power saving status of the port LEDs.
“SHOW SYSTEM ENVIRONMENT” on page 119	Privileged Exec	Displays the environmental information for the switch, such as temperatures, voltage, and fan status.

ECOFRIENDLY LED

Syntax

```
ecofriendly led
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to turn off the port LEDs on the switch to save power.

Confirmation Command

“SHOW ECOFRIENDLY” on page 118

Example

```
awplus# ecofriendly led
```

NO ECOFRIENDLY LED

Syntax

```
no ecofriendly led
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to turn on the port LEDs on the switch.

Confirmation Command

"SHOW ECOFRIENDLY" on page 118

Example

The following command turns on the port LEDs on the switch:

```
awplus# no ecofriendly led
```

SHOW ECOFRIENDLY

Syntax

```
show ecofriendly
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the power saving status of the port LEDs. An example of the information the command displays is shown in Figure 32.

```
Front panel port LEDs: on
```

Figure 32. SHOW ECOFRIENDLY Command

Example

The following example displays the power saving status of the port LEDs:

```
awplus# show ecofriendly
```

SHOW SYSTEM ENVIRONMENT

Syntax

```
show system environment
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the environmental information for the switch.

Figure 33 shows an example of the information that the command displays.

```
Environment Monitoring Status

-------------------------------------------------------
Switch Model: AT-FS970M/48PS
-------------------------------------------------------
ID  Sensor (Units)      Reading  Status
-------------------------------------------------------
 0  Temp (Degrees C)    37       Normal
 1  Fan 1 (RPM)         3467     Normal
 2  PSU 1               On       Normal
 3  PSU 2               Off      Off
-------------------------------------------------------
```

Figure 33. SHOW SYSTEM ENVIRONMENT Command

The columns in the display are described here:

Table 7. SHOW SYSTEM ENVIRONMENT Command

Parameter	Description
Switch Model	Indicates a model name of the switch.
ID	Indicates the ID number of an item.
Sensor (Units)	Indicates an item on the switch, such as temperature, fan, or power supply unit (PSU).

Table 7. SHOW SYSTEM ENVIRONMENT Command

Parameter	Description
Reading	Indicates the current reading of the item.
Status	Indicates the status of the item.

Example

The following example displays environmental information for the switch:

```
awplus# show system environment
```

Section II

Basic Operations

This section contains the following chapters:

Chapter 7

Basic Switch Management

This chapter contains the following:

Adding a Name to the Switch

The switch will be easier to identify if you assign it a name. The switch displays its name in the command line prompt, in place of the default prefix “awplus.”

To assign the switch a name, use the HOSTNAME command in the Global Configuration mode. A name can consist of up to 39 alphanumeric characters. Spaces, punctuation, special characters, and quotation marks are *not* permitted.

This example assigns the name Switch12 to the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# hostname Switch12
Switch12(config)#
```

To remove the current name without assigning a new name, use the NO HOSTNAME command:

```
Unit2b_bld4> enable
Unit2b_bld4# configure terminal
Unit2b_bld4(config)# no hostname
awplus(config)#
```

For reference information, refer to “HOSTNAME” on page 155 and “NO HOSTNAME” on page 158.

Adding Contact and Location Information

The commands for assigning the switch contact and location information are the SNMP-SERVER CONTACT and SNMP-SERVER LOCATION commands, both of which are found in the Global Configuration mode. Here are the formats of the commands:

```
snmp-server contact contact

snmp-server location location
```

The variables can be from 1 to 255 alphanumeric characters in length. Spaces and special characters are allowed.

To view the information, use the SHOW SYSTEM command in the User Exec and Privileged Exec modes.

Here is an example that assigns the switch this contact and location information:

- Contact: JordanB
- Location: 123_Westside_Dr_room_45

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server contact JordanB
awplus(config)# snmp-server location 123_Westside_Dr_room_45
```

To remove the contact or location information without adding new information, use the NO form of the commands. This example removes the location information:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server location
```

Displaying Parameter Settings

To display the current parameter settings on the switch, use the SHOW RUNNING-CONFIG command in the Privileged Exec mode. The settings, which are displayed in their equivalent command line commands, are limited to just those parameters that have been changed from their default values. The information includes new settings that have yet to be saved in the active boot configuration file. Here is the command:

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

For reference information, refer to “SHOW RUNNING-CONFIG” on page 168.

Manually Setting the Date and Time

To manually set the date and time on the switch, use the CLOCK SET command in the Privileged Exec mode. Here is the format of the command:

```
clock set hh:mm:ss dd mmm yyyy
```

Here are the variables:

- *hh:mm:ss*: Use this variable to specify the hour, minute, and second for the switch's time in 24-hour format.
- *dd*: Use this variable to specify the day of the month.
- *mmm*: Use this variable to specify the month. The month is specified by its first three letters. For example, June is Jun. The first letter must be uppercase and the second and third letters lowercase.
- *yyyy*: Use this variable to specify the year. The year must be specified in four digits (for example, 2011 or 2012).

The command has to include both the date and time. This example sets the time to 4:11 pm and the date to January 4, 2011:

```
awplus> enable
awplus# clock set 16:11:0 4 Jan 2011
```

To display the date and time, use the SHOW CLOCK command in the User Exec or Privileged Exec mode.

```
awplus# show clock
```

For reference information, refer to "CLOCK SET" on page 150 and "SHOW CLOCK" on page 167.

Note
The date and time, when set manually, are not retained by the switch when it is reset or power cycled.

Pinging Network Devices

If the switch is unable to communicate with a network device, such as a syslog server or a TFTP server, you can test for an active link between the two devices by instructing the switch to send ICMP Echo Requests and to listen for replies sent back from the other device. This is accomplished with the PING command in the Privileged Exec mode.

This command instructs the switch to send ICMP Echo Requests to a network device known by the IP address 149.122.14.15:

```
awplus> enable
awplus# ping 149.122.14.15
```

The results of the ping are displayed on the screen.

Note
To send ICMP Echo Requests, the switch must have a management IP address. For instructions, refer to Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.

Note
The switch sends the ICMP Echo Requests from the ports of the VLAN assigned the management IP address. The device the switch is pinging must be a member of that VLAN or must be accessible through routers or other Layer 3 devices.

For reference information, refer to “PING” on page 159.

Resetting the Switch

To reset the switch, use either the REBOOT or RELOAD command in the Privileged Exec mode. You might reset the switch if it is experiencing a problem or if you want to reconfigure its settings after designating a new active boot configuration file. The commands display a confirmation prompt.

Caution
The switch will not forward network traffic while it initializes its management software. Some network traffic may be lost. The reset can take from thirty seconds to two minutes, depending on the number and complexity of the commands in the active boot configuration file.

Note
Any configuration changes that have not been saved in the active boot configuration file are discarded when you reset the switch. To save your changes, use the WRITE or COPY RUNNING-CONFIG STARTUP-CONFIG command in the Privileged Exec mode.

To reset the switch with the REBOOT command:

```
awplus> enable
awplus# reboot

Are you sure you want to reboot the switch? (y/n) y
```

To reset the switch with the RELOAD command:

```
awplus> enable
awplus# reload

Are you sure you want to reboot the switch? (y/n) y
```

To resume managing the switch, wait for the switch to initialize its management software and then start a new management session.

For reference information, refer to "REBOOT" on page 162 and "RELOAD" on page 163.

Restoring the Default Settings to the Switch

To restore the default settings to the switch, delete or rename the active boot configuration file and then reset the unit. Without an active boot configuration file, the switch will use the default parameter settings after it initializes the management software.

Caution
Restoring the default settings requires that you reset the switch. The unit will not forward network traffic while it initializes the management software. Some network traffic may be lost.

There are two ways to delete the active boot configuration file. One way is with the DELETE command in the Privileged Exec mode. Here is the format of the command:

```
delete filename.cfg
```

This example deletes the active boot configuration file “Sales_unit.cfg” and resets the switch:

```
awplus> enable
awplus# delete Sales_unit.cfg
awplus# reboot

reboot switch? (y/n): y
```

If you do not know the name of the active boot configuration file, you can display it with the SHOW BOOT command in the Privileged Exec mode. Figure 34 is an example of what is displayed:

```
Current software   : v1.0.0
Current boot image : v1.0.0
Default boot config: /cfg/boot.cfg
Current boot config: /cfg/switch2.cfg (file exists)
```

Figure 34. SHOW BOOT Command

The active boot configuration file is identified in the “Current boot config” field.

Another way to delete the file is with the ERASE STARTUP-CONFIG command, also in the Privileged Exec mode. The advantage of this command over the DELETE command is that you do not have to know the name of the active boot configuration file. When you enter the command, a confirmation prompt is displayed. If you enter "Y" for yes, the switch automatically deletes the active boot configuration file from the file system. Afterwards, you can reset the switch with the REBOOT command so that it restores the default settings.

Here is the sequence of commands and messages:

```
awplus> enable
awplus# erase startup-config

erase start-up config? (y/n):y
Deleting..
Successful Operation
awplus# reboot

reboot switch? (y/n): y
```

If you prefer to keep the active boot configuration file, you can rename it with the MOVE command in the Privileged Exec mode and then reset the switch. Here is the format of the MOVE command:

```
move filename1.cfg filename2.cfg
```

The FILENAME1 parameter is the name of the configuration file you want to rename. The FILENAME2 parameter is the file's new name. The extensions of the files must be ".cfg". For example, if the name of the active boot configuration file is "Sales_unit.cfg," these commands rename it to "Sales_unit_backup.cfg" and reset the switch:

```
awplus> enable
awplus# move Sales_unit.cfg Sales_unit_backup.cfg
awplus# reboot

reboot switch? (y/n): y
```

To resume managing the switch after restoring the default settings, you must establish a local management session from the Console port. Remote management is not possible because the switch will not have a management IP address.

Note
For instructions on how to create a new boot configuration file, refer to Chapter 38, "Boot Configuration Files" on page 589.

Setting the Baud Rate of the Console Port

The Console port is used for local management of the switch. To set its baud rate, use the BAUD-RATE SET command in the Global Configuration mode.

> **Note**
> If you change the baud rate of the Console port during a local management session, your session is interrupted. To resume the session you must change the speed of the terminal or the terminal emulator program to match the new speed of the serial terminal port on the switch.

Here is an example to set the baud rate of the Console port on the switch to 57600 bps:

Example 1:

```
awplus> enable
awplus# configure terminal
awplus(config-conf)# baud-rate set 57600

awplus# config
Enter configuration commands, one per line. End with CNTL/Z.
awplus(config)# line console
awplus(config-line)# speed 57600

Baud rate changed to 57600 bps.
Please change your console baud rate correspondingly.
```

To display the current settings of the Console port, use the SHOW BAUD-RATE command in the User Exec or Privileged Exec mode. Here is the command:

```
awplus# show baud-rate
```

Here is an example of the information.

```
Asynchronous Port (Console) Information:
Baud Rate ..................... 57600
Parity ........................ None
Data bits ..................... 8
Stop bits ..................... 1
```

Figure 35. SHOW BAUD-RATE Command

Note
The baud rate is the only adjustable parameter on the Console port.

For reference information, refer to "BAUD-RATE SET" on page 149 and "SHOW BAUD-RATE" on page 166.

Configuring the Management Session Timers

You should always conclude a management session by logging off so that if you leave your workstation unattended, someone cannot use it to change the switch's configuration. If you forget to log off, the switch has management session timers that detect and log off inactive local and remote management sessions automatically. A session is deemed inactive when there is no management activity for the duration of the corresponding timer.

There are different timers for the different types of management sessions. There is one timer for local management sessions, which are conducted through the Console port, and ten timers for each supported VTY line, for remote Telnet and SSH management sessions.

The command for setting the timers is the EXEC-TIMEOUT command. You enter this command in different modes depending on the timer you want to set. The timer for local management sessions is set in the Line Console mode, which is accessed using the LINE CONSOLE 0 command from the Global Configuration mode. This example of the commands sets the timer for local management sessions on the switch to 5 minutes:

```
awplus> enable
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# exec-timeout 5
```

Note
The default value the EXEC-TIMEOUT command is 10 minutes.

There are ten VTY lines for remote Telnet and SSH sessions. Each remote management session uses one line. The switch automatically allocates a line when a remote session is initiated. The first remote Telnet or SSH session is allocated the VTY 0 line, the second session is allocated the VTY 1 line, and so forth.

Each VTY line has its own management session timer. The timers are set in the Virtual Terminal Line mode, which is accessed with the LINE VTY command. The format of the LINE VTY command is shown here:

```
line vty first_line_id last_line_id
```

Both the first_line_id and the last_line_id parameters have value of 0 to 9. You can specify one VTY line or a range of VTY lines. This example sets the management session timer to 8 minutes on VTY line 2:

```
awplus> enable
awplus# configure terminal
awplus(config)# line vty 2
awplus(config-line)# exec-timeout 8
```

This example sets the management session timer to 3 minutes for all VTY lines:

```
awplus> enable
awplus# configure terminal
awplus(config)# line vty 0 9
awplus(config-line)# exec-timeout 3
```

Setting the Maximum Number of Manager Sessions

The switch supports up to three manager sessions simultaneously so that more than one person can manage the unit at a time. You set the maximum number of sessions with the SERVICE MAXMANAGER command in the Global Configuration mode. The default is three manager sessions.

This example sets the maximum number of manager sessions to three:

```
awplus> enable
awplus# configure terminal
awplus(config)# service maxmanager 3
```

For reference information, refer to “SERVICE MAXMANAGER” on page 164.

Configuring the Banners

The switch has banner messages you may use to identify the switch or to display other information about the unit. The banners are listed here:

- Message-of-the-day banner
- Login banner
- User Exec and Privileged Exec modes banner
- Display login banner

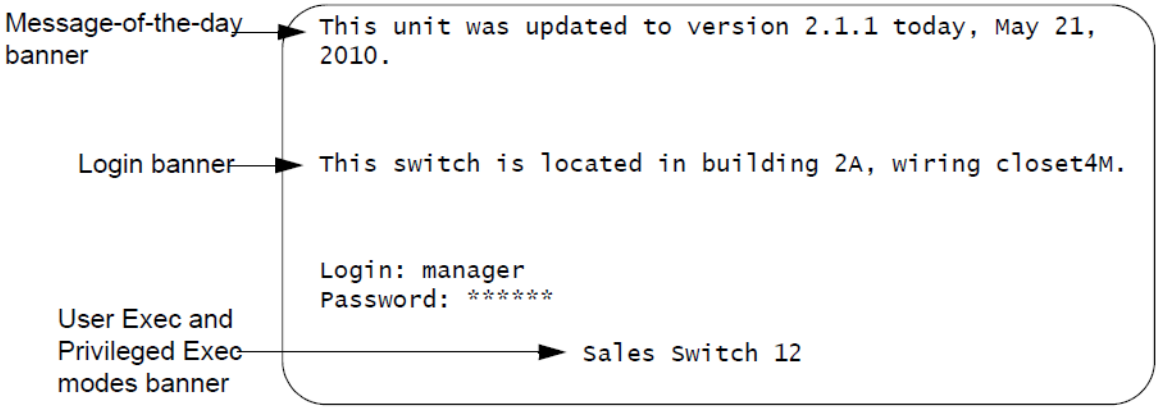

Figure 36. Banner Messages

The message-of-the-day and login banners are displayed above the login user name and password prompts of local, Telnet, and SSH management sessions. The display banner displays the contents of the login banner.

The User Exec and Privileged Exec modes banner is displayed above the command line prompts of these two modes, after you log on or whenever you use the CLEAR SCREEN command to clear the screen.

Note
The banners are not displayed in web browser management sessions.

The banner commands are:

- BANNER MOTD
- BANNER LOGIN
- BANNER EXEC
- SHOW BANNER LOGIN

The commands for setting the banners are located in the Global Configuration mode with the exception of the SHOW BANNER LOGIN command which you access in the Privileged Exec mode.

After you enter the BANNER EXEC, BANNER LOGIN, or BANNER MOTD command, the “Type CTRL/D to finish” prompt is displayed. When you see this message, enter the banner message. Both the BANNER MOTD and BANNER EXEC banners may be up to 256 characters, while the BANNER LOGIN banner may be up to 4,000 characters. Spaces and special characters are allowed.

After you finish entering your message, press CTRL D to return to the command prompt in the Global Configuration mode.

This example of the BANNER MOTD command assigns the switch the message-of-the-day banner in Figure 36 on page 137:

```
awplus> enable
awplus# configure terminal
awplus(config)# banner motd
Type CTRL/D to finish
This unit was updated to version 2.1.1 today, May 21, 2010.
awplus(config)#
```

This example of the BANNER LOGIN command assigns the switch the login banner in Figure 36 on page 137:

```
awplus> enable
awplus# configure terminal
awplus(config)# banner login
Type CTRL/D to finish
This switch is located in building 2A, wiring closet 4M.
awplus(config)#
```

Here is an example of the BANNER EXEC command:

```
awplus> enable
awplus# configure terminal
awplus(config)# banner exec
Type CTRL/D to finish
Sales Switch 12
awplus(config)#
```

This example uses the SHOW BANNER LOGIN command to display the contents of the BANNER LOGIN file:

```
awplus> enable
awplus# configure terminal
awplus(config)# show banner login
```

To remove messages without assigning new messages, use the NO versions of the commands. This example removes the message-of-the-day banner:

```
awplus> enable
awplus# configure terminal
awplus(config)# no banner motd
```

This example removes the login banner:

```
awplus> enable
awplus# configure terminal
awplus(config)# no banner login
```

This example removes the User Exec and Privileged Exec modes banner:

```
awplus> enable
awplus# configure terminal
awplus(config)# no banner exec
```

Chapter 8

Basic Switch Management Commands

The basic switch management commands are summarized in Table 8.

Table 8. Basic Switch Management Commands

Command	Mode	Description
“BANNER EXEC” on page 143	Global Configuration	Creates a User Exec and Privileged Exec modes banner.
“BANNER LOGIN” on page 145	Global Configuration	Creates a login banner.
“BANNER MOTD” on page 147	Global Configuration	Creates a message-of-the-day banner.
“BAUD-RATE SET” on page 149	Line Console	Configures the baud rate of the serial terminal port on the switch.
“CLOCK SET” on page 150	Privileged Exec	Manually sets the date and time.
“ERASE STARTUP-CONFIG” on page 151	Privileged Exec	Restores the default settings to all the parameter settings on the switch.
“EXEC-TIMEOUT” on page 152	Line Console	Sets the console timer which is used to end inactive management sessions.
“HELP” on page 154	All	Displays how to use the on-line help system.
“HOSTNAME” on page 155	Global Configuration	Assigns a name to the switch.
“LINE CONSOLE” on page 156	Global Configuration	Enters the Line Console mode.
“LINE VTY” on page 157	Global Configuration	Enters the Virtual Terminal Line mode for a VTY line.
“NO HOSTNAME” on page 158	Global Configuration	Deletes the switch’s name without assigning a new name.
“PING” on page 159	User Exec and Privileged Exec	Instructs the switch to ping another network device.
“PING IPv6” on page 161	User Exec and Privileged Exec	Instructs the switch to ping another IPv6 network device.

Table 8. Basic Switch Management Commands

Command	Mode	Description
“REBOOT” on page 162	Privileged Exec	Resets the switch.
“RELOAD” on page 163	Privileged Exec	Resets the switch.
“SERVICE MAXMANAGER” on page 164	Global Configuration	Sets the maximum number of permitted manager sessions.
“SHOW BANNER LOGIN” on page 165	Privileged Exec	Displays the banner set with the BANNER LOGIN command.
“SHOW BAUD-RATE” on page 166	Global Configuration	Displays the settings of the Console port.
“SHOW CLOCK” on page 167	User Exec and Privileged Exec	Displays the date and time.
“SHOW RUNNING-CONFIG” on page 168	Privileged Exec	Displays all of the settings on the switch, including those that have not yet been saved in the active boot configuration file.
“SHOW SWITCH” on page 169	Privileged Exec	Displays general information about the switch.
“SHOW SYSTEM” on page 171	User Exec	Displays general information about the switch.
“SHOW SYSTEM SERIALNUMBER” on page 172	User Exec and Privileged Exec	Displays the serial number of the switch.
“SHOW USERS” on page 173	Privileged Exec	Displays the managers who are currently logged on the switch.
“SHOW VERSION” on page 175	User Exec and Privileged Exec	Displays the version number and build date of the management software.
“SNMP-SERVER CONTACT” on page 176	Global Configuration	Adds contact information to the switch.
“SNMP-SERVER LOCATION” on page 177	Global Configuration	Adds location information to the switch.
“SYSTEM TERRITORY” on page 178	Global Configuration	Specifies the territory of the switch.

BANNER EXEC

Syntax

```
banner exec
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to create a banner for the User Exec and Privilege Exec modes. The message is displayed above the command line prompt when you log on or clear the screen with the CLEAR SCREEN command, in local, Telnet, and SSH management sessions.

After you enter the command, the "Type CTRL/D to finish" prompt is displayed. Enter a banner message of up to 256 characters. Spaces and special characters are allowed. When you are finished, press CTRL D.

To remove the banner, use the NO version of this command, NO BANNER EXEC.

Note
Web browser management sessions do not display this banner.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

This example creates the banner "Production Switch 1P" for the User Exec and Privileged Exec modes:

```
awplus> enable
awplus# configure terminal
awplus(config)# banner exec
Type CNTL/D to finish
Production Switch 1P
```

This example deletes the banner:

```
awplus> enable
awplus# configure terminal
awplus(config)# no banner exec
```

BANNER LOGIN

Syntax

```
banner login
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to configure the login banner. The message is displayed prior to the login user name and password prompts for local, Telnet, and SSH management sessions. If the switch also has a message-of-the-day banner, this message is displayed after the login banner.

After you enter the command, the "Type CTRL/D to finish" prompt is displayed on your screen. Enter a login message of up to 4,000 characters. Spaces and special characters are allowed. When you are finished, press CTRL D.

To remove the login banner, use the NO version of this command, NO BANNER LOGIN.

Note
Web browser management sessions do not display the login banner.

Confirmation Command

"SHOW BANNER LOGIN" on page 165

Examples

This example creates a login banner:

```
awplus> enable
awplus# configure terminal
awplus(config)# banner login
Type CTRL/D to finish
This switch is located in building B on the second floor,
wiring closet 2B.
awplus(config)#
```

This example removes the login banner:

```
awplus> enable
awplus# configure terminal
awplus(config)# no banner login
```

BANNER MOTD

Syntax

```
banner motd
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to create a message-of-the-day banner. The message is displayed prior to the login user name and password prompts for local, Telnet, and SSH management sessions. If the switch also has a login banner, this message is displayed before the message-of-the-day banner.

After you enter the command, the "Type CTRL/D to finish" prompt is displayed. Enter a message-of-the-day banner of up to 256 characters. Spaces and special characters are allowed. When you are finished, press CTRL D.

To remove the message-of-the-day banner, use the NO version of this command, NO BANNER MOTD.

Note
Web browser management sessions do not display the message-of-the-day banner.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

This example create a message-of-the-day banner:

```
awplus> enable
awplus# configure terminal
awplus(config)# banner motd
Type CTRL/D to finish
This switch was updated to the latest software on May 23,
2010.
```

This example removes the message-of-the-day banner:

```
awplus> enable
awplus# configure terminal
awplus(config)# no banner motd
```

BAUD-RATE SET

Syntax

```
baud-rate set 1200|2400|4800|9600|19200|38400|57600|115200
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to set the baud rate of the Console port, which is used for local management sessions of the switch.

Note
If you change the baud rate of the serial terminal port during a local management session, your session will be interrupted. To resume the session you must change the speed of your terminal or the terminal emulator program to match the new speed of the serial terminal port on the switch.

Confirmation Command

"SHOW BAUD-RATE" on page 166

Example

This example sets the baud rate of the Console port to 19200 bps:

```
awplus> enable
awplus# configure terminal
awplus(config)# baud-rate set 19200
```

CLOCK SET

Syntax

```
clock set hh:mm:ss dd mmm yyyy
```

Parameters

hh:mm:ss
: Specifies the hour, minute, and second for the switch's time in 24-hour format.

dd
: Specifies the day of the month.

mmm
: Specifies the month. The month is specified by its first three letters. For example, June is Jun. The first letter must be uppercase and the second and third letters lowercase.

year
: Specifies the year. The year must be specified in four digits (for example, 2011 or 2012).

Mode

Privileged Exec mode

Confirmation Command

"SHOW CLOCK" on page 167

Description

Use this command to manually set the date and the time on the switch. The command must include both the date and the time.

Note
When set manually the date and time are not retained by the switch when it is reset or powered off.

Example

This example sets the time and date to 2:15 pm, April 7, 2011:

```
awplus> enable
awplus# clock set 14:15:0 7 Apr 2011
```

ERASE STARTUP-CONFIG

Syntax

```
erase startup-config
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to delete the active boot configuration file to restore the default settings to all the parameters on the switch. After entering this command, enter the REBOOT command to reset the switch and restore the default settings.

Caution
The switch will not forward network traffic while it initializes its management software. Some network traffic may be lost.

To resume managing the switch after restoring the default settings, you must establish a local management session from the Console port. Remote management is not possible because the switch will not have a management IP address.

Note
For instructions on how to create a new boot configuration file, refer to Chapter 38, "Boot Configuration Files" on page 589.

Example

The following command deletes the active boot configuration file and restores the default settings to all the parameters on the switch.

```
awplus> enable
awplus# erase startup-config

erase start-up config? (y/n):y
Deleting..
Successful Operation
awplus# reboot
```

EXEC-TIMEOUT

Syntax

```
exec-timeout value
```

Parameters

exec-timeout
: Specifies the session timer in minutes. The range is 0 to 35,791 minutes. The default value is 10 minutes.

Mode

Line Console and Virtual Terminal Line modes

Description

Use this command to set the management session timers. The timers are used by the switch to end inactive management sessions to protect against unauthorized changes should you leave your management station unattended during a management session. A management session is deemed inactive by the switch if there is no management activity for the duration of a timer.

Local management sessions, which are conducted through the Console port on the switch, and remote Telnet and SSH sessions have different timers. The timer for local management sessions is set in the Line Console mode. The timers for remote Telnet and SSH sessions are set in the Virtual Terminal Line mode. There is a different timer for each of the ten VTY lines for remote Telnet and SSH sessions.

Confirmation Commands

“SHOW SWITCH” on page 169 and “SHOW RUNNING-CONFIG” on page 168

Examples

This example sets the session timer for local management sessions to 15 minutes:

```
awplus> enable
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# exec-timeout 15
```

This example sets the session timer for the first (vty 0) Telnet or SSH session to 5 minutes:

```
awplus> enable
awplus# configure terminal
awplus(config)# line vty 0
awplus(config-line)# exec-timeout 5
```

HELP

Syntax

```
help
```

Parameters

None

Mode

All modes

Description

Use this command to learn how to use on-line help. Entering this command at a command line displays how to use the on-line help system. See Figure 37 for the description displayed on the screen.

```
   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?’).
```

Figure 37. HELP Command

Example

This example displays the HELP command:

```
awplus# help
```

HOSTNAME

Syntax

```
hostname name
```

Parameters

name

Specifies a name of up to 39 alphanumeric characters for the switch. Spaces, punctuation, special characters, and quotation marks are *not* permitted.

Mode

Global Configuration mode

Description

Use this command to assign the switch a name. The switch displays the name in the command line prompt, in place of the default prefix "awplus."

Example

This example assigns the name "Sw_Sales" to the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# hostname Sw_Sales
Sw_Sales(config)#
```

LINE CONSOLE

Syntax

```
line console 0
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enter the Line Console mode to set the session timer and to activate or deactivate remote authentication for local management sessions.

Example

The following example enters the Line Console mode to set the session timer and to activate or deactivate remote authentication for local management sessions:

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

LINE VTY

Syntax

```
line vty first_line_id [last_line_id]
```

Parameters

first_line_id
: Specifies the number of a VTY line. The range is 0 to 9.

last_line_id
: Specifies the number of a VTY line. The range is 0 to 9. This is an optional parameter.

Mode

Global Configuration mode

Description

Use this command to enter the Virtual Terminal Line mode for a VTY line or a range of VTY lines, to set the session timer or to activate or deactivate remote authentication for Telnet or SSH management sessions.

Refer to "EXEC-TIMEOUT" on page 152 to set session timeout values and "LOGIN AUTHENTICATION" on page 1535 to activate remote authentication.

Examples

This example enters the Virtual Terminal Line mode for VTY line 0:

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

This example enters the Virtual Terminal Line mode for all VTY lines:

```
awplus> enable
awplus# configure terminal
awplus(config)# line vty 0 9
awplus(config-line)#
```

NO HOSTNAME

Syntax

`no hostname`

Parameters

None

Mode

Global Configuration mode

Description

Use this command to delete the switch's name without assigning a new name.

Example

This example deletes the current name of the switch without assigning a new value:

```
Bld2_Shipping> enable
Bld2_Shipping# configure terminal
Bld2_Shipping(config)# no hostname
awplus#(config)
```

PING

Syntax

`ping` *ipaddress*|*hostname*

Parameters

ipaddress
: Specifies the IP address of the network device to receive the ICMP Echo Requests from the switch. You can specify only one IP address.

hostname
: Specifies the host name of the network device to receive the ICMP Echo Requests from the switch. You can specify only one host name.

Modes

Privileged Exec mode

Description

Use this command to instruct the switch to send ICMP Echo Requests to a network device with an IPv4 address. You can use the command to determine whether there is an active link between the switch and another network device, such as a RADIUS server or a Telnet client, or to troubleshoot communication problems. To ping an IPv6 address, see "PING IPv6" on page 161.

In order to specify the host name parameter, the switch needs a connection to a name server. To accomplish this, the switch can obtain a name server automatically with DHCP. See "IP ADDRESS DHCP" on page 314 for information about how to set the switch to DHCP.

Note
To send ICMP Echo Requests the switch must be configured with a management IP address. For background information, refer to

Note
The switch sends the ICMP Echo Requests from the ports of the VLAN assigned the management IP address. The device the switch is pinging must be a member of that VLAN or must be accessible through routers or other Layer 3 devices.

Example

This command instructs the switch to ping a network device with the IP address 149.122.14.15:

```
awplus> enable
awplus# ping 149.122.14.15
```

The results of the ping are displayed on the screen.

PING IPv6

Syntax

```
ping ipv6 <ipv6-address> repeat <1-99> size <36-18024>
```

Parameters

ipv6-address

Indicates the destination IPv6 address. The IPv6 address uses the format:

nnnn:nnnn:nnnn:nnnn:nnnn:nnnn:nnnn:nnnn

Where N is a hexadecimal digit from 0 to F. The eight groups of digits have to be separated by colons. Groups where all four digits are '0' can be omitted. Leading '0's in groups can also be omitted. For example, the following IPv6 addresses are equivalent:

12c4:421e:09a8:0000:0000:0000:00a4:1c50

12c4:421e:09a8::a4:1c50 X:X::X:X

repeat <1-99>

Specifies the number of times the ping is sent. The default is 4 times.

size *<36-18024>*

Indicates the packet size, in bytes, that are sent to the destination IPv6 address. The packet size excludes the 8 byte ICMP header. The default is 56 bytes. The range is 36 to 18,024 bytes.

Mode

User Exec and Privileged Exec modes

Description

Use this command to instruct the switch to send ICMP Echo Requests to an IPv6 host.

Example

The following example sends 37 data bytes in an ICMP Echo Request to IPv6 address 2001:0db8::a2 for a total of 12 times:

```
awplus> enable
awplus# ping ipv6 2001:0db8::a2 repeat 12 size 37
```

REBOOT

Syntax

```
reboot
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to reset the switch. You might reset the unit if it is experiencing a problem or if you want to reconfigure its settings after you designate a new active boot configuration file.This command is identical to “RELOAD” on page 163. The command displays a confirmation prompt.

Caution
The switch does not forward network traffic while it initializes its management software. Some network traffic may be lost. The reset can take from 10 seconds to two minutes, depending on the number and complexity of the commands in the active boot configuration file.

Note
The switch discards any configuration changes that have not been saved in its active boot configuration file. To save your changes, enter the WRITE command or the COPY RUNNING-CONFIG STARTUP-CONFIG command before resetting the switch. For instructions, refer to “WRITE” on page 110 or “COPY RUNNING-CONFIG STARTUP-CONFIG” on page 99.

To resume managing the switch, wait for the switch to initialize the management software and then start a new management session.

Example

The following command resets the switch:

```
awplus> enable
awplus# reboot

Are you sure you want to reboot the switch? (y/n): y
```

RELOAD

Syntax

```
reload
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to reset the switch. You might reset the unit if it is experiencing a problem or if you want to reconfigure its settings after you designate a new active boot configuration file. This command is identical to "REBOOT" on page 162. The command displays a confirmation prompt.

Caution
The switch does not forward network traffic while it initializes its management software. Some network traffic may be lost. The reset can take from 10 seconds to 2 minutes, depending on the number and complexity of the commands in the active boot configuration file.

Note
The switch discards any configuration changes that have not been saved in its active boot configuration file. To save your changes, enter the WRITE command or the COPY RUNNING-CONFIG STARTUP-CONFIG command before resetting the switch. For instructions, refer to "WRITE" on page 110 or "COPY RUNNING-CONFIG STARTUP-CONFIG" on page 99.

To resume managing the switch, wait for the switch to initialize the management software and then start a new management session.

Example

The following example resets the switch:

```
awplus> enable
awplus# reload

reboot switch? (y/n): y
```

SERVICE MAXMANAGER

Syntax

```
service maxmanager value
```

Parameters

value

Specifies the maximum number of manager sessions the switch will allow at one time. The range is 1 to 3. The default is 3.

Mode

Global Configuration mode

Description

Use this command to set the maximum number of manager sessions that can be open on the switch simultaneously. This feature makes it possible for more than one person to manage the unit at one time. The range is one to three manager sessions, with the default, three manager sessions.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example sets the maximum number of manager sessions to two:

```
awplus> enable
awplus# configure terminal
awplus(config)# service maxmanager 2
```

SHOW BANNER LOGIN

Syntax

```
show banner login
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the contents of the banner login file configured with the BANNER LOGIN command. A sample of the display is shown below.

```
This switch is located on the third floor of building 4 in
lab 2B.
```

Figure 38. SHOW BANNER LOGIN Command

Example

This example displays the contents of the banner login file configured with the BANNER LOGIN command:

```
awplus> enable
awplus# show banner login
```

SHOW BAUD-RATE

Syntax

```
show baud-rate
```

Parameters

None

Mode

User Exec mode and Privileged Exec mode

Description

Use this command to display the settings of the Console port, used for local management sessions of the switch. Here is an example of the information.

```
Asynchronous Port (Console) Information:
   Baud Rate ..................... 9600
   Parity ........................ User Configured
   Data bits ..................... 0
   Stop bits ..................... 1
```

Figure 39. SHOW BAUD-RATE Command

To set the baud rate, refer to “BAUD-RATE SET” on page 149.

Note
The baud rate is the only adjustable parameter on the Console port.

Example

This example displays the settings of the console port:

```
awplus# show baud-rate
```

SHOW CLOCK

Syntax

```
show clock
```

Parameters

None

Modes

User Exec mode

Description

Use this command to display the system's current date and time.

Example

This example displays the system's current date and time:

```
awplus# show clock
```

SHOW RUNNING-CONFIG

Syntax

```
show running-config
```

Parameters

None

Modes

Privileged Exec mode

Description

Use this command to display the settings of the switch, in their equivalent command line commands.

The command displays only the settings that have been changed from their default values and includes those values that have not yet been saved in the active boot configuration file. Parameters at their default settings are not included in the running configuration file.

To display the port configuration settings, see “SHOW RUNNING-CONFIG INTERFACE” on page 242.

Example

This example displays the switch settings:

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

SHOW SWITCH

Syntax

```
show switch
```

Parameters

None

Modes

Privileged Exec mode

Description

Use this command to view the information in Figure 40.

```
Switch Information:
Application Software Version ......... v1.0.0
Application Software Build date ...... May 2010 10:24:12
MAC Address ........................... 00:15:77:cc:e2:42
Active Spanning Tree version ......... RSTP
Console Disconnect Timer Interval .... 10 minute(s)
Telnet Server status .................. Enabled
MAC address aging time ................ 300 second(s)
```

Figure 40. SHOW SWITCH Command

The fields are described in Table 9.

Table 9. SHOW SWITCH Command

Parameter	Description
Application Software Version	The version number of the management software.
Application Software Build Date	The date and time when Allied Telesis released this version of the management software.
MAC Address	The MAC address of the switch.

Table 9. SHOW SWITCH Command (Continued)

Parameter	Description
Active Spanning Tree version	The active spanning tree protocol on the switch. The protocol can be STP, RSTP, or MSTP. The active spanning tree protocol is set with “SPANNING-TREE MODE STP” on page 838, “SPANNING-TREE MODE RSTP” on page 874, and “SPANNING-TREE MODE MSTP” on page 916.
Console Disconnect Timer Interval	The current setting of the console timer. The switch uses the console timer to end inactive management sessions. The switch ends management sessions if they are inactive for the length of the timer. To set the timer, refer to “EXEC-TIMEOUT” on page 152.
Telnet Server Status	The status of the Telnet server. The switch can be remotely managed from a Telnet client on your network when the server is enabled. When the server is disabled, the switch cannot be remotely managed with a Telnet client. To configure the Telnet client, refer to “SERVICE TELNET” on page 1437 and “NO SERVICE TELNET” on page 1436.
MAC Address Aging Time	The current setting of the aging timer, which the switch uses to delete inactive dynamic MAC addresses from the MAC address table. To set this value, refer to “MAC ADDRESS-TABLE AGEING-TIME” on page 428.

Example

The following example displays the switch information:

```
awplus# show switch
```

SHOW SYSTEM

Syntax

```
show system
```

Parameters

None

Modes

User Exec and Privileged Exec modes

Description

Use this command to view general information about the switch. Figure 41 is an example of the information.

```
Switch System StatusFri, 18 Nov 2011 00:37:26
BoardBoard NameRevSerial Number
-------------------------------------------------------------------
BaseAT-FS970M/24 R1S05525A090200007
-------------------------------------------------------------------

Environmental Status:Normal
Uptime:0 days 00:37:27
Bootloader version:5.1.2
Bootloader build date:June 01 2010 10:24:05

Software version:2.2.2.0
Build date:Oct 23 2011 01:40:25

Current boot config:/cfg/switch1a.cfg (file exists)
Territory:

System Name:

System Contact:

System Location:
```

Figure 41. SHOW SYSTEM Command

Example

This example displays general information about the switch:

```
awplus# show system
```

SHOW SYSTEM SERIALNUMBER

Syntax

```
show system serialnumber
```

Parameters

None

Mode

User Exec and Privileged Exec modes

Description

Use this command to display the serial number of the switch. Figure 42 is an example of the output.

```
S05525A023600001
```

Figure 42. SHOW SYSTEM SERIALNUMBER Command

Example

This example displays the system's serial number:

```
awplus# show system serialnumber
```

SHOW USERS

Syntax

```
show users
```

Parameters

None

Modes

Privileged Exec mode

Description

Use this command to display the managers who are currently managing the switch locally through the Console port and remotely from Telnet and SSH sessions. This command does not display managers who are configuring the device with a web browser application or an SNMP application. Figure 43 displays an example of the information.

```
LineUserHost(s)IdleLocationPriv
con0manageridle00:00:00ttyS015
vty0Cassandraidle00:03:11149.112.167.2915
```

Figure 43. SHOW USERS Command

The columns are described in Table 10.

Table 10. SHOW USERS Command

Parameter	Description
Line	The active management sessions. The possible designators are "con0" for a local management session and "vty" for remote Telnet and SSH sessions.
User	The login user name of the manager account.
Host(s)	This field is not applicable to the switch.

Table 10. SHOW USERS Command (Continued)

Parameter	Description
Idle	The number of hours, minutes, and seconds since the manager using the account entered a command on the switch. The value is always zero for your account because you just entered the SHOW USERS command.
Location	The network device from which the manager is accessing the switch. A device connected to the Console port is identified by “ttys0”, while remote Telnet and SSH devices are identified by their IP addresses.
Priv	The privilege level of the manager account. Manager accounts with the privilege level 1 are restricted to the User Exec mode, while accounts with the level 15 can access all of the command modes.

Example

This example displays the managers who are logged on to the switch:

```
awplus# show users
```

SHOW VERSION

Syntax

```
show version
```

Parameters

None

Mode

User Exec and Privileged Exec modes

Description

Use this command to display the software version number and build date of the management software. Figure 44 displays an example of the information.

```
AlliedWare Plus (TM) 2.3.1.0 10/23/10 01:40:25


Application Build name : ats-fs970m-2.3.1.0.img
Application Build date : Oct 23 2011 01:40:25
Application Build type : RELEASE

Bootloader version     : 5.1.2
Bootloader build date  : Jun 01 2010 10:24:05
```

Figure 44. SHOW VERSION Command

Example

This example displays the management software version number:

```
awplus# show version
```

SNMP-SERVER CONTACT

Syntax

```
snmp-server contact contact
```

Parameters

contact

Specifies the name of the person responsible for managing the switch. The name can be up to 255 alphanumeric characters in length. Spaces and special characters are allowed.

Mode

Global Configuration mode

Description

Use this command to add contact information to the switch. The contact information is usually the name of the person who is responsible for managing the unit.

To remove the current contact information without adding a new contact, use the NO form of this command.

Confirmation Command

“SHOW SYSTEM” on page 171

Example

This example assigns the contact “JSmith_ex5441” to the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server contact JSmith_ex5441
```

This example removes the current contact information:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server contact
```

SNMP-SERVER LOCATION

Syntax

```
snmp-server location location
```

Parameters

location

Specifies the location of the switch. The location can be up to 255 alphanumeric characters. Spaces and special characters are allowed.

Mode

Global Configuration mode

Description

Use this command to add location information to the switch.

To remove the current location information without adding new information, use the NO form of this command.

Confirmation Command

"SHOW SYSTEM" on page 171

Examples

This example adds the location "Bldg5_fl2_rm201a" to the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server location Bldg5_fl2_rm201a
```

This example removes the current location information:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server location
```

SYSTEM TERRITORY

Syntax

```
system territory territory
```

Parameters

territory

Specifies the territory of the switch. The switch can have only one territory. You may choose from the following:

australia

china

europe

japan

korea

nz (New Zealand)

usa

Mode

Global Configuration mode

Description

Use this command to specify the territory of the switch. The territory setting is not currently used by any of the features on the switch.

Confirmation Command

“SHOW SYSTEM” on page 171

Examples

This example sets the switch’s territory to Australia:

```
awplus> enable
awplus# configure terminal
awplus(config)# system territory australia
```

This example removes the current territory information:

```
awplus> enable
awplus# configure terminal
awplus(config)# no system territory
```

Chapter 9

Port Parameters

This chapter contains the following:

Adding Descriptions

The ports will be easier to identify if you give them descriptions. The descriptions are viewed with the SHOW INTERFACE command in the Privileged Exec mode.

The command for adding descriptions is the DESCRIPTION command in the Port Interface mode. Here is the format:

```
description description
```

The DESCRIPTION parameter can be up to 80 alphanumeric characters. Spaces and special characters are allowed.

You can assign a description to more than one port at a time.

To remove the current description from a port without assigning a new description, use the NO form of this command.

This example assigns the name “printer22” to port 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# description printer22
```

This example removes the current name from port 16 without assigning a new description:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16
awplus(config-if)# no description
```

For reference information, refer to “DESCRIPTION” on page 208.

Note
The POWER-INLINE DESCRIPTION command is used to describe powered devices that are connected to the ports. For information about this command, see “POWER-INLINE DESCRIPTION” on page 277.

Setting the Speed and Duplex Mode

The twisted pair ports on the switch can operate at 10, 100, or 1000 Mbps, in either half-duplex or full-duplex mode. You may set the speeds and duplex modes yourself or, since the ports support Auto-Negotiation, you may let the switch configure the ports automatically. The default setting for the ports is Auto-Negotiation for both speed and duplex mode.

To set the speed manually on a port or to reactivate Auto-Negotiation, use the SPEED command in the Port Interface mode. The format of the command is:

```
speed auto|10|100|1000
```

The "10" setting is for 10Mbps, the "100" for 100Mbps and the "1000" for 1000Mbps. The "auto" activates Auto-Negotiation for port speed.

The DUPLEX command, for setting the duplex mode, has this format:

```
duplex auto|half|full
```

The "half" setting is for half-duplex mode and "full" for full-duplex mode. The "auto" activates Auto-Negotiation for duplex mode.

You should review the following information before configuring the ports:

- Auto-Negotiation may be activated separately for speed and duplex mode on a port. For instance, you may activate Auto-Negotiation for speed on a port, but set the duplex mode manually.
- The 1000 Mbps setting in the SPEED command is for fiber optic modules. The twisted pair ports on the switch must be set to Auto-Negotiation to operate at 1000 Mbps.

Note
To avoid a duplex mode mismatch between switch ports and network devices, do not use duplex mode Auto-Negotiation on ports that are connected to network devices on which the duplex modes are set manually. Switch ports that are set to Auto-Negotiation default to half duplex mode if they detect that the network devices are not using Auto-Negotiation. This may result in duplex mode mismatches in which the switch ports use half duplex mode, and the network devices full duplex mode. To prevent this problem, always manually set the duplex mode on ports that are connected to network devices that are not using Auto-Negotiation.

This example sets the speeds of ports 11 and 17 to 100Mbps:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11,port1.0.17
awplus(config-if)# speed 100
```

This example configures port 1 to half-duplex:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# duplex half
```

This example configures ports 2 to 4 to 10 Mbps, full-duplex:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2-port1.0.4
awplus(config-if)# speed 10
awplus(config-if)# duplex full
```

This example sets the speed on port 15 to Auto-Negotiation and the duplex mode to half duplex:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# speed auto
awplus(config-if)# duplex half
```

This example sets the speed on port 23 to 100 Mbps and the duplex mode to Auto-Negotiation:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.23
awplus(config-if)# speed 100
awplus(config-if)# duplex auto
```

For reference information, refer to “SPEED” on page 249 and “DUPLEX” on page 210.

Setting the MDI/MDI-X Wiring Configuration

The wiring configurations of twisted pair ports that operate at 10 or 100 Mbps are MDI (medium dependent interface) and MDI-X (medium dependent interface crossover). A port on the switch and a port on a link partner must have different settings. For instance, a switch port has to be using the MDI wiring configuration if the port on its link partner is using the MDIX wiring configuration.

The command for setting the wiring configuration is the POLARITY command in the Port Interface mode. Here is the format of the command:

```
polarity auto|mdi|mdix
```

The AUTO setting activates auto-MDI/MDIX, which enables a port to detect the wiring configuration of its link partner so that it can set its wiring configuration to the opposite setting.

This example of the command configures ports 22 and 23 to the MDI wiring configuration:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.22,port1.0.23
awplus(config-if)# polarity mdi
```

This example activates auto-MDI/MDIX on ports 7 to 9:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.7-port1.0.9
awplus(config-if)# polarity auto
```

For reference information, refer to "POLARITY" on page 224.

Enabling or Disabling Ports

Disabling ports turns off their receivers and transmitters so that they cannot forward traffic. You might disable unused ports on the switch to protect them from unauthorized use, or if there is a problem with a cable or a network device.

To disable ports, use the SHUTDOWN command in the Port Interface mode. To enable ports again, use the NO SHUTDOWN command.

This example disables ports 1 to 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1-port1.0.4
awplus(config-if)# shutdown
```

This example enables ports 17 and 22:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17,port1.0.22
awplus(config-if)# no shutdown
```

For reference information, refer to “SHUTDOWN” on page 247 and “NO SHUTDOWN” on page 221.

Enabling or Disabling Backpressure

Ports use backpressure during periods of packet congestion, to prevent packet overruns. They use it to stop their link partners from sending any further packets to enable them to process the packets already in their buffers.

Backpressure applies to ports that are operating in half-duplex mode at 10 or 100 Mbps. A port that is experiencing packet congestion initiates backpressure by transmitting a signal on the shared link. When the link partner detects that its own transmission has become garbled on the link, it ceases transmission, waits a random period of time, and, if the link is clear, resumes transmitting.

You can enable or disable backpressure on ports where you disabled Auto-Negotiation and set the speeds and duplex modes manually. If you enable backpressure, the default setting, a port initiates backpressure when it needs to prevent a buffer overrun from packet congestion. If you disable backpressure, a port does not use backpressure. (Ports that are set to Auto-Negotiation always use backpressure when operating in half-duplex mode at 10 or 100 Mbps.)

Backpressure is set with the BACKPRESSURE command in the Port Interface mode. In this example, ports 11 and 12 are manually set to 10 Mbps, half-duplex, with backpressure enabled:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11,port1.0.12
awplus(config-if)# speed 10
awplus(config-if)# duplex half
awplus(config-if)# backpressure on
```

In this example, port 12 is manually set to 100 Mbps, half-duplex, with backpressure disabled:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12
awplus(config-if)# speed 100
awplus(config-if)# duplex half
awplus(config-if)# backpressure off
```

For reference information, refer to "BACKPRESSURE" on page 204.

Enabling or Disabling Flow Control

When a port that is operating in full-duplex mode needs to temporarily stop its local or remote counterpart from sending any further packets, it initiates flow control by sending what are known as pause packets. Pause packets instruct the link partner to stop sending packets to allow the sender of the packets time to process the packets already stored in its buffers.

There are two aspects to flow control on the ports on the switch. The first is whether or not a port will issue pause packets during periods of buffer congestion. The other is whether or not a port will stop sending packets when it receives pause packets from another network device. You can control both of these aspects of flow control on the ports on the switch.

Flow control is set with the FLOWCONTROL RECEIVE command and the the FLOWCONTROL SEND command. The formats of the commands are:

```
flowcontrol send on|off
flowcontrol receive on|off
```

The FLOWCONTROL SEND command controls whether or not a port sends pause packets during periods of packet congestion. If you set it to ON, the port sends pause packets when it reaches the point of packet congestion. If you set it to OFF, the port does not send pause packets. At the default setting, the send portion of flow control is off.

The FLOWCONTROL RECEIVE command is used to control whether or not a port stops transmitting packets when it receives pause packets from its local or remote counterpart. If you set it to ON, a port stops transmitting packets when it receives pause packets. If you set it to OFF, a port does not stop transmitting packets when it receives pause packets. At the default setting, the receive portion of flow control is off.

The commands are located in the Port Interface mode. This example configures ports 12 and 13 to 100Mbps, full-duplex mode. The receive portion of flow control is disabled so that the ports ignore any pause packets that they receive from their link partners:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12,port1.0.13
awplus(config-if)# speed 100
awplus(config-if)# duplex full
awplus(config-if)# flowcontrol receive off
```

This example configures port 21 not to send pause packets during periods of packet congestion:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.21
awplus(config-if)# speed 100
awplus(config-if)# duplex full
awplus(config-if)# flowcontrol send off
```

This example enables both the receive and send portions of flow control on port 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.7
awplus(config-if)# flowcontrol receive on
awplus(config-if)# flowcontrol send on
```

For reference information, refer to "FLOWCONTROL" on page 214.

To disable flow control, use the NO FLOWCONTROL command in the Port Interface mode. This example disables flow control on ports 22 and 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.22,port1.0.23
awplus(config-if)# no flowcontrol
```

To view the flow control settings on ports, use the SHOW FLOWCONTROL INTERFACE command in the Privilege Exec mode. Here is the format of the command:

```
show flowcontrol interface port
```

You can view just one port at a time. This example displays the flow control settings for port 4:

```
awplus# show flowcontrol interface port1.0.4
```

Here is an example of the information the command displays.

```
Port      Send      Receive   RxPause    TxPause
          admin     admin
-----     -------   -------   -------    -------
1.0.4     yes       yes       112        83
```

Figure 45. SHOW FLOWCONTROL INTERFACE Command

The columns in the table are described in "SHOW FLOWCONTROL INTERFACE" on page 229.

If flow control is not configured on a port, this message is displayed:

```
Flow control is not set on interface port1.0.2
```

Resetting Ports

If a port is experiencing a problem, you may be able to correct it with the RESET command in the Port Interface mode. This command performs a hardware reset. The port parameter settings are retained. The reset takes just a second or two to complete.

This example resets ports 16 and 17:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16,port1.0.17
awplus(config-if)# reset
```

For reference information, refer to "RESET" on page 228.

Configuring Threshold Limits for Ingress Packets

You can set threshold limits for the ingress packets on the ports. The threshold limits control the number of packets the ports accept each second. Packets that exceed the limits are discarded by the ports. You can set different limits for broadcast, multicast, and unknown unicast traffic. This feature is useful in preventing bottlenecks from forming in a network.

To assign a threshold limit on a port, use the STORM-CONTROL command in the Port Interface mode. The format is:

```
storm-control broadcast|multicast|dlf level value
```

The BROADCAST, MULTICAST and DLF parameters specify the packet type of the threshold limit. (The DLF parameter, the acronym for “database lookup failure,” is for unknown unicast packets.) The VALUE parameter specifies the maximum permitted number of ingress packets per second a port will accept. The range is 0 to 33,554,431 packets.

This example sets a threshold of 5,000 packets per second for ingress broadcast packets on port 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12
awplus(config-if)# storm-control broadcast level 5000
```

This example sets a threshold of 100,000 packets per second for ingress multicast packets on port 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# storm-control multicast level 100000
```

This example sets a threshold of 200,000 packets per second for ingress unknown unicast packets on ports 15 and 17:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15,port1.0.17
awplus(config-if)# storm-control dlf level 200000
```

To remove threshold limits from the ports, use the NO STORM-CONTROL command, also in the Port Interface mode. This example removes the threshold limit for broadcast packets on port 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12
awplus(config-if)# no storm-control broadcast
```

This example disables unknown unicast rate limiting on port 5, 6, and 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5,port1.0.6,port1.0.15
awplus(config-if)# no storm-control dlf
```

This example removes the threshold limit for multicast packets on port 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.23
awplus(config-if)# no storm-control multicast
```

For reference information, refer to "STORM-CONTROL" on page 251 and "NO STORM-CONTROL" on page 223.

Displaying Threshold Limit Settings on Ports

To display the threshold settings for the ingress packets on the ports, use the SHOW STORM-CONTROL command in the Privileged Exec mode. Here is the format:

```
show storm-control [port]
```

This example of the command displays the broadcast, multicast and dif levels on ports 18:

```
awplus# show storm-control port1.0.18
```

Here is an example of the information the command displays.

```
Port          Bcastlevel  Mcastlevel   Diflevel
port1.0.18    30          100          100
```

Figure 46. SHOW STORM-CONTROL Command

The columns are described in Table 15 on page 237.

If the parameter port is not specified, the command displays the threshold settings on all the ports on the switch.

If you want to display information on multiple ports at a time, enter:

```
awplus# show storm-control port1.0.18,port1.0.20,port1.0.21
```

Here is an example of the information the command displays.

```
Port          Bcastlevel  Mcastlevel   Diflevel
port1.0.18    30          100          100
Port1.0.20    100          50          100
port1.0.21    100         100          100
```

Figure 47. SHOW STORM-CONTROL Command

Reinitializing Auto-Negotiation

If you believe that a port set to Auto-Negotiation is not using the highest possible common speed and duplex-mode between itself and a network device, you can instruction it to repeat Auto-Negotiation. This is accomplished with the RENEGOTIATE command in the Port Interface mode. The command does not have any parameters. A port must already be set to Auto-Negotiation before you can use this command.

This example prompts ports 4 and 8 to use Auto-Negotiation to renegotiate their settings with the ports on their network counterparts:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4,port1.0.8
awplus(config-if)# renegotiate
```

For reference information, refer to "RENEGOTIATE" on page 227.

Restoring the Default Settings

To restore the default settings on a port, use the PURGE command in the Port Interface mode. This example returns ports 12, 13 and 15 to their default settings:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12,port1.0.13,port1.0.15
awplus(config-if)# purge
```

For reference information, refer to “PURGE” on page 226.

Displaying Port Settings

There are several ways to display port settings. See the following:

- "Displaying Speed and Duplex Settings" on page 197
- "Displaying Port Status" on page 197
- "Displaying Port Configuration" on page 198

Displaying Speed and Duplex Settings

To display the speed and duplex mode settings of the ports, use the SHOW INTERFACE STATUS command in the Privileged Exec mode. Here is the format:

```
show interface [port] status
```

This example of the command displays the speed and duplex mode settings for ports 18 and 20:

```
awplus# show interface port1.0.18,port1.0.20 status
```

Here is an example of the information the command displays.

```
Port        Name      Status    Vlan  Duplex   Speed  Type
port1.0.18  Port_01   down      3     half     100    10/100/1000Base-T
port1.0.20  Port_02   up        11    auto     auto   10/100/1000Base-T
```

Figure 48. SHOW INTERFACE STATUS Command

The columns are described in Table 15 on page 237. For a description of the command, see "SHOW INTERFACE STATUS" on page 237.

Displaying Port Status

To display the current status of the ports on the switch, use the SHOW INTERFACE command in the Privileged Exec mode. Here is the format:

```
show interface [port]
```

This example displays the settings for ports 1 and 2:

```
awplus# show interface port1.0.1,port1.0.2
```

See Figure 49 on page 198 for an example of the display.

```
Interface port1.0.1
   Link is UP, administrative state is UP
   Address is 0015.77cc.e243
   index 1 mtu 9198
   SNMP link-status traps: Enabled (Suppressed in 0 sec.)
   Bandwidth 1g
      input packets 0, bytes 0, dropped 0, multicast packets 0
      output packets 0, bytes 0, multicast packets 0 broadcast packets 0
Interface port1.0.2
   Link is UP, administrative state is UP
   Address is 0015.77cc.e244
   index 2 mtu 9198
   SNMP link-status traps: Enabled (Suppressed in 0 sec.)
   Bandwidth 1g
      input packets 0, bytes 0, dropped 0, multicast packets 0
      output packets 0, bytes 0, multicast packets 0 broadcast packets 0
```

Figure 49. SHOW INTERFACE Command

The fields are described in Table 13 on page 232. For a description of the command, see “SHOW INTERFACE” on page 231.

Displaying Port Configuration

To display the current port configuration settings, use the SHOW RUNNING-CONFIG INTERFACE command in the Privileged Exec mode. Here is the format:

```
show running-config interface interface-list
```

This example displays the settings for ports 1 and 2:

```
awplus# show running-config interface port1.0.7
```

See Figure 50 for an example of the display.

```
Interface port1.0.7
   switchport
   switchport mode access
   switchport access vlan 2
```

Figure 50. SHOW RUNNING-CONFIG INTERFACE Command

For a description of the command, see “SHOW RUNNING-CONFIG INTERFACE” on page 242.

Displaying or Clearing Port Statistics

To view packet statistics for the individual ports, use the SHOW PLATFORM TABLE PORT COUNTERS command in the Privileged Exec mode. Here is the format of the command:

```
show platform table port [port] counters
```

This example displays the statistics for ports 23 and 24:

```
awplus# show platform table port port1.0.23,port1.0.24
counter
```

The statistics are described in Table 16 on page 239.

To clear the port counters, use the CLEAR PORT COUNTER command, which has this format:

```
clear port counter port
```

This example clears the counters for ports 1 and 4:

```
awplus# clear port counter port1.0.1,port1.0.4
```

Displaying SFP Information

To view information on a plugged SFP on the switch, use the SHOW SYSTEM PLUGGABLE command in the Privileged Exec mode. Here is the format of the command:

```
show system pluggable
```

For more information about this command, see “SHOW SYSTEM PLUGGABLE” on page 245.

To view more detail information on a plugged SFP, use the following command:

```
awplus# show system pluggable detail
```

The fields are described in Table 16 on page 239.

Chapter 10

Port Parameter Commands

The port parameter commands are summarized in Table 11.

Table 11. Port Parameter Commands

Command	Mode	Description
“BACKPRESSURE” on page 204	Port Interface	Enables or disables backpressure on ports that are operating in half-duplex mode.
“BPLIMIT” on page 206	Port Interface	Specifies threshold levels for backpressure on ports.
“CLEAR PORT COUNTER” on page 207	User Exec and Privileged Exec	Clears the packet counters.
“DESCRIPTION” on page 208	Port Interface	Adds port descriptions.
“DUPLEX” on page 210	Port Interface	Configures the duplex modes.
“EGRESS-RATE-LIMIT” on page 212	Port Interface	Sets a limit on the amount of traffic that can be transmitted per second from the port.
“FCTRLLIMIT” on page 213	Port Interface	Specifies threshold levels for flow control.
“FLOWCONTROL” on page 214	Port Interface	Enables or disables flow control on ports that are operating in full-duplex mode.
“HOLBPLIMIT” on page 217	Port Interface	Specifies a threshold for head of line blocking events.
“NO EGRESS-RATE-LIMIT” on page 219	Port Interface	Disables egress rate limiting on the ports.
“NO FLOWCONTROL” on page 220	Port Interface	Disables flow control on ports.
“NO SHUTDOWN” on page 221	Port Interface	Activates disabled ports so that they resume forwarding network traffic again.
“NO SNMP TRAP LINK-STATUS” on page 222	Port Interface	Deactivates link traps.

Table 11. Port Parameter Commands (Continued)

Command	Mode	Description
“NO STORM-CONTROL” on page 223	Port Interface	Removes threshold limits for broadcast, multicast, or unknown unicast packets.
“POLARITY” on page 224	Port Interface	Sets the MDI/MDI-X settings on twisted pair ports.
“PURGE” on page 226	Port Interface	Restores the default settings.
“RENEGOTIATE” on page 227	Port Interface	Prompts ports that are using Auto-Negotiation to renegotiate their settings with the network devices.
“RESET” on page 228	Port Interface	Performs software resets on the ports.
“SHOW FLOWCONTROL INTERFACE” on page 229	Privileged Exec	Displays the current settings for flow control on the ports.
“SHOW INTERFACE” on page 231	Privileged Exec	Displays port settings.
“SHOW INTERFACE BRIEF” on page 235	Privileged Exec	Displays administrative and link statuses.
“SHOW INTERFACE STATUS” on page 237	Privileged Exec	Displays the speed and duplex mode settings of the ports.
“SHOW PLATFORM TABLE PORT COUNTERS” on page 239	Privileged Exec	Displays packet statistics for the individual ports.
“SHOW RUNNING-CONFIG INTERFACE” on page 242	Privileged Exec	Displays the settings of the specified ports.
“SHOW STORM-CONTROL” on page 243	Privileged Exec	Displays threshold settings for broadcast, multicast, and unknown unicast packets.
“SHOW SYSTEM PLUGGABLE” on page 245	Privileged Exec	Displays information about the SFP modules in the switch.
“SHOW SYSTEM PLUGGABLE DETAIL” on page 246	Privileged Exec	Displays information about the SFP modules in the switch.
“SHUTDOWN” on page 247	Port Interface	Disables ports to stop them from forwarding network traffic.
“SNMP TRAP LINK-STATUS” on page 248	Port Interface	Activates link traps.
“SPEED” on page 249	Port Interface	Manually sets port speed or activates Auto-Negotiation.

Table 11. Port Parameter Commands (Continued)

Command	Mode	Description
“STORM-CONTROL” on page 251	Port Interface	Sets a maximum limit of the number of broadcast, multicast, or unknown unicast packets forwarded by a port.

BACKPRESSURE

Syntax

```
backpressure on|off
```

Parameters

on

Activates backpressure on the ports.

off

Deactivates backpressure on the ports.

Mode

Port Interface mode

Description

Use this command to enable or disable backpressure on ports that are operating at 10 or 100 Mbps in half-duplex mode. Backpressure is used by ports during periods of packet congestion to temporarily stop their network counterparts from transmitting more packets. This prevents a buffer overrun and the subsequent loss and retransmission of network packets. A port initiates backpressure by transmitting on the shared link to cause a data collision, which causes its link partner to cease transmission.

To set backpressure on a port, you must configure the speed and duplex mode manually. You cannot set backpressure on a port that is using Auto-Negotiation.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

This example configures port 15 to 10 Mbps, half-duplex mode, and activates backpressure:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# speed 10
awplus(config-if)# duplex half
awplus(config-if)# backpressure on
```

This example configures ports 8 and 21 to 100 Mbps, half-duplex mode, with backpressure disabled:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.8,port1.0.21
awplus(config-if)# speed 100
awplus(config-if)# duplex half
awplus(config-if)# backpressure off
```

BPLIMIT

Syntax

```
bplimit bplimit
```

Parameters

bplimit

Specifies the number of cells for backpressure. A cell represents 128 bytes. The range is 1 to 7935 cells. The default value is 7935 cells.

Mode

Port Interface mode

Description

Use this command to specify a threshold level for backpressure on a port.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

This example sets the threshold for backpressure on ports 15 and 20 to 7000 cells:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15,port1.0.20
awplus(config-if)# bplimit 7000
```

CLEAR PORT COUNTER

Syntax

```
clear port counter port
```

Parameters

port

Specifies the port whose packet counters you want to clear. You can specify more than one port at a time in the command.

Mode

User Exec mode and Privileged Exec mode

Description

Use this command to clear the packet counters of the ports. To display the counters, refer to "SHOW PLATFORM TABLE PORT COUNTERS" on page 239.

Example

This example clears the packet counters for ports 4 to 7:

```
awplus# clear port counter port1.0.4-port1.0.7
```

DESCRIPTION

Syntax

```
description description
```

Parameters

description
: Specifies a description of 1 to 240 alphanumeric characters for a port. Spaces and special characters are allowed.

Mode

Port Interface mode

Description

Use this command to add descriptions to the ports on the switch. The ports will be easier to identify if they have descriptions.

Use the NO form of this command to remove descriptions from ports without assigning new descriptions.

> **Note**
> The POWER-INLINE DESCRIPTION command is used to describe powered devices that are connected to the ports. For information about this command, see “POWER-INLINE DESCRIPTION” on page 277.

Confirmation Command

“SHOW INTERFACE” on page 231

Examples

This example assigns the description “printer22” to port 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# description printer22
```

This example removes the current name from port 11 without assigning a new name:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11
awplus(config-if)# no description
```

DUPLEX

Syntax

```
duplex auto|half|full
```

Parameters

auto
: Activates Auto-Negotiation for the duplex mode, so that the duplex mode is set automatically.

half
: Specifies half-duplex mode.

full
: Specifies full-duplex mode.

Mode

Port Interface mode

Description

Use this command to set the duplex modes of the twisted pair ports. Ports operating in half-duplex mode can either receive packets or transmit packets, but not both at the same time, while ports operating in full-duplex can both send and receive packets, simultaneously.

Note
To avoid a duplex mode mismatch between switch ports and network devices, do not select Auto-Negotiation on ports that are connected to network devices on which the duplex modes are set manually. Switch ports that are set to Auto-Negotiation default to half duplex mode if they detect that the network devices are not using Auto-Negotiation. This may result in duplex mode mismatches in which the switch ports use half duplex mode and the network devices full duplex mode. To prevent this problem, always manually set the duplex mode on ports that are connected to network devices that are not using Auto-Negotiation.

Confirmation Command

“SHOW INTERFACE STATUS” on page 237

Examples

This example sets the duplex mode on port 11 half-duplex:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11
awplus(config-if)# duplex half
```

This example configures the duplex mode with Auto-Negotiation on port 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# duplex auto
```

EGRESS-RATE-LIMIT

Syntax

```
egress-rate-limit value
```

Parameters

value

Specifies the maximum amount of traffic that can be transmitted from the port. The value is kilobits per second. The range is 64 to 1,000,000 kilobits per second.

Mode

Port Interface mode

Description

Use this command to set a limit on the amount of traffic that can be transmitted per second from the port.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example sets the egress rate limit to 1,000,000 kilobits per second on ports 15, 16 and 21:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15,port1.0.16,port1.0.21
awplus(config-if)# egress-rate-limit 1000000
```

FCTRLLIMIT

Syntax

```
fctrllimit fctrllimit
```

Parameters

fctrllimit

Specifies the number of cells for flow control. A cell represents 128 bytes. The range is 1 to 7935 cells. The default value is 7935 cells.

Mode

Port Interface mode

Description

Use this command to specify threshold levels for flow control on the ports.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

This example sets the threshold level for flow control on port 14 to 5000 cells:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.14
awplus(config-if)# fctrllimit 5000
```

FLOWCONTROL

Syntax

```
flowcontrol send|receive|both on|off
```

Parameter

send
: Controls whether a port sends pause packets during periods of packet congestion, to initiate flow control.

receive
: Controls whether a port, when it receives pause packets from its network counterpart, stops sending packets.

on
: Activates flow control.

off
: Deactivates flow control.

Mode

Port Interface mode

Description

Use this command to enable or disable flow control on ports that are operating in full-duplex mode. Ports use flow control when they are experiencing traffic congestion and need to temporary stop their link partners from transmitting any more traffic. This allows them time to process the packets already in their buffers.

A port that is experiencing traffic congestion initiates flow control by sending pause packets. These packets instruct the link partner to stop transmitting packets. A port continues to issue pause packets so long as the traffic congestion persists. Once the condition has cleared, a port stops sending pause packets to allow its link partner to resume the transmission of packets.

The ports on the switch can both send pause packets during periods of traffic congestion and stop transmitting packets when they receive pause packets from their link partners. You can control both aspects of flow control separately on the ports.

The RECEIVE parameter in the command controls the behavior of a port when it receives pause packets from a network device. If receive is on, a port stops sending packets in response to pause packets from its link

partner. If it is off, a port does not respond to pause packets and continues to transmit packets. At the default setting, the receive portion of flow control is off.

The SEND parameter determines whether a port sends pause packets when it experiences traffic congestion. If send is on, a port sends pause packets to signal its link partner of the condition and to stop the transmission of more packets. If send is off, a port does not send pause packets during periods of traffic congestion. At the default setting, the send portion of flow control is off.

To configure flow control on a port, you must disable Auto-Negotiation and set the speed and duplex mode manually. A port set to Auto-Negotiation always uses flow control when operating in full-duplex mode.

Confirmation Command

"SHOW FLOWCONTROL INTERFACE" on page 229

Examples

This example configures port 19 to 100 Mbps, full-duplex mode, with both the send and receive parts of flow control enabled:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.19
awplus(config-if)# speed 100
awplus(config-if)# duplex full
awplus(config-if)# flowcontrol send on
awplus(config-if)# flowcontrol receive on
```

This example configures ports 18 to 21 and 24 to 10 Mbps, full-duplex mode, with both the send and receive portions of flow control disabled. The ports will neither respond to pause packets from their link partners by ceasing transmission nor will they issue pause packets during periods of traffic congestion:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.18-port1.0.21,port1.0.24
awplus(config-if)# speed 10
awplus(config-if)# duplex full
awplus(config-if)# flowcontrol receive off
awplus(config-if)# flowcontrol send off
```

This example configures port 1 and 2 to 10 Mbps, full-duplex mode. The send portion of flow control is disabled so that the ports do not send pause packets during periods of traffic congestion. But the receive portion is enabled so that the ports respond to pause packets from their network counterparts by temporarily ceasing transmission:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.2
awplus(config-if)# speed 10
awplus(config-if)# duplex full
awplus(config-if)# flowcontrol send off
awplus(config-if)# flowcontrol receive on
```

HOLBPLIMIT

Syntax

holbplimit *holbplimit*

Parameter

holbplimit
: Specifies the threshold at which a port signals a head of line blocking event. The threshold is specified in cells. A cell is 128 bytes. The range is 1 to 8,191 cells; the default is 7,168 cells.

Mode

Port Interface mode

Description

Use this command to specify a threshold for head of line blocking events on the ports. Head of line (HOL) blocking is a problem that occurs when a port on the switch becomes oversubscribed because it is receiving more packets from other switch ports than it can transmit in a timely manner.

An oversubscribed port can prevent other ports from forwarding packets to each other because ingress packets on a port are buffered in a First In, First Out (FIFO) manner. If a port has, at the head of its ingress queue, a packet destined for an oversubscribed port, it will not be able to forward any of its other packets to the egress queues of the other ports.

A simplified version of the problem is illustrated in Figure 51 on page 218. It shows four ports on the switch. Port D is receiving packets from two ports— 50% of the egress traffic from port A and 100% of the egress traffic from port B. Not only is port A unable to forward packets to port D because port D's ingress queues are filled with packets from port B, but port A is also unable to forward traffic to port C because its egress queue has frames destined to port D that it is unable to forward.

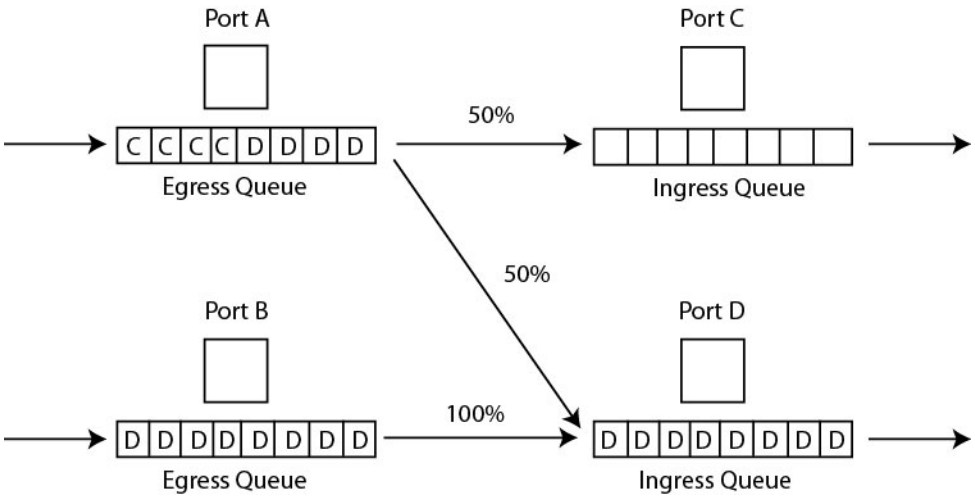

Figure 51. Head of Line Blocking

The HOL Limit parameter can help prevent this problem from occurring. It sets a threshold on the utilization of a port's egress queue. When the threshold for a port is exceeded, the switch signals other ports to discard packets to the oversubscribed port.

For example, referring to the figure above, when the utilization of the storage capacity of port D exceeds the threshold, the switch signals the other ports to discard packets destined for port D. Port A drops the D packets, enabling it to once again forward packets to port C.

The number you enter for this value represents cells. A cell is 128 bytes. The range is 1 to 8,191 cells; the default is 7,168 cells.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

This example sets the head of line blocking threshold on port 9 to 5,000 cells:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.9
awplus(config-if)# holbplimit 5000
```

NO EGRESS-RATE-LIMIT

Syntax

```
no egress-rate-limit
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to disable egress rate limiting on the ports.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example disable egress rate limiting on the ports 4 and 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4,port1.0.5
awplus(config-if)# no egress-rate-limit
```

NO FLOWCONTROL

Syntax

```
no flowcontrol
```

Parameter

None

Mode

Port Interface mode

Description

Use this command to disable flow control on ports.

Confirmation Command

“SHOW FLOWCONTROL INTERFACE” on page 229

Example

This example disables flow control on port 16:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16
awplus(config-if)# no flowcontrol
```

NO SHUTDOWN

Syntax

```
no shutdown
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to enable ports so that they forward packets again. This is the default setting for a port.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example enables port 22:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.22
awplus(config-if)# no shutdown
```

NO SNMP TRAP LINK-STATUS

Syntax

```
no snmp trap link-status
```

Parameter

None

Mode

Port Interface mode

Description

Use this command to deactivate SNMP link traps on the ports of the switch. The switch does not send traps when a port on which link trap is disabled experiences a change in its link state (i.e., goes up or down).

Confirmation Command

“SHOW INTERFACE” on page 231

Example

This example deactivates link traps on ports 18 and 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.18,port1.0.23
awplus(config-if)# no snmp trap link-status
```

NO STORM-CONTROL

Syntax

```
no storm-control broadcast|multicast|dlf
```

Parameters

broadcast
Specifies broadcast packets.

multicast
Specifies multicast packets.

dlf
Specifies unknown unicast packets.

Description

Use this command to remove packet threshold levels that were set on the ports with "STORM-CONTROL" on page 251.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

This example removes the threshold limit for broadcast packets on port 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12
awplus(config-if)# no storm-control broadcast
```

This example removes the threshold limit for unknown unicast rate on port 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# no storm-control dlf
```

This example removes the threshold limit for multicast packets on port 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.23
awplus(config-if)# no storm-control multicast
```

POLARITY

Syntax

```
polarity auto|mdi|mdix
```

Parameters

auto
: Activates auto-MDI/MDIX.

mdi
: Sets a port's wiring configuration to MDI.

mdix
: Sets a port's wiring configuration to MDI-X.

Mode

Port Interface mode

Description

Use this command to set the wiring configuration of twisted pair ports that are operating at 10 or 100 Mbps, in half- or full-duplex mode.

A twisted pair port that is operating at 10 or 100 Mbps can have one of two wiring configurations, known as MDI (medium dependent interface) and MDI-X (medium dependent interface crossover). To forward traffic, a port on the switch and a port on a network device must have different settings. For instance, the wiring configuration of a switch port has to be MDI if the wiring configuration on a port on a network device is MDIX.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

This example sets port 28 to the MDI wiring configuration:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.28
awplus(config-if)# polarity mdi
```

This example sets ports 4 and 18 to the MDI-X wiring configuration:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4,port1.0.18
awplus(config-if)# polarity mdix
```

This example activates auto-MDI/MDIX on ports 1 to 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1-port1.0.3
awplus(config-if)# polarity auto
```

PURGE

Syntax

```
purge
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to restore the default settings to these port parameters:

- Enabled status (NO SHUTDOWN)
- Description
- Speed
- Duplex mode
- MDI/MDI-X
- Flow control
- Backpressure
- Head of line blocking threshold
- Backpressure cells

Example

This example restores the default settings to ports 5, 6 and 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5,port1.0.6,port1.0.12
awplus(config-if)# purge
```

RENEGOTIATE

Syntax

```
renegotiate
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to prompt a port that is set to Auto-Negotiation to renegotiate its speed and duplex mode with its network device. You might use this command if you believe that a port and a network device did not establish the highest possible common settings during the Auto-Negotiation process.

Example

This example prompts port 18 to renegotiate its settings with its network counterpart:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.18
awplus(config-if)# renegotiate
```

RESET

Syntax

```
reset
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to perform a hardware reset on the ports. The ports retain their parameter settings. The reset takes only a second or two to complete. You might reset a port if it is experiencing a problem.

Example

This example resets port 14:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.14
awplus(config-if)# reset
```

SHOW FLOWCONTROL INTERFACE

Syntax

```
show flowcontrol interface port
```

Parameter

port

Specifies the port whose flow control setting you want to view. You can specify just one port at a time.

Modes

Privileged Exec mode

Description

Use this command to display the current settings for flow control on the ports. An example of the information is shown in Figure 52.

```
PortSendReceive   RxPause     TxPause
   adminadmin
-------------------------     -------
1.0.13yesyes      6520        7823
```

Figure 52. SHOW FLOWCONTROL INTERFACE Command

The fields are described in Table 12.

Table 12. SHOW FLOWCONTROL INTERFACE Command

Parameter	Description
Port	Port number.
Send admin	Whether or not flow control is active on the transmit side of the port. If yes, the port transmits pause packets during periods of packet congestion. If no, the port does not transmit pause packets.
Receive admin	Whether or not flow control is active on the receive side of the port. If yes, the port stops transmitting packets when it receives pause packets from the other network device. If no, the port does not stop transmitting packets.

Table 12. SHOW FLOWCONTROL INTERFACE Command (Continued)

Parameter	Description
RxPause	The number of received pause packets.
TxPause	The number of transmitted pause packets.

Example

This command displays the flow control settings for port 2:

```
awplus# show flowcontrol interface port1.0.2
```

SHOW INTERFACE

Syntax

```
show interface [port]
```

Parameter

port

Specifies the port whose current status you want to view. You can display more than one port at a time. To display all the ports, do not include this parameter.

Modes

Privileged Exec mode

Description

Use this command to display the current operating status of the ports. An example of the information is shown in Figure 53 on page 232.

```
Interface port1.0.1

   Link is UP, administrative state is UP
   Address is 0015.77cc.e243

   Description:
   index 1 mtu 9198

   Unknown Ingress Multicast Blocking: Disabled

   Unknown Egress Multicast Blocking: Disabled

   SNMP link-status traps: Enabled (Suppressed in 0 sec.)

   Bandwidth 1g

   input packets 0, bytes 0, dropped 0, multicast packets 0

   output packets 0, bytes 0, multicast packets 0 broadcast packets 0
Interface port1.0.2

   Link is UP, administrative state is UP

   Address is 0015.77cc.e244

   Description:
   index 1 mtu 9198

   Unknown Ingress Multicast Blocking: Disabled

   Unknown Egress Multicast Blocking: Disabled

   SNMP link-status traps: Enabled (Suppressed in 0 sec.)

   Bandwidth 1g

   input packets 0, bytes 0, dropped 0, multicast packets 0

   output packets 0, bytes 0, multicast packets 0 broadcast packets 0
```

Figure 53. SHOW INTERFACE Command

The fields are described in Table 13.

Table 13. SHOW INTERFACE Command

Parameter	Description
Interface	Port number.

Table 13. SHOW INTERFACE Command (Continued)

Parameter	Description
Link is	The status of the link on the port. This field is UP when the port has a link with a network device, and DOWN when the port does not have a link.
Administrative state	The administrative state of the port. The administrative state will be DOWN if the port was disabled with the SHUTDOWN command. Otherwise, the administrative state of the port will be UP. To disable and enable ports, refer to "SHUTDOWN" on page 247 and "NO SHUTDOWN" on page 221, respectively.
Address is	The MAC address of the port.
Description	The port's description. To set the description, refer to "DESCRIPTION" on page 208.
Index mtu	The maximum packet size of the ports. The ports have a maximum packet size of 9198 bytes. This is not adjustable.
Unknown Ingress/Egress Multicast Blocking	The status of multicast blocking on the port. To set multicast blocking, refer to Chapter 35, "Multicast Commands" on page 565.
SNMP link-status traps	The status of SNMP link traps on the port. The switch sends link traps if the status is Enabled and does not send link traps if the status is Disabled. To enable and disable link traps, refer to "SNMP TRAP LINK-STATUS" on page 248 and "NO SNMP TRAP LINK-STATUS" on page 222, respectively.
Bandwidth	The current operating speed of the port. The bandwidth will be Unknown if the port does not have a link to a network device.
Input statistics	Ingress packet statistics.
Output statistics	Egress packet statistics.

Examples

This command displays the current operational state of all the ports:

```
awplus# show interface
```

This command displays the current operational state of ports 1 to 4:

```
awplus# show interface port1.0.1-port1.0.4
```

SHOW INTERFACE BRIEF

Syntax

```
show interface brief
```

Parameter

None

Modes

Privileged Exec mode

Description

Use this command to display the administrative and link statuses of all of the ports on the switch. An example of the information is shown in Figure 54.

```
Interface StatusProtocol
port1.0.1admin up down
port1.0.2admin up down
port1.0.3admin up down
port1.0.4admin up down
port1.0.5admin up down
port1.0.6admin up down
```

Figure 54. SHOW INTERFACE BRIEF Command

The fields are described in Table 14.

Table 14. SHOW INTERFACE BRIEF Command

Field	Description
Interface	Indicates the port number.
Status	Indicates the administrative state of the port. The administrative state is DOWN if the port was disabled with the SHUTDOWN command. Otherwise, the administrative state of the port is UP. To disable and enable ports, refer to "SHUTDOWN" on page 247 and "NO SHUTDOWN" on page 221, respectively.

Table 14. SHOW INTERFACE BRIEF Command (Continued)

Field	Description
Protocol	Indicates the status of the link on the port. This field is UP when the port has a link with a network device, and DOWN when the port does not have a link.

Example

The following example displays the administrative and link statuses of all of the ports on the switch:

```
awplus# show interface brief
```

SHOW INTERFACE STATUS

Syntax

```
show interface [port] status
```

Parameter

port

Specifies the port whose parameter settings you want to view. You can display more than one port at a time. To display all the ports, do not include a port number.

Modes

Privileged Exec mode

Description

Use this command to display the speed, duplex mode, and VLAN settings of the ports. An example of the information is shown in Figure 55.

```
PortNameStatus    Vlan        Duplex         SpeedType
port1.0.1Port_01down3         half           10010/100/1000Base-T
port1.0.2Port_02up11          auto           auto10/100/1000Base-T
port1.0.2Port_02up2           auto           auto10/100/1000Base-T
port1.0.2Port_02up2           full           10010/100/1000Base-T
port1.0.2Port_02up2           auto           auto10/100/1000Base-T
```

Figure 55. SHOW INTERFACE STATUS Command

The fields are described in Table 15.

Table 15. SHOW INTERFACE STATUS Command

Parameter	Description
Port	Port number.
Name	Description of port. To set the description, refer to "DESCRIPTION" on page 208.
Status	Link status of the port. The status is Up if the port has a link to a network device. The status is Down if the port does not have a link.
VLAN	The ID of the VLAN in which the port is an untagged member.

Table 15. SHOW INTERFACE STATUS Command (Continued)

Parameter	Description
Duplex	The duplex mode setting of the port. The setting can be half, full or auto for Auto-Negotiation. To set the duplex mode, refer to “DUPLEX” on page 210.
Speed	The speed of the port. The settings are 10, 100, or 1000 Mbps, or auto for Auto-Negotiation.
Type	The Ethernet standard of the port.

Examples

This command displays the settings of all the ports:

```
awplus# show interface status
```

This command displays the settings of ports 17 and 18:

```
awplus# show interface port1.0.17-port1.0.18 status
```

SHOW PLATFORM TABLE PORT COUNTERS

Syntax

```
show platform table port [port] counters
```

Parameter

port

Specifies the port whose statistics you want to view. You can specify more than one port at a time in the command. To view all the ports, omit this parameter.

Modes

Privileged Exec mode

Description

Use this command to display the packet statistics for the individual ports on the switch. The statistics are described in Table 16. To clear the packet counters, refer to "CLEAR PORT COUNTER" on page 207.

Table 16. SHOW PLATFORM TABLE PORT COUNTERS Command

Parameter	Description
64 65-127 128-255 256-511 512-1023 1024-1518 1519-1522	Number of frames transmitted by the port, grouped by size.
General Counters	
Octets	Number of received and transmitted octets.
Pkts	Number received and transmitted packets.
CRCErrors	Number of frames with a cyclic redundancy check (CRC) error but with the proper length (64-1518 bytes) received by the port.
FCSErrors	Number of ingress frames that had frame check sequence (FCS) errors.

Table 16. SHOW PLATFORM TABLE PORT COUNTERS Command

Parameter	Description
MulticastPkts	Number of received and transmitted multicast packets.
BroadcastPkts	Number of received and transmitted broadcast packets
PauseMACCtrlFrms	Number of received and transmitted flow control pause packets.
OversizePkts	Number of received packets that exceeded the maximum size as specified by IEEE 802.3 (1518 bytes including the CRC).
Fragments	Number of undersized frames, frames with alignment errors, and frames with frame check sequence (FCS) errors (CRC errors).
Jabbers	Number of occurrences of corrupted data or useless signals the port has encountered.
UnsupportOpcode	Number of MAC Control frames with unsupported opcode.
UndersizePkts	Number of frames that were less than the minimum length as specified in the IEEE 802.3 standard (64 bytes including the CRC).
SingleCollsnFrm	Number of frames that were transmitted after at least one collision.
MultCollsnFrm	Number of frames that were transmitted after more than one collision.
LateCollisions	Number of late collisions.
ExcessivCollsns	Number of excessive collisions.
Collisions	Total number of collisions on the port.
Layer 3 Counters	
ifInUcastPkts	Number of ingress unicast packets.
ifOutUcastPkts	Number of egress unicast packets.
ifInDiscards	Number of ingress packets that were discarded.

Table 16. SHOW PLATFORM TABLE PORT COUNTERS Command

Parameter	Description
ifOutErrors	Number of packets that were discarded prior to transmission because of an error.
ipInHdrErrors	Number of ingress packets that were discarded because of a hardware error.
Miscellaneous Counters	
MAC TxErr	Number of frames not transmitted correctly or dropped due to an internal MAC transmit error.
MAC RxErr	Number of Receive Error events seen by the receive side of the MAC.
Drop Events	Number of frames successfully received and buffered by the port, but discarded and not forwarded.

Examples

This command displays the statistics for ports 21 and 23:

```
awplus# show platform table port port1.0.21,port1.0.23
counters
```

This command displays the statistics for all the ports on the switch:

```
awplus# show platform table port counters
```

SHOW RUNNING-CONFIG INTERFACE

Syntax

```
show running-config interface port
```

Parameters

port

Specifies a port, multiple ports, or a range of ports. For a detailed explanation on how to specify ports, see “Port Numbers in Commands” on page 69.

Modes

Privileged Exec mode

Description

Use this command to display the configuration settings of the ports. The command displays only the settings that have been changed from their default values and includes those values that have not yet been saved in the active boot configuration file. An example of the information is shown in Figure 56.

```
interface port1.0.1
   dot1x port-control auto
   no auth dynamic-vlan-creation

interface port1.0.3-port1.0.4
   switchport access vlan 2
```

Figure 56. SHOW RUNNING-CONFIG INTERFACE Command

Example

This example displays the configuration settings for ports 1, 3, and 4:

```
awplus# show running-config interface port1.0.1,port1.0.3-
port1.0.4
```

SHOW STORM-CONTROL

Syntax

```
show storm-control [port]
```

Parameters

port

Specifies the port whose storm-control, threshold limit settings you want to view. You can specify more than one port at a time. To display all the ports, do not include this parameter.

Mode

Privileged Exec mode

Description

Use this command to display information about the threshold limit settings on the ports. Figure 57 shows an example of the information when you enter the following command:

awplus# show storm-control port1.0.15

```
Port     BcastLevel   Mcastlevel   Dlflevel
Port1.0.15 30100  100
```

Figure 57. SHOW STORM-CONTROL Command

See Table 17 for a description of the table headings.

Table 17. SHOW STORM-CONTROL Command

Column	Description
Port	Indicates the port number.
BcastLevel	Indicates the maximum number of ingress broadcast packets per second for the port. Broadcast packets beyond this number are discarded.
McastLevel	Indicates the maximum number of ingress multicast packets per second for the port. Multicast packets beyond this number are discarded.

Table 17. SHOW STORM-CONTROL Command (Continued)

Column	Description
DlfLevel	Indicates the maximum number of unknown unicast packets, destination lookup failure (DLF) packets per second for the port. DLF packets beyond this number are discarded.

Examples

This command displays the settings of all the ports:

```
awplus# show storm-control
```

This command displays the settings of ports 15 and 18:

```
awplus# show storm-control port1.0.15,port1.0.18
```

SHOW SYSTEM PLUGGABLE

Syntax

```
show system pluggable
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display information about the SFP modules in the switch.

```
 System Pluggable Information

PortVendorDevice  Serial NumberDatecode      Type
-----------------------------------------------------------
1.0.49ATIAT-SPSX  A03240R08420074120081018   1000BASE-SX
1.0.51ATIAT-SPSX  A03240R08420074920081018   1000BASE-SX
-----------------------------------------------------------
```

Figure 58. SHOW SYSTEM PLUGGABLE Command

Example

This example displays SFP module information:

```
awplus# show system pluggable
```

SHOW SYSTEM PLUGGABLE DETAIL

Syntax

```
show system pluggable detail
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display information about the SFP modules in the switch. See Figure 59. The SHOW SYSTEM PLUGGABLE DETAIL command provides more detailed information than the SHOW SYSTEM PLUGGABLE command. See “SHOW SYSTEM PLUGGABLE” on page 245.

```
Port1.0.49
==========
Vendor Name:ATI
Device Name:AT-SPSX
Device Type:1000BASE-SX
Serial Number:A03240R084200741
Manufacturing Datecode:20081018
SFP Laser Wavelength:850nm

Link Length Supported
   OM1 (62.5um) Fiber:270m
   OM2 (50um) Fiber:550m
```

Figure 59. SHOW SYSTEM PLUGGABLE DETAIL Command

The OM1 field specifies the link length supported by the pluggable transceiver using 62.5 micron multi-mode fiber. The OM2 field specifies the link length supported by the pluggable transceiver using 50 micron multi-mode fiber.

Example

This example displays detailed information about SFP modules:

```
awplus# show system pluggable detail
```

SHUTDOWN

Syntax

```
shutdown
```

Parameter

None

Mode

Port Interface mode

Description

Use this command to disable ports. Ports that are disabled do not forward traffic. You might disable ports that are unused to secure them from unauthorized use or that are having problems with network cables or their link partners. The default setting for the ports is enabled.

To reactivate a port, refer to "NO SHUTDOWN" on page 221.

Confirmation Command

"SHOW INTERFACE" on page 231

Example

This example disables ports 15 and 16:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15,port1.0.16
awplus(config-if)# shutdown
```

SNMP TRAP LINK-STATUS

Syntax

```
snmp trap link-status
```

Parameter

None

Mode

Port Interface mode

Description

Use this command to activate SNMP link traps on the ports. The switch sends an SNMP trap to an SNMP trap receiver on your network whenever a port experiences a change in its link state.

To disable link traps on a port, refer to “NO SNMP TRAP LINK-STATUS” on page 222.

Note
For the switch to send SNMP traps, you must activate SNMP and specify one or more trap receivers. For instructions, refer to Chapter 76, “SNMPv1 and SNMPv2c Commands” on page 1181 or Chapter 77, “SNMPv3 Commands” on page 1205.

Confirmation Command

“SHOW INTERFACE” on page 231

Example

This example activates link traps on port 22:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.22
awplus(config-if)# snmp trap link-status
```

SPEED

Syntax

```
speed auto|10|100|1000
```

Parameters

auto
: Activates Auto-Negotiation so that the speed is configured automatically.

10
: Specifies 10 Mbps.

100
: Specifies 100 Mbps.

1000
: Specifies 1000 Mbps. This setting should not be used on twisted pair ports. For 1000Mbps, full duplex operation, a twisted pair port must be set to Auto-Negotiation.

Mode

Port Interface mode

Description

Use this command to manually set the speeds of the twisted pair ports or to activate Auto-Negotiation.

Confirmation Commands

- Configured speed: "SHOW INTERFACE STATUS" on page 237
- Current operating speed: "SHOW INTERFACE" on page 231

Examples

This example sets the speed on ports 11 and 17 to 100 Mbps:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11,port1.0.17
awplus(config-if)# speed 100
```

This example activates Auto-Negotiation on port 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# speed auto
```

STORM-CONTROL

Syntax

```
storm-control broadcast|multicast|dlf level value
```

Parameters

broadcast
Specifies broadcast packets.

multicast
Specifies multicast packets.

dlf
Specifies unknown unicast packets.

level
Specifies the maximum number of ingress packets per second of the designated type the port will forward. The range is 0 to 33,554,431 packets.

Mode

Port Interface mode

Description

Use this command to set maximum thresholds for the ingress packets on the ports. Ingress packets that exceed the thresholds are discarded by the ports. Thresholds can be set independently for broadcast packets, multicast packets, and unknown unicast packets. To view the current thresholds of the ports, refer to "SHOW RUNNING-CONFIG" on page 168.

To remove threshold levels from the ports, refer to "NO STORM-CONTROL" on page 223.

Confirmation Commands

"SHOW STORM-CONTROL" on page 243

"SHOW RUNNING-CONFIG" on page 168

Examples

This example sets the maximum threshold level of 5,000 packets per second for ingress broadcast packets on port 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12
awplus(config-if)# storm-control broadcast level 5000
```

This example sets the maximum threshold level of 100,000 packets per second for ingress multicast packets on port 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# storm-control multicast level 100000
```

This example sets the threshold level of 200,000 packets per second for ingress unknown unicast packets on ports 15 and 17:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15,port1.0.17
awplus(config-if)# storm-control dlf level 200000
```

Chapter 11

Power Over Ethernet

Overview

The AT-FS970M/8PS, AT-FS970M/8PS-E, AT-FS970M/24PS, and AT-FS970M/48PS switches feature Power over Ethernet (PoE) on the 10/100Base-Tx ports. PoE is used to supply power to network devices over the same twisted pair cables that carry the network traffic.

The main advantage of PoE is that it can make it easier to install a network. The selection of a location for a network device is often limited by whether there is a power source nearby. This constraint limits equipment placement or requires the added time and cost of having additional electrical sources installed. However, with PoE, you can install PoE-compatible devices wherever they are needed without having to worry about whether there is a power source nearby.

Power Sourcing Equipment (PSE)

A device that provides PoE to other network devices is referred to as power sourcing equipment (PSE). The AT-FS970M/8PS, AT-FS970M/8PS-E, AT-FS970M/24PS, and AT-FS970M/48PS switches are PSE devices providing DC power to the network cable and functioning as a central power source for other network devices.

Powered Device (PD)

A device that receives power from a PSE device is called a *powered device* (PD). Examples include wireless access points, IP phones, webcams, and even other Ethernet switches.

PD Classes

PDs are grouped into five classes. The classes are based on the amount of power that PDs require. The AT-FS970M PoE switches support all five classes listed in Table 18.

Table 18. IEEE Powered Device Classes

Class	Maximum Power Output from a Switch Port	Power Ranges of the PDs
0	15.4W	0.44W to 12.95W
1	4.0W	0.44W to 3.84W
2	7.0W	3.84W to 6.49W
3	15.4W	6.49W to 12.95W
4	30W	12.95W to 25.5W

Power Budget

Power budget is the maximum amount of power that the PoE switch can provide at one time to the connected PDs.

The AT-FS970M/8PS and AT-FS970M/8PS-E switches have one power supply. The AT-FS970M/24PS and AT-FS970M/48PS switches have two

power supplies and can be operated using either one power supply or both power supplies. One power supply is responsible for providing 185 watts of the power budget. Table 19 shows power budget per model.

Table 19. PoE Switch's Power Budget

Switch Model	When Using One Power Supply	When Using Two Power Supplies
AT-FS970M/8PS	185W	N/A
AT-FS970M/8PS-E	185W	N/A
AT-FS970M/24PS	185W	370W
AT-FS970M/48PS	185W	370W

Port Prioritization

As long as the total power requirements of the PDs is less than the total available power of the switch, it can supply power to all of the PDs. However, when the PD power requirements exceed the total available power, the switch denies power to some ports based on a process called port prioritization.

The ports on the PoE switch are assigned to one of three priority levels. These levels and descriptions are listed in Table 20.

Table 20. PoE Port Priorities

Priority Level	Description
Critical	This is the highest priority level. Ports set to the Critical level are guaranteed to receive power before any of the ports assigned to the other priority levels.
High	Ports set to the High level receive power only when all the ports assigned to the Critical level are already receiving power.
Low	This is the lowest priority level. Ports set to the Low level receive power only when all the ports assigned to the Critical and High levels are already receiving power. This level is the default setting.

Without enough power to support all the ports set to the same priority level at one time, the switch provides power to the ports based on the port number, in ascending order. For example, when all of the ports in the switch are set to the low priority level, and the power requirements are exceeded on the switch, port 1 has the highest priority level, port 2 has the next highest priority level and so forth.

Enabling and Disabling PoE

Enabling PoE on ports allows the switch to supply power to PDs connected to the ports. In order for PDs to receive power, PoE must be enabled on the ports. By default, PoE is enabled on all the ports on the PoE switch.

The switch detects whether or not a network device connected to the port is a valid PD. If the device is not a valid PD, the port functions as a regular Ethernet port even when PoE is enabled on the port. The PoE feature remains activated on the port, but no power is delivered to the device.

Disabling PoE on the port turns off the power supply to the port. You may want to disable PoE on the ports used only for data traffic in order to prevent them from unauthorized power use.

There are two ways to disable and enable PoE:

- Globally: all the ports on the switch at a time.
- Individually: on a port basis.

To enable PoE globally, use the SERVICE POWER-INLINE command in the Global Configuration mode. See “SERVICE POWER-INLINE” on page 283. The NO SERVICE POWER-INLINE command disables PoE on all the ports on the switch. See “NO SERVICE POWER-INLINE” on page 274.

To enable PoE on an individual port basis, use the POWER-INLINE ENABLE command in the Port Interface mode. See “POWER-INLINE ENABLE” on page 278. The NO POWER-INLINE command disables PoE on a port. See “NO POWER-INLINE ENABLE” on page 270.

This example enables PoE globally:

```
awplus> enable
awplus# configure terminal
awplus(config)# service power-inline
```

This example disables PoE globally:

```
awplus> enable
awplus# configure terminal
awplus(config)# no service power-inline
```

This example enables PoE individually on port 6 and port 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.6,port1.0.8
awplus(config-if)# power-inline enable
```

This example disables PoE individually on port 5 to port 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5-port1.0.8
awplus(config-if)# no power-inline enable
```

Adding PD Descriptions to Ports

PDs connected to the ports are easier to identify if you give them descriptions. To add descriptions to PDs, use the POWER-INLINE DESCRIPTION command in the Port Interface mode. Here is the format:

```
power-inline description description
```

The *description* parameter can consist of up to 256 alphanumeric characters. Spaces and special characters are allowed. You can assign a description to more than one port at a time. See “POWER-INLINE DESCRIPTION” on page 277.

To remove the current description from the port without assigning a new one, use the NO POWER-INLINE DESCRIPTION command. See “NO POWER-INLINE DESCRIPTION” on page 269.

This example adds a PD description of “Desk Phone” to port 1.0.5 and port1.0.6:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5,port1.0.6
awplus(config-if)# power-inline description Desk Phone
```

This example removes the description previously added to the port 6:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.6
awplus(config-if)# no power-inline description
```

Note
To add a general description to a port, use the DESCRIPTION command. For more information, see “DESCRIPTION” on page 208.

Prioritizing Ports

When the total power requirements of the PDs exceed the total available power of the switch, the switch denies power to one or more ports based on port prioritization.To guarantee power to the most critical PDs before any other PDs, the switch allows you to prioritize the ports for power supply.

You can assign one of three priority levels to a port: Critical, High, and Low. See "Port Prioritization" on page 255 for details. By default, all ports are set to the Low priority level. To change the priority level, use the POWER-INLINE PRIORITY command. Here is the format:

```
power-inline priority critical | high | low
```

To guarantee that the most critical PDs receive power, assign the highest priority level to the PDs. See "POWER-INLINE PRIORITY" on page 280.

To reset the priority level to the default Low level, use the NO POWER-INLINE PRIORITY command. See "NO POWER-INLINE PRIORITY" on page 272.

This example assigns ports 1, 2, and 3 to the Critical priority level to guarantee these ports receive power before any other ports with the High or Low priority level:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1-port1.0.3
awplus(config-if)# power-inline priority critical
```

This example assigns port 4 to port 10 to the High priority level so that the ports receive power before any ports with the Low priority level:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4-port1.0.10
awplus(config-if)# power-inline priority high
```

This example sets port 8 to the Low priority level:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.8
awplus(config-if)# no power-inline priority
```

Managing the Maximum Power Limit on Ports

To manage the switch's power and optimize its power distribution, the switch allows you to adjust the power limit that the switch provides to each port. The switch automatically sets a default power limit to the port where a PD is connected and allows you to change the default settings.

The switch detects the power class of a PD when the PD is connected to the port. PDs are assigned one of five classes described in "PD Classes" on page 254. Each class has a maximum power. The switch sets this value as a default power limit to the port where the PD is connected.

For example, you connect an IP phone to port 1 on the PoE switch. The switch detects that the power class of the IP phone is 2. The maximum power output from the switch for a PD of class 2 is 7.0 watts. Thus, the switch sets 7.0 watts as the default power limit to port 1.

If a PD connected to the port does not support power classification, a default class of 0 is assigned to the PD. The maximum power for a PD of class 0 is 15.4 watts so that the switch sets 15.4 watts to the default power limit to the port.

To change a default power limit to the port, use the POWER-INLINE MAX command in the Port Interface mode. Specify the value in milliwatts (mW) See "POWER-INLINE MAX" on page 279.

This example changes the maximum power that the switch provides port 2 to 4.0 watts (4000 milliwatts):

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# power-inline max 4000
```

Managing Legacy PDs

The PoE switch automatically detects whether or not a device plugged into the PoE-enabled port is a valid PD. The switch supports PDs compliant with the IEEE 802.3af and IEEE 802.3at PoE standards. In addition, the switch supports legacy PDs that were designed before the IEEE standards were finalized.

If the switch detects the connected device as an invalid PD, the port functions as a regular Ethernet port. The PoE feature remains activated on the port, but no power is delivered to the PD.

To enable the switch to detect legacy PDs as valid PDs, use the POWER-INLINE ALLOW-LEGACY command to provide power to legacy PDs. See "POWER-INLINE ALLOW-LEGACY" on page 276. To disable the switch to detect legacy PDs as valid PDs, use the NO POWER-INLINE ALLOW-LEGACY command not to provide power to legacy PDs. By default, the switch detects legacy PDs as valid PDs. See "NO POWER-INLINE ALLOW-LEGACY" on page 268.

This example enables the switch to detect legacy PDs as valid PDs on port 1 to port 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1-port1.0.3
awplus(config-if)# power-inline allow-legacy
```

This example disables the switch to detect legacy PDs as valid PDs on ports 1:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# no power-inline allow-legacy
```

Monitoring Power Consumption

You can monitor the power consumption of the switch and PDs by configuring the unit to transmit an SNMP power-inline trap if their combined power requirements exceed a defined threshold. The threshold is specified as a percentage of the switch's nominal power, which is the total available power of the switch. You can view the nominal power with "SHOW POWER-INLINE" on page 284. The threshold has the range of 1 to 99%. You may specify only one threshold. The commands for setting the threshold and activating the trap are listed in Table 21.

Table 21. Receiving Power Consumption Notification

To Do This Task	Use This Command
Set the power threshold as a percentage of the switch's nominal power.	POWER-INLINE USAGE-THRESHOLD
Activate SNMP on the switch.	SNMP-SERVER
Activate the transmission of SNMP trap for PoE.	SNMP-SERVER ENABLE TRAP POWER-INLINE

Note
You have to configure SNMP to use the trap. For instructions, refer to Chapter 75, "SNMPv1 and SNMPv2c" on page 1169 or Chapter 77, "SNMPv3 Commands" on page 1205.

This example configures the switch to send the SNMP power-inline trap if the power requirements of the switch and PDs exceed 90% of its nominal power:

```
awplus> enable
awplus# configure terminal
awplus(config)# power-inline usage-threshold 90
awplus(config)# snmp-server
awplus(config)# snmp-server enable trap power-inline
```

Displaying PoE Information

The switch allows you to display PoE information using three commands. Each command displays a different set of PoE information as described in Table 22.

Table 22. PoE Show Commands

Command	Description
SHOW POWER-INLINE	Displays PoE information about the switch and all the ports on the switch.
SHOW POWER-INLINE COUNTERS	Displays the PoE event counters for the ports.
SHOW POWER-INLINE INTERFACE	Displays PoE information of specified ports.
SHOW POWER-INLINE INTERFACE DETAIL	Displays detailed PoE information of the specified ports.

This example displays PoE information on both the switch and all the ports on the switch:

```
awplus# show power-inline
```

Figure 60 shows an example of the information the command displays. The columns are described in Table 24 on page 285.

```
PoE Status:
Nominal Power: 490W
Power Allocated: 346.0W
Actual Power Consumption: 151.0W
Operational Status: On
Power Usage Threshold: 80% (392W)
PoE Interface:

Interface  Admin    Pri   Oper     Power(mW) Device   Class  Max(mW)
port1.0.1  Enabled  Low   Powered  3840      Phone#1  1      4000 [C]
port1.0.2  Enabled  High  Powered  6720      n/a      2      7000 [C]
port1.0.3  Enabled  Low   Powered  14784     n/a      3      15400 [C]
port1.0.4  Enabled  Crit  Powered  14784     n/a      3      15400 [C]
port1.0.5  Enabled  Crit  Powered  3840      Phone#2  1      4000 [C]
port1.0.6  Enabled  High  Powered  6720      n/a      2      7000 [C]
port1.0.7EnabledLowPowered14784n/a315400 [C]
```

Figure 60. SHOW POWER-INLINE Command

This example displays the PoE information of port 1 through port 4:

```
awplus# show power inline interface port1.0.1-port1.0.4
```

Figure 61 shows an example of the information the command displays. The columns are described in Table 24 on page 285.

```
Interface  Admin     Pri   Oper      Power  Device       Class  Max(mW)
port1.0.1  Disabled  Low   Disabled  0      n/a          0      15400 [C]
port1.0.2  Enabled   High  Powered   3840   Desk Phone   1      5000 [U]
port1.0.3  Enabled   Crit  Powered   6720   AccessPoint  2      7000 [C]
port1.0.4  Disabled  Low   Disabled  0      n/a          0      15400 [C]
```

Figure 61. SHOW POWER-INLINE INTERFACE Command

This example displays the detailed PoE information of port 10:

```
awplus# show power inline interface port1.0.10 detail
```

Figure 62 shows an example of the information the command displays. The columns are described in Table 26 on page 290.

```
Interface port1.0.10
   Powered device type: Desk Phone #1
   PoE admin enabled
    Low Priority
   Detection status: Powered
   Current power consumption: 00 mW
   Powered device class: 1
   Power allocated: 5000 mW (from configuration)
   Detection of legacy device is disabled
   Powered pairs: Data
```

Figure 62. SHOW POWER-INLINE INTERFACE DETAIL Command

Chapter 12

Power Over Ethernet Commands

The Power over Ethernet (PoE) commands are summarized in Table 23. These commands are only supported on the PoE switches.

Table 23. Power over Ethernet Commands

Command	Mode	Description
“CLEAR POWER-INLINE COUNTERS INTERFACE” on page 267	Privileged Exec	Clears the PoE event counters on the ports.
“NO POWER-INLINE ALLOW-LEGACY” on page 268	Port Interface	Configures ports to deny power to legacy powered devices (PDs).
“NO POWER-INLINE DESCRIPTION” on page 269	Port Interface	Deletes the PD descriptions.
“NO POWER-INLINE ENABLE” on page 270	Port Interface	Disables PoE on the ports.
“NO POWER-INLINE MAX” on page 271	Port Interface	Restores a port’s power limit to the default value.
“NO POWER-INLINE PRIORITY” on page 272	Port Interface	Restores a port’s priority setting to the default Low level.
“NO POWER-INLINE USAGE-THRESHOLD” on page 273	Global Configuration	Resets the power usage threshold to the default 80%.
“NO SERVICE POWER-INLINE” on page 274	Global Configuration	Disables PoE on all of the ports on the switch.
“NO SNMP-SERVER ENABLE TRAP POWER-INLINE” on page 275	Global Configuration	Disables the SNMP power-inline trap.
“POWER-INLINE ALLOW-LEGACY” on page 276	Port Interface	Configures a port to support legacy PDs.
“POWER-INLINE DESCRIPTION” on page 277	Port Interface	Adds a PD description to a port.
“POWER-INLINE ENABLE” on page 278	Port Interface	Enables PoE on a port.
“POWER-INLINE MAX” on page 279	Port Interface	Specifies the power limit of a port.

Table 23. Power over Ethernet Commands (Continued)

Command	Mode	Description
“POWER-INLINE PRIORITY” on page 280	Port Interface	Assigns a PoE priority level to a port.
“POWER-INLINE USAGE-THRESHOLD” on page 282	Global Configuration	Sets the power threshold for the SNMP power-inline trap.
“SERVICE POWER-INLINE” on page 283	Global Configuration	Activates PoE on all of the ports on the switch.
“SHOW POWER-INLINE” on page 284	Privileged Exec	Displays switch and port PoE information.
“SHOW POWER-INLINE COUNTERS INTERFACE” on page 287	Privileged Exec	Displays the port PoE event counters.
“SHOW POWER-INLINE INTERFACE” on page 289	Privileged Exec	Displays port PoE information.
“SHOW POWER-INLINE INTERFACE DETAIL” on page 290	Privileged Exec	Displays additional port PoE information.
“SNMP-SERVER ENABLE TRAP POWER-INLINE” on page 293	Global Configuration	Activates the SNMP power-inline trap for PoE.

CLEAR POWER-INLINE COUNTERS INTERFACE

Syntax

```
clear power-inline counters interface [port]
```

Parameter

port

Specifies a port. You can specify more than one port and clear event counters for multiple ports.

Mode

Privileged Exec mode

Description

Use this command to clear the PoE port event counters. To clear all of the port counters, do not enter a port number.

Confirmation Command

"SHOW POWER-INLINE COUNTERS INTERFACE" on page 287

Examples

This example clears all of the PoE port event counters:

```
awplus# clear power-inline counters interface
```

This example clears the event counters on ports 4 to 6:

```
awplus# clear power-inline counters interface port1.0.4-
port1.0.6
```

NO POWER-INLINE ALLOW-LEGACY

Syntax

```
no power-inline allow-legacy
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to configure the ports to deny power to legacy PDs. Legacy PDs are PoE devices that were designed before the IEEE 802.3af and IEEE 802.3at PoE standards were finalized. This is the default setting for the ports.

Confirmation Command

“SHOW POWER-INLINE INTERFACE DETAIL” on page 290

Example

This example configures ports 1 to 12 to deny power to legacy PDs:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1-port1.0.12
awplus(config-if)# no power-inline allow-legacy
```

NO POWER-INLINE DESCRIPTION

Syntax

```
no power-inline description
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to delete PD descriptions from the ports.

Confirmation Commands

"SHOW POWER-INLINE" on page 284

"SHOW POWER-INLINE INTERFACE" on page 289

"SHOW POWER-INLINE INTERFACE DETAIL" on page 290

Example

The following example deletes the PD description from port 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# no power-inline description
```

NO POWER-INLINE ENABLE

Syntax

```
no power-inline enable
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to disable PoE on the ports. Ports do not transmit power when PoE is disabled, but they do forward network traffic.

Confirmation Commands

“SHOW POWER-INLINE” on page 284

“SHOW POWER-INLINE INTERFACE” on page 289

“SHOW POWER-INLINE INTERFACE DETAIL” on page 290

Example

The following example disables PoE on ports 10, 11 and 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.10-port1.0.12
awplus(config-if)# no power-inline enable
```

NO POWER-INLINE MAX

Syntax

```
no power-inline max
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to restore the default maximum power limits on the ports. The default power limits are based on the power classes of the PDs. See "Managing the Maximum Power Limit on Ports" on page 260 for details.

Confirmation Commands

"SHOW POWER-INLINE" on page 284

"SHOW POWER-INLINE INTERFACE" on page 289

"SHOW POWER-INLINE INTERFACE DETAIL" on page 290

Example

This example restores the default maximum power limit on port 6:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.6
awplus(config-if)# no power-inline max
```

NO POWER-INLINE PRIORITY

Syntax

```
no power-inline priority
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to restore the default Low priority setting to the ports.

Confirmation Commands

“SHOW POWER-INLINE” on page 284

“SHOW POWER-INLINE INTERFACE” on page 289

“SHOW POWER-INLINE INTERFACE DETAIL” on page 290

Example

This example restores the default Low priority level to port 20:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.20
awplus(config-if)# no power-inline priority
```

NO POWER-INLINE USAGE-THRESHOLD

Syntax

```
no power-inline usage-threshold
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to reset the power usage threshold to the default 80%. The switch sends an SNMP power-inline trap if the power requirements of the switch and PDs exceed the defined threshold.

Confirmation Command

"SHOW POWER-INLINE" on page 284

Example

This example restores the default power usage threshold of 80%:

```
awplus> enable
awplus# configure terminal
awplus(config)# no power-inline usage-threshold
```

NO SERVICE POWER-INLINE

Syntax

```
no service power-inline
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable PoE on the switch. The ports do not transmit power to the PDs when PoE is disabled, but they do forward network traffic. The default setting for PoE is enabled.

Confirmation Commands

“SHOW POWER-INLINE” on page 284

“SHOW POWER-INLINE INTERFACE” on page 289

“SHOW POWER-INLINE INTERFACE DETAIL” on page 290

Example

This example disables PoE on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no service power-inline
```

NO SNMP-SERVER ENABLE TRAP POWER-INLINE

Syntax

```
no snmp-server enable trap power-inline
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable the transmission of SNMP power-inline traps. The switch sends this trap if the power requirements of the switch and PDs exceed the threshold set with "POWER-INLINE USAGE-THRESHOLD" on page 282

Confirmation Command

"SHOW RUNNING-CONFIG SNMP" on page 1191

Example

The following example disables the SNMP power-inline trap:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server enable trap power-inline
```

POWER-INLINE ALLOW-LEGACY

Syntax

```
power-inline allow-legacy
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to configure the ports to support legacy PDs. Legacy PDs are PoE devices that were designed before the IEEE 802.3af and IEEE 802.3at PoE standards were finalized. The default setting is no support for legacy PDs.

Confirmation Commands

“SHOW POWER-INLINE INTERFACE DETAIL” on page 290

Example

This example configures ports 1 to 6 to support legacy PDs:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1-port1.0.6
awplus(config-if)# power-inline allow-legacy
```

POWER-INLINE DESCRIPTION

Syntax

```
power-inline description description
```

Parameters

description
Specifies a PD description of up to 256 alphanumeric characters. Spaces and special characters are allowed.

Mode

Port Interface mode

Description

Use this command to add PD descriptions to the ports to make the ports and PDs easier to identify.

Note
To add a general description to a port, use the DESCRIPTION command. For more information, see "DESCRIPTION" on page 208.

Confirmation Commands

"SHOW POWER-INLINE" on page 284

"SHOW POWER-INLINE INTERFACE" on page 289

"SHOW POWER-INLINE INTERFACE DETAIL" on page 290

Example

This example adds the PD description "Surveillance Camera5" to port 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# power-inline description Surveillance
Camera5
```

POWER-INLINE ENABLE

Syntax

```
power-inline enable
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to enable PoE on the ports. This is the default setting.

Confirmation Commands

“SHOW POWER-INLINE” on page 284

“SHOW POWER-INLINE INTERFACE” on page 289

“SHOW POWER-INLINE INTERFACE DETAIL” on page 290

Example

This example enables PoE on port 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12
awplus(config-if)# power-inline enable
```

POWER-INLINE MAX

Syntax

```
power-inline max max_power
```

Parameters

max_power
: Specifies the maximum power limit of the ports in milliwatts (mW). The range is 4000 to 30000 mW.

Mode

Port Interface mode

Description

Use this command to set the maximum power limits on the ports. The maximum power limit is the maximum amount of power a port may transmit to a PD. Ports can have different limits. The default power limits are based on the classes of the PDs. See "Managing the Maximum Power Limit on Ports" on page 260 for details.

Confirmation Commands

"SHOW POWER-INLINE" on page 284

"SHOW POWER-INLINE INTERFACE" on page 289

"SHOW POWER-INLINE INTERFACE DETAIL" on page 290

Example

This example sets the maximum power limits on ports 1 to port 6 to 6.5 watts:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1-port1.0.6
awplus(config-if)# power-inline max 6500
```

POWER-INLINE PRIORITY

Syntax

```
power-inline priority critical|high|low
```

Parameters

critical
: Sets ports to the Critical priority level for PoE ports. Ports set to the Critical level are guaranteed power before any of the ports assigned to the other priority levels.

high
: Sets ports to the High priority level. Ports set to the High level receive power only when all of the ports assigned to the Critical level are already receiving power.

low
: Sets ports to the Low priority level. Ports set to the Low level receive power only when all of the ports assigned to the critical and high levels are already receiving power. This level is the default setting.

Mode

Port Interface mode

Description

Use this command to assign PoE priority levels to the ports. The priority levels are Low, High, and Critical. Ports connected to the most critical PDs should be assigned the Critical level to guarantee them power before any of the other ports in the event the switch does not have enough power for all of the PDs.

If the switch does not have enough power to support all the ports set to the same priority level, it allocates power based on port number, in ascending order. For example, if all of the ports are set to the Low priority level, port 1 has the highest priority level, port 2 has the next highest priority level and so forth.

Confirmation Commands

“SHOW POWER-INLINE” on page 284

“SHOW POWER-INLINE INTERFACE” on page 289

“SHOW POWER-INLINE INTERFACE DETAIL” on page 290

Example

This example assigns the Critical priority level to port 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# power-inline priority critical
```

POWER-INLINE USAGE-THRESHOLD

Syntax

```
power-inline usage-threshold threshold
```

Parameters

threshold
: Specifies the power usage threshold in a percentage of the switch's total available system and PoE power. The range is 1 to 99%.

Mode

Global Configuration mode

Description

Use this command to set a threshold of the switch's total available system and PoE power. An SNMP trap is transmitted if the requirements of the switch and the PDs exceed the threshold. To activate the trap, refer to "SNMP-SERVER ENABLE TRAP POWER-INLINE" on page 293. The default setting is 80%.

Confirmation Command

"SHOW POWER-INLINE" on page 284

Example

This example sets the threshold to 90% of the switch's total available power:

```
awplus> enable
awplus# configure terminal
awplus(config)# power-inline usage-threshold 90
```

SERVICE POWER-INLINE

Syntax

```
service power-inline
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enable PoE on the switch. This is the default setting.

Confirmation Commands

"SHOW POWER-INLINE" on page 284

"SHOW POWER-INLINE INTERFACE" on page 289

"SHOW POWER-INLINE INTERFACE DETAIL" on page 290

Example

This example enables PoE on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# service power-inline
```

SHOW POWER-INLINE

Syntax

```
show power-inline
```

Parameter

None

Mode

Privileged Exec mode

Description

Use this command to display operational information about PoE. An example is shown in Figure 63. The fields are described in Table 24 on page 285.

```
PoE Status:
Nominal Power: 490W
Power Allocated: 346.0W
Actual Power Consumption: 151.0W
Operational Status: On
Power Usage Threshold: 80% (392W)
PoE Interface:

Interface  Admin    Pri   Oper     Power(mW) DeviceClassMax(mW)
port1.0.1  Enabled  Low   Powered  3840      n/a1     4000 [C]
port1.0.2  Enabled  High  Powered  6720      n/a2     7000 [C]
port1.0.3  Enabled  Low   Powered  14784     n/a3     15400 [C]
port1.0.4  Enabled  Crit  Powered  14784     n/a3     15400 [C]
port1.0.5  Enabled  Crit  Powered  3840      n/a1     4000 [C]
port1.0.6  Enabled  High  Powered  6720      n/a2     7000 [C]
port1.0.7EnabledLowPowered14784n/a315400 [C]
```

Figure 63. SHOW POWER-INLINE Command

Table 24. SHOW POWER-INLINE Command

Field	Description
Nominal Power	The switch's total available power in watts (W).
Power Allocated	The available power in watts (W) for PDs. This value is updated every 5 seconds.
Actual Power Consumption	The current power consumption in watts (W) of the PDs. This value is updated every 5 seconds.
Operational Status	The operational status of the power supply units (PSU) in the switch. The status can be one of the following: ❒ On: The units are powered on. ❒ Fault: One of the power supplies has encountered a problem.
Power Usage Threshold	The SNMP power-inline trap threshold. A SNMP trap is transmitted if the power requirements of the switch and PDs exceed the threshold. This parameter is set with "POWER-INLINE USAGE-THRESHOLD" on page 282.
PoE Interface	A table of port PoE information.
Interface	The port number.
Admin	The status of PoE on the port. The status can be one of the following: ❒ Enabled: PoE is enabled. The port can transmit power to a PD. PoE is enabled with "POWER-INLINE ENABLE" on page 278. ❒ Disabled: PoE is disabled. The port does not supply power to a PD, but it does forward network traffic. PoE is disabled with "NO POWER-INLINE ENABLE" on page 270.
Pri	The port's PoE priority level. This parameter is set with "POWER-INLINE PRIORITY" on page 280. The priority level can be one of the following: ❒ Low: The lowest priority level. Default level. ❒ High: The higher priority level. ❒ Crit: Critical, the highest priority level.

Table 24. SHOW POWER-INLINE Command (Continued)

Field	Description
Oper	The PoE operating status of the port. The possible status are listed here: ❒ Powered: The port is transmitting power to the PD. ❒ Denied: The port is not transmitting power to the PD because the switch has reached its maximum power capacity. ❒ Off: PoE is disabled on the port. ❒ Fault: The switch is exceeding the total available power. ❒ Test: The port is in a test mode.
Power	The port's current power consumption in milliwatts (mW).
Device	The port's PD description. This parameter is set with "POWER-INLINE DESCRIPTION" on page 277.
Class	The PD's class PD. See "PD Classes" on page 254 for details.
Max (mW)	The port's maximum power limit in milliwatts (mW) and how the limit was set. The methods are listed here: ❒ [U]: The power limit was set with "POWER-INLINE MAX" on page 279. ❒ [L]: The power limit was supplied by LLDP. ❒ [C]: The power limit was set according to the PD's class.

Example

This example displays PoE information about the switch and ports:

```
awplus# show power-inline
```

SHOW POWER-INLINE COUNTERS INTERFACE

Syntax

```
show power-inline counters interface port
```

Parameter

port

Specifies a port. You can specify and display more than one port at a time. Omit this parameter to display all of the ports.

Mode

Privileged Exec mode

Description

Use this command to display the PoE event counters for the ports. An example is shown in Figure 64.

```
PoE Counters:
Interface  MPSAbsent Overload Short Invalid Denied
port1.0.4     0          0       0       0      0
port1.0.5     0          0       0       0      0
port1.0.6     0          0       0       0      0
```

Figure 64. SHOW POWER-INLINE COUNTERS INTERFACE Command

The fields are described in Table 25.

Table 25. SHOW POWER-INLINE COUNTERS INTERFACE Command

Field	Description
Interface	The port number.
Overload	The number of times the PD exceeded the power limit set with "POWER-INLINE MAX" on page 279.
Short	The number of short circuits the port has experienced.
Invalid	The number of times the port detected an invalid signature. An invalid signature indicates an open circuit, a short circuit, or a legacy PD.

Table 25. SHOW POWER-INLINE COUNTERS INTERFACE Command

Field	Description
Denied	The number of times the port had to deny power to the PD because the switch had reached its maximum power capacity.

Example

This command displays the PoE event counters for ports 4 to 6:

```
awplus# show power-inline counters interface port1.0.4-
port1.0.6
```

SHOW POWER-INLINE INTERFACE

Syntax

```
show power-inline interface port
```

Parameter

port
Specifies a port. You can display more than one port at a time.

Mode

Privileged Exec mode

Description

Use this command to display the PoE information on the ports. An example is shown in Figure 65.

```
Interface Admin    Pri   Oper     Power  Device  Class  Max(mW)
port1.0.1 Disabled Low   Disabled 0               0    15400 [C]
port1.0.2 Enabled  High  Powered  3840   Phone     1    5000 [U]
port1.0.3 Enabled  Crit  Powered  6720   AccessPt  2    7000 [C]
port1.0.4 Disabled Low   Disabled 0               0    15400 [C]
```

Figure 65. SHOW POWER-INLINE INTERFACE Command

This command displays a subset of the information the SHOW POWER-INLINE command displays. The fields are described in Table 24 on page 285.

Example

This example displays PoE information for ports 1 to 4:

```
awplus# show power-inline interface port1.0.1-port1.0.4
```

SHOW POWER-INLINE INTERFACE DETAIL

Syntax

`show power-inline interface` *`port`* `detail`

Parameter

port

Specifies a port. You can display more than one port at a time.

Mode

Privileged Exec mode

Description

Use this command to display additional information about the ports. An example is shown in Figure 66.

```
Interface port1.0.1
   Powered device type: Desk Phone #1
   PoE admin enabled
   Priority Low
   Detection status: Powered
   Current power consumption: 00 mW
   Powered device class: 1
   Power allocated: 5000 mW (from configuration)
   Detection of legacy devices is disabled
```

Figure 66. SHOW POWER-INLINE INTERFACE DETAIL Command

The fields are described in Table 26.

Table 26. SHOW POWER-INLINE INTERFACE DETAIL Command

Field	Description
Interface	The port number.
Powered device type	The PD description. The description is set with “POWER-INLINE DESCRIPTION” on page 277.

Table 26. SHOW POWER-INLINE INTERFACE DETAIL Command

Field	Description
PoE admin	The status of PoE on the port. The status can be one of the following: ❒ Enabled: PoE is enabled. The port can transmit power to a PD. PoE is enabled with "POWER-INLINE ENABLE" on page 278. ❒ Disabled: PoE is disabled. The port does not supply power to a PD, but it does forward network traffic. PoE is disabled with "NO POWER-INLINE ENABLE" on page 270.
Priority	The port's PoE priority level. The priority level is set with "POWER-INLINE PRIORITY" on page 280. The priorities are listed here: ❒ Low: the lowest priority level. This is default level. ❒ High: the higher priority level. ❒ Crit: the critical, or highest priority level.
Detection status	The PoE operating status of the port. The possible status are listed here: ❒ Powered: The port is transmitting power to the PD. ❒ Denied: The port is not transmitting power to the PD because the switch has reached its maximum power capacity. ❒ Off: PoE is disabled on the port. ❒ Fault: The switch is exceeding the total available power. ❒ Test: The port is in a test mode.
Current power consumption	The port's current power consumption in milliwatts (mW).
Powered device class	The PD's class. See "PD Classes" on page 254 for details.
Power allocated	The port's power limit in milliwatts (mW).

Table 26. SHOW POWER-INLINE INTERFACE DETAIL Command

Field	Description
Detection of legacy devices	The status of support for a legacy PD on the port: ❒ Enabled: The port supports legacy devices. ❒ Disabled: The port does not support legacy devices. Support for legacy devices is enabled with "POWER-INLINE ALLOW-LEGACY" on page 276 and disabled with "NO POWER-INLINE ALLOW-LEGACY" on page 268.
Powered pairs	The twisted pairs used to transfer power to the PD. This parameter is not adjustable. The value is one of the following: ❒ Data ❒ Spare

Examples

This example displays PoE information for port 1:

```
awplus# show power-inline interface port1.0.1 detail
```

This example displays PoE information for ports 7 to 10:

```
awplus# show power-inline interface port1.0.7-port1.0.10
detail
```

SNMP-SERVER ENABLE TRAP POWER-INLINE

Syntax

```
snmp-server enable trap power-inline
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate the transmission of the SNMP power-inline trap. The trap is sent if the power requirements of the switch and PDs exceed the power limit threshold set with "POWER-INLINE USAGE-THRESHOLD" on page 282.

Confirmation Command

"SHOW RUNNING-CONFIG SNMP" on page 1191

Example

This example enables the SNMP power-inline trap:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server enable trap power-inline
```

Chapter 13

IPv4 and IPv6 Management Addresses

This chapter contains the following information:

Overview

This chapter explains how to assign the switch an IP address. The switch must have an IP address to perform the features in Table 27. It uses the address as its source address when it communicates with other network devices, such as TFTP servers, and Telnet management workstations.

To assign an IP address to the switch, you have to create an IPv4 routing interface in one of its VLANs. You should assign the routing interface to the VLAN from which the switch is to access the management devices. The switch uses the IP address of the routing interface as its source address.

Routing interfaces are also used to implement the IPv4 packet routing feature, described in Chapter 106, “Internet Protocol Version 4 Packet Routing” on page 1843. If you do not plan to use the packet routing feature, create only one IPv4 routing interface on the switch. The switch does not route packets if it has only one interface.

You may also assign the switch one IPv6 management address. However, as the table indicates, the switch does not support all of the features when assigned only an IPv6 address.

Table 27. Features Requiring an IP Management Address on the Switch

Feature	Description	Supported by IPv4 Address	Supported by IPv6 Address
802.1x port-based network access control	Used with a RADIUS server for port security.	yes	no
Enhanced stacking	Used to manage more than one switch from the same local or remote management session.	yes	no
Ping	Used to test for valid links between the switch and other network devices.	yes	yes
RADIUS client	Used for remote management authentication and for 802.1x port-based network access control.	yes	no

Table 27. Features Requiring an IP Management Address on the Switch (Continued)

Feature	Description	Supported by IPv4 Address	Supported by IPv6 Address
RMON	Used with the RMON portion of the MIB tree on an SNMP workstation to remotely monitor the switch.	yes	no
Secure Shell server	Used to remotely manage the switch with a Secure Shell client.	yes	yes
sFlow agent	Used to transmit packet statistics and port counters to an sFlow collector on your network.	yes	no
SNMPv1, v2c, and v3	Used to remotely manage the switch with SNMP.	yes	yes
SNTP client	Used to set the date and time on the switch from an NTP or SNTP server on your network or the Internet.	yes	no
Static ARP entries	Used to add static ARP entries to the switch.	yes	no
Syslog client	Used to send the event messages from the switch to syslog servers on your network for storage.	yes	no
TACACS+ client	Used for remote management authentication using a TACACS+ server on your network.	yes	no
Telnet client	Used to manage other network devices from the switch.	yes	yes
Telnet server	Used to remotely manage the switch with a Telnet client.	yes	yes
TFTP client	Used to download files to or upload files from the switch using a TFTP server.	yes	yes
Non-secure HTTP web browser server	Used to remotely manage the switch with a web browser.	yes	yes

Table 27. Features Requiring an IP Management Address on the Switch (Continued)

Feature	Description	Supported by IPv4 Address	Supported by IPv6 Address
Secure HTTPS web browser server	Used to remotely manage the switch with a web browser, with encryption.	yes	yes

Here are the guidelines to assigning the switch management IPv4 and IPv6 addresses:

- You may assign the switch more than one IPv4 address. However, the switch routes IPv4 packets if it has more than one routing interface, as explained in Chapter 106, “Internet Protocol Version 4 Packet Routing” on page 1843. If you want the switch to support the features in Table 27 on page 296 but not route packets, assign it only one IPv4 routing interface.
- The switch supports only one IPv6 address.
- A management address can be assigned to a VLAN on the switch. It can be assigned to any VLAN, including the Default_VLAN. For background information on VLANs, refer to Chapter 62, “Port-based and Tagged VLANs” on page 927.
- If you assign both IPv4 and IPv6 addresses to the switch, they must be assigned to the same VLAN.
- An IPv4 management address can be assigned manually or from a DHCP server on your network. (To learn the switch’s MAC address to add to a DHCP server, refer to “SHOW SWITCH” on page 169.)
- An IPv6 address must be assigned manually. The switch does not support the assignment of an IPv6 management address from a DHCP server or by IPv6 auto assignment.
- You must also assign the switch a default gateway if the management devices (syslog servers, Telnet workstations, etc,) are not members of the same subnet as the management address. This IP address designates an interface on a router or other Layer 3 device that represents the first hop to the remote subnets or networks where the network devices are located.
- The default gateway address, if needed, must be a member of the same subnet as the management address.

Assigning an IPv4 Management Address and Default Gateway

This section covers the following topics:

Adding an IPv4 Management Address

The command to assign the switch an IPv4 management address is the IP ADDRESS command. It has to be performed from the VLAN Configuration mode of the VLAN to which the address is to be assigned. If the VLAN does not already exist, you have to create it before you can assign the address. For instructions, refer to Chapter 62, "Port-based and Tagged VLANs" on page 927.

Here is the format of the command:

`ip address` *`ipaddress/mask`*`|dhcp`

The IPADDRESS parameter is the IPv4 management address to be assigned the switch. The address is specified in this format:

nnn.nnn.nnn.nnn

Each NNN is a decimal number from 0 to 255. The numbers must be separated by periods.

The MASK parameter is a decimal number that represents the number of bits, from left to right, that constitute the network portion of the address. Here are a couple of basic examples:

- The decimal mask 16 is equivalent to the mask 255.255.0.0.
- The decimal mask 24 is equivalent to the mask 255.255.255.0.

Here are several examples of the command. The first example assigns the switch the management IPv4 address 149.121.43.56/24 to the Default_VLAN, which has the VID number 1.

> **Note**
> By default, the switch is configured with the Default_VLAN which has a VID number of 1 and includes all ports on the switch. The Default_VLAN only has default values and cannot be created, modified or deleted.

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip address 149.121.43.56/24
awplus(config-if)# exit
```

This example assigns the IPv4 management address 143.24.55.67 and subnet mask 255.255.255.0 to a new VLAN titled Tech_support. The VLAN is assigned the VID 17 and consists of untagged ports 5 and 6. The first series of commands create the new VLAN.

`awplus> enable`	Enter the Privileged Executive mode from the User Exec mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# vlan database`	Use the VLAN DATABASE command to enter the VLAN Configuration mode.
`awplus(config-vlan)# vlan 17 name Tech_support`	Use the VLAN command to assign the VID 17 and the name Tech_support to the new VLAN.
`awplus(config-vlan)# exit`	Return to the Global Configuration mode.
`awplus(config)# interface port1.0.5,port1.0.6`	Enter the Port Interface mode for ports 5 and 6.
`awplus(config-if)# switchport access vlan 17`	Use the SWITCHPORT ACCESS VLAN command to add the ports to the new VLAN.
`awplus(config-if)# end`	Return to the Privileged Exec mode.
`awplus# show vlan`	Use the SHOW VLAN command to confirm the configuration of the new VLAN.

The next series of commands assigns the management address 143.24.55.67 and subnet mask 255.255.255.0 to the new VLAN.

`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# interface vlan17`	Use the INTERFACE VLAN command to move to the VLAN Interface.
`awplus(config-if)# ip address 143.24.55.67/24`	Use the IP ADDRESS command to assign the management address 143.24.55.67 and subnet mask 255.255.255.0 to the VLAN.
`awplus(config-if)# end`	Return to the Privileged Exec mode.
`awplus# show ip interface`	Use the SHOW IP INTERFACE command to display the new management IPv4 address.

This example activates the DHCP client so that the management IPv4 address is assigned to the Default_VLAN:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip address dhcp
```

Adding an IPv4 Default Gateway Address

The switch must be assigned a default gateway if the management devices (for example, syslog servers, TFTP servers, and Telnet clients) are not members of the same subnet as the management IPv4 address. A default gateway is an IP address of an interface on a router or other Layer 3 device. It represents the first hop to the networks in which the management devices reside. The switch can have only one IPv4 default gateway and the address must be a member of the same subnet as the management IPv4 address.

The command for assigning the default gateway is the IP ROUTE command in the Global Configuration mode. Here is the format:

`ip route 0.0.0.0/0` *`ipaddress`*

The IPADDDRESS parameter is the default gateway to be assigned the switch.

Note
If an IPv4 default gateway is already assigned to the switch, you must delete it prior to entering the new address. For instructions, refer to “Deleting an IPv4 Management Address and Default Gateway” on page 302.

This example assigns the switch the default gateway address 149.121.43.23:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip route 0.0.0.0/0 149.121.43.23
```

To verify the default route, issue these commands:

```
awplus(config)# exit
awplus# show ip route
```

For information about how to add static IPv4 routes, see “Adding Static and Default Routes” on page 1858.

Deleting an IPv4 Management Address and Default Gateway

The switch does not allow you to make any changes to the current management address on the switch. If you want to change the address or assign it to a different VLAN, you have to delete it and recreate it, with the necessary changes.

To delete a static IPv4 management address from the switch, enter the NO IP ADDRESS command in the VLAN Interface mode in which the current address is assigned. This example of the command deletes the address from a VLAN with the VID of 17:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan17
awplus(config-if)# no ip address
```

To delete an IPv4 management address assigned by a DHCP server, use the NO IP ADDRESS DHCP command. This example of the command deletes the management address assigned by a DHCP server, from a VLAN on the switch with the VID of 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan23
awplus(config-if)# no ip address dhcp
```

To remove the current default gateway, use the NO form of the IP ROUTE command. The command must include the current default gateway. This example removes the default route 149.121.43.23:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip route 0.0.0.0/0 149.121.43.23
```

Displaying an IPv4 Management Address and Default Gateway

The easiest way to view the IPv4 management address and default gateway address of the switch is with the SHOW IP ROUTE command. It displays both addresses at the same time. The command is found in the Privileged Exec mode, as shown here:

```
awplus# show ip route
```

See Figure 67 for an example of the information. The management IPv4 address of the switch is displayed in the first entry in the table and the default gateway address, if assigned to the switch, in the second entry. Figure 67 displays an example of the information.

```
-----------------------------------------------------------------
Destination     Mask            NextHop        Interface   Protocol
-----------------------------------------------------------------
192.168.1.0     255.255.255.0   192.168.1.1     vlan1-0    INTERFACE
-----------------------------------------------------------------
```

Figure 67. SHOW IP ROUTE Command

The columns in the display are defined in Table 29 on page 328.

To view only the management IP address, use the SHOW IP INTERFACE command, also in the Privileged Exec mode:

```
awplus# show ip interface
```

Here is an example of the information from the command.

```
Interface      IP Address         Status         Protocol
VLAN14-0       123.94.146.72      admin up       down
```

Figure 68. SHOW IP INTERFACE Command

For definitions of the columns: See "SHOW IP INTERFACE" on page 327.

Assigning an IPv6 Management Address and Default Gateway

This section covers the following topics:

Adding an IPv6 Management Address

The command to assign the switch an IPv6 management address is the IPv6 ADDRESS command. As with the IPv4 address command, this command has to be performed in the VLAN Configuration mode of the VLAN to which the address is to be assigned. If the VLAN does not already exist, you have to create it first. For instructions, refer to Chapter 62, “Port-based and Tagged VLANs” on page 927. If the switch already has an IPv4 address, the IPv6 address must be assigned to the same VLAN as that address.

Here is the format of the command:

`ipv6 address` *`ipaddress/mask`*

The IPADDRESS parameter is the management IPv6 address for the switch, entered in this format:

nnnn:nnnn:nnnn:nnnn:nnnn:nnnn:nnnn:nnnn

Where N is a hexadecimal digit from 0 to F. The eight groups of digits are separated by colons. Groups where all four digits are ‘0’ can be omitted. Leading ‘0’s in groups can also be omitted. For example, the following IPv6 addresses are equivalent:

12c4:421e:09a8:0000:0000:0000:00a4:1c50

12c4:421e:9a8::a4:1c50

The MASK parameter is a decimal number that represents the number of bits, from left to right, that constitute the network portion of the address. For example, an address whose network designator consists of the first eight bytes would need a mask of 64 bits.

Note
If there is a management IPv6 address already assigned to the switch, you must delete it prior to entering the new address. For instructions, refer to "Deleting an IPv6 Management Address and Default Gateway" on page 306.

Here are several examples of the command. The first example assigns the switch this static management IPv6 address to the Default_VLAN with VID number 1.

90:0a21:091b:0000:0000:0000:09bd:c458

Here are the commands:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ipv6 address 90:a21:91b::9bd:c458/64
awplus(config-if)# exit
```

This example assigns a management IPv6 address to a VLAN with the VID 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan8
awplus(config-if)# ipv6 address 1857:80cf:d54::1a:8f57/64
awplus(config-if)# exit
```

Note
You cannot use a DHCP server or SLAAC (State Address Autoconfiguration) to assign the switch a dynamic IPv6 address. The switch supports only a single static IPv6 address.

Adding an IPv6 Default Gateway Address

The switch must be assigned a default gateway if the management devices (for example, TFTP servers, Telnet clients and SSH clients) are not members of the same subnet as its management IPv6 address. A default gateway is an IP address of an interface on a router or other Layer 3 device that is the first hop to the networks in which the management devices are located. The switch can have only one IPv6 default gateway and the address must be a member of the same subnet as the management IPv6 address.

The command for assigning the default gateway is the IPV6 ROUTE command in the Global Configuration mode. Here is the format of the command:

```
ipv6 route ::/0 ipaddress
```

The IPADDDRESS parameter is the default gateway to be assigned the switch. The address must be an IPv6 address and it must be a member of the same subnet as the management IPv6 address.

Note
This configuration is different in the AT-8000GS switch where the gateway is specified as the Link Local address.

Note
If there is an IPv6 default gateway already assigned to the switch, you must delete it prior to entering the new default gateway. For instructions, refer to “Deleting an IPv6 Management Address and Default Gateway” on page 306.

This example assigns the switch the default gateway address 389c:be45:78::c45:8156:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 route ::/0 389c:be45:78::c45:8156
```

To verify the default route, issue these commands:

```
awplus(config-if)# end
awplus# show ipv6 route
```

Deleting an IPv6 Management Address and Default Gateway

To delete a static IPv6 management address, enter the NO IPV6 ADDRESS command in the VLAN Interface mode in which the current address is assigned. This example of the command deletes the address from a VLAN with the VID 21:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan21
awplus(config-if)# no ipv6 address
```

To remove the default gateway, use the NO form of the IPV6 ROUTE command. The command must include the current default gateway. Here is the format of the command:

```
no ipv6 route ::/0 ipaddress
```

The IPADDRESS parameter specifies the default route to be deleted. This example deletes the default route 389c:be45:78::c45:8156:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ipv6 route ::/0 389c:be45:78::c45:8156
```

Displaying an IPv6 Management Address and Default Gateway

There are two commands for displaying a management IPv6 address and default gateway. If the switch has both an IPv6 address and default gateway, you can display both of them with the SHOW IPV6 ROUTE command, in the Privileged Exec mode, as shown here:

```
awplus# show ipv6 route
```

Here is an example of the information. The default route is displayed first, followed by the management address.

```
IPv6 Routing Table
Codes: C - connected, S - static

S    0:0:0:0:0:0:0:0/0 via 832a:5821:b34a:0:0:0:187:14, vlan4-0

C    832a:5821:b34a:0:0:0:187:95a/64 via ::, vlan4-0
```

Figure 69. SHOW IPV6 ROUTE Command

Another way to display just the management address is with the SHOW IPV6 INTERFACE command, shown here:

```
awplus# show ipv6 interface
```

Here is an example of the information from the command.

```
Interface      IPv6-Address                              Status        Protocol
VLAN3-0        832a:5821:b34a:0:0:0:187:95a/64           admin up      down
```

Figure 70. SHOW IPV6 INTERFACE Command

The columns are defined in Table 31 on page 331.

Chapter 14

IPv4 and IPv6 Management Address Commands

The IPv4 and IPv6 management address commands are summarized in Table 28.

Table 28. Management IP Address Commands

Command	Mode	Description
“CLEAR IPV6 NEIGHBORS” on page 311	Privileged Exec	Clears all dynamic IPv6 neighbor entries.
“IP ADDRESS” on page 312	VLAN Interface	Assigns the switch a static IPv4 management address.
“IP ADDRESS DHCP” on page 314	VLAN Interface	Assigns the switch an IPv4 management address from a DHCP server on your network.
“IP ROUTE” on page 316	Global Configuration	Assigns the switch an IPv4 default gateway address.
“IPV6 ADDRESS” on page 318	VLAN Interface	Assigns the switch a static IPv6 management address.
“IPV6 ROUTE” on page 320	Global Configuration	Assigns the switch an IPv6 default gateway address.
“NO IP ADDRESS” on page 322	VLAN Interface	Deletes the IPv4 management address.
“NO IP ADDRESS DHCP” on page 323	VLAN Interface	Deactivates the IPv4 DHCP client on the switch.
“NO IP ROUTE” on page 324	Global Configuration	Deletes the IPv4 default gateway.
“NO IPV6 ADDRESS” on page 325	VLAN Interface	Deletes the IPv6 management address.
“NO IPV6 ROUTE” on page 326	Global Configuration	Deletes the IPv6 default gateway.
“SHOW IP INTERFACE” on page 327	Privileged Exec	Displays the IPv4 management address.
“SHOW IP ROUTE” on page 328	Privileged Exec	Displays the IPv4 management address and default gateway.

Table 28. Management IP Address Commands (Continued)

Command	Mode	Description
“SHOW IPV6 INTERFACE” on page 331	Privileged Exec	Displays the IPv4 management address.
“SHOW IPV6 ROUTE” on page 332	Privileged Exec	Displays the IPv6 management address and default gateway.

CLEAR IPV6 NEIGHBORS

Syntax

```
clear ipv6 neighbors
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to clear all of the dynamic IPv6 neighbor entries.

Example

This example clears all of the dynamic IPv6 neighbor entries:

```
awplus> enable
awplus# clear ipv6 neighbors
```

IP ADDRESS

Syntax

`ip address` *ipaddress/mask*

Parameters

ipaddress

Specifies a management IPv4 address for the switch. The address is specified in the following format:

nnn.nnn.nnn.nnn

Where each NNN is a decimal number from 0 to 255. The numbers must be separated by periods.

mask

Specifies the subnet mask for the address. The mask is a decimal number that represents the number of bits, from left to right, that constitute the network portion of the address. For example, the IPv4 decimal masks 16 and 24 are equivalent to masks 255.255.0.0 and 255.255.255.0, respectively.

Mode

VLAN Interface mode

Description

Use this command to manually assign the switch an IPv4 management address. You must perform this command from the VLAN Interface mode of the VLAN to which to the address is to be assigned.

To assign the switch an IPv4 address from a DHCP server, refer to “IP ADDRESS DHCP” on page 314.

An IPv4 management address is required to support the features listed in Table 27 on page 296. The switch can have only one IPv4 address, and it must be assigned to the VLAN from which the switch is to communicate with the management devices (such as Telnet workstations and syslog servers). The VLAN must already exist on the switch before you use this command.

Confirmation Command

“SHOW IP INTERFACE” on page 327

Examples

This example assigns the switch the IPv4 management address 142.35.78.21 and subnet mask 255.255.255.0. The address is assigned to the Default_VLAN, which has the VID 1:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip address 142.35.78.21/24
```

This example assigns the switch the IPv4 management address 116.152.173.45 and subnet mask 255.255.255.0. The VLAN assigned the address has the VID 14:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan14
awplus(config-if)# ip address 116.152.173.45/24
```

IP ADDRESS DHCP

Syntax

```
ip address dhcp
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to assign the switch an IPv4 management address from a DHCP server. This command activates the DHCP client, which automatically queries the network for a DHCP server. The client also queries for a DHCP server whenever you reset or power cycle the switch.

You must perform this command from the VLAN Interface mode of the VLAN to which you want to assign the address.

The switch must have a management IPv4 address to support the features listed in Table 27 on page 296. The switch can have only one IPv4 address, and it must be assigned to the VLAN from which the switch is to communicate with the management devices (such as Telnet workstations and syslog servers). The VLAN must already exist on the switch.

To manually assign the switch an IPv4 address, refer to “IP ADDRESS” on page 312.

Note
You cannot assign the switch a dynamic IPv6 address from a DHCP server. An IPv6 management address must be assigned manually with “IPV6 ADDRESS” on page 318.

Confirmation Commands

“SHOW IP INTERFACE” on page 327 and “SHOW IP ROUTE” on page 328

Example

This example activates the DHCP client so that the switch obtains its IPv4 management address from a DHCP server on your network. The address is applied to a VLAN with the VID 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ip address dhcp
```

IP ROUTE

Syntax

```
ip route 0.0.0.0/0 ipaddress
```

Parameters

ipaddress
Specifies an IPv4 default gateway address.

Mode

Global Configuration mode

Description

Use this command to assign the switch an IPv4 default gateway address. A default gateway is an address of an interface on a router or other Layer 3 device. The switch uses the address as the first hop to reaching remote subnets or networks when communicating with management network devices, such as Telnet clients and syslog servers, that are not members of the same subnet as its IPv4 address.

You must assign the switch a default gateway address if both of the following are true:

- ❒ You assigned the switch an IPv4 management address.
- ❒ The management network devices are not members of the same subnet as the management IP address.

Review the following guidelines before assigning a default gateway address to the switch:

- ❒ The switch can have just one IPv4 default gateway address.
- ❒ The switch must already have an IPv4 management address.
- ❒ The management address and the default gateway address must be members of the same subnet.

Confirmation Command

“SHOW IP ROUTE” on page 328

Example

This example assigns the switch the IPv4 default gateway address 143.87.132.45:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip route 0.0.0.0/0 143.87.132.45
```

IPV6 ADDRESS

Syntax

`ipv6 address` *`ipaddress/mask`*

Parameters

ipaddress

Specifies an IPv6 management address for the switch. The address is entered in this format:

nnnn:nnnn:nnnn:nnnn:nnnn:nnnn:nnnn:nnnn

Where N is a hexadecimal digit from 0 to F. The eight groups of digits have to be separated by colons. Groups where all four digits are ‘0’ can be omitted. Leading ‘0’s in groups can also be omitted. For example, the following IPv6 addresses are equivalent:

12c4:421e:09a8:0000:0000:0000:00a4:1c50

12c4:421e:9a8::a4:1c50

mask

Specifies the subnet mask of the address. The mask is a decimal number that represents the number of bits, from left to right, that constitute the network portion of the address. For example, an address whose network designator consists of the first eight bytes would need a mask of 64 bits.

Mode

VLAN Interface mode

Description

Use this command to manually assign the switch an IPv6 management address. You must perform this command from the VLAN Interface mode of the VLAN to which to the address is to be assigned.

Note
An IPv6 management address must be assigned manually. The switch cannot obtain an IPv6 address from a DHCP server.

The switch must have a management address to support the features listed in Table 27 on page 296. The switch can have only one IPv6 address, and it must be assigned to the VLAN from which the switch is to communicate with the management devices (such as Telnet workstations

and syslog servers). The VLAN must already exist on the switch before you use this command.

Confirmation Commands

"SHOW IPV6 INTERFACE" on page 331 and "SHOW IPV6 ROUTE" on page 332

Examples

This example assigns the IPv6 management address 4c57:17a9:11::190:a1d4/64 to the Default_VLAN, which has the VID 1:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ipv6 address 4c57:17a9:11::190:a1d4/64
```

This example assigns the switch the IPv6 management IPv4 address 7891:c45b:78::96:24/64 to a VLAN with the VID 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ipv6 address 7891:c45b:78::96:24/64
```

IPV6 ROUTE

Syntax

```
ipv6 route ::/0 ipaddress
```

Parameters

ipaddress

Specifies an IPv6 address of a default gateway. The address is entered in this format:

nnnn:nnnn:nnnn:nnnn:nnnn:nnnn:nnnn:nnnn

Where N is a hexadecimal digit from 0 to F. The eight groups of digits have to be separated by colons. Groups where all four digits are ‘0’ can be omitted. Leading ‘0’s in groups can also be omitted.

Mode

Global Configuration mode

Description

Use this command to assign the switch an IPv6 default gateway address. A default gateway is an address of an interface on a router or other Layer 3 device. It defines the first hop to reaching the remote subnets or networks where the network devices are located. You must assign the switch a default gateway address if both of the following are true:

- You assigned the switch an IPv6 management address.
- The remote management devices (such as Telnet workstations and TFTP servers) are not members of the same subnet as the IPv6 management address.

Review the following guidelines before assigning a default gateway address:

- The switch can have just one IPv6 default gateway.
- The switch must already have an IPv6 management address.
- The IPv6 management address and the default gateway address must be members of the same subnet.

Confirmation Command

“SHOW IPV6 ROUTE” on page 332

Example

This example assigns the switch the IPv6 default gateway address 45ab:672:934c::78:17cb:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 route ::/0 45ab:672:934c::78:17cb
```

NO IP ADDRESS

Syntax

```
no ip address
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to delete the current IPv4 management address from the switch if the address was assigned manually. If a DHCP server supplied the address, refer to “NO IP ADDRESS DHCP” on page 323. You must perform this command from the VLAN Interface mode of the VLAN to which the address is attached.

> **Note**
> The switch uses the IPv4 management address to perform the features listed Table 27 on page 296. If you delete it, the switch will not support the features unless it also has an IPv6 management address.

Confirmation Commands

“SHOW IP INTERFACE” on page 327 and “SHOW IP ROUTE” on page 328

Example

This example removes the static IPv4 management address from the VLAN with the VID 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan15
awplus(config-if)# no ip address
```

NO IP ADDRESS DHCP

Syntax

```
no ip address dhcp
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to delete the current IPv4 management address from the switch if the address was assigned by a DHCP server. You must perform this command from the VLAN Interface mode of the VLAN to which the address is attached. This command also disables the DHCP client.

> **Note**
> The switch uses the IPv4 management address to perform the features listed Table 27 on page 296. If you delete it, the switch will not support the features unless it also has an IPv6 management address.

Confirmation Command

"SHOW IP INTERFACE" on page 327 and "SHOW IP ROUTE" on page 328

Example

This example removes the IPv4 management address from a VLAN with the VID 3 and disables the DHCP client:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# no ip address dhcp
```

NO IP ROUTE

Syntax

```
no ip route 0.0.0.0/0 ipaddress
```

Parameters

ipaddress
Specifies the current default gateway.

Mode

Global Configuration mode

Description

Use this command to delete the current IPv4 default gateway. The command must include the current default gateway.

Confirmation Command

“SHOW IP ROUTE” on page 328

Example

This example deletes the default route 121.114.17.28 from the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip route 0.0.0.0/0 121.114.17.28
```

NO IPV6 ADDRESS

Syntax

```
no ipv6 address
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to delete the current IPv6 management address from the switch. You must perform this command from the VLAN Interface mode of the VLAN to which the address is attached.

> **Note**
> The switch uses the IPv6 management address to perform the features listed Table 27 on page 296. If you delete it, the switch will not support the features unless it also has an IPv4 management address.

Confirmation Command

"SHOW IPV6 INTERFACE" on page 331 and "SHOW IPV6 ROUTE" on page 332

Example

This example removes the static IPv6 management address from the VLAN with the VID 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# no ipv6 address
```

NO IPV6 ROUTE

Syntax

```
no ipv6 route ::/0 ipaddress
```

Parameters

ipaddress
Specifies the current IPv6 default gateway.

Mode

Global Configuration mode

Description

Use this command to delete the current IPv6 default gateway from the switch. The command must include the current default gateway.

Confirmation Command

“SHOW IPV6 ROUTE” on page 332

Example

This example deletes the IPv6 default route 2b45:12:9ac4::5bc7:89 from the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ipv6 route ::/0 2b45:12:9ac4::5bc7:89
```

SHOW IP INTERFACE

Syntax

```
show ip interface
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the management IP address on the switch. Figure 71 is an example of the information.

```
Interface      IP Address         Status         Protocol
VLAN14-0       123.94.146.72      admin up       down
```

Figure 71. SHOW IP INTERFACE Command

The Interface field is the VID of the VLAN to which the management IP address is assigned. The IP Address field is the management IP address of the switch.

Example

The following example displays the management IP address assigned to a switch:

```
awplus# show ip interface
```

SHOW IP ROUTE

Syntax

```
show ip route
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the routes on the switch. Figure 72 displays an example of the information.

```
-------------------------------------------------------------------
Destination     Mask            NextHop        Interface   Protocol
-------------------------------------------------------------------
192.168.1.0     255.255.255.0   192.168.1.1     vlan1-0    INTERFACE
-------------------------------------------------------------------
```

Figure 72. SHOW IP ROUTE Command

The fields are described in Table 29.

Table 29. SHOW IP ROUTE Command

Parameter	Description
Mask	The masks of the management IP address and the default gateway address. The mask of the default gateway is always 0.0.0.0.
NextHop	The management IP address and the default gateway address. The management IP address is the first entry in the table, and the default gateway address is the second entry.
Interface	The VID of the VLAN to which the management IP address is assigned.

The field "Gateway of last resort is" states the default gateway, which, if defined on the switch, is also included as the first entry in the table.

The possible codes in the left column in the table are described in Table 30.

Table 30. Route Codes in the SHOW IP ROUTE Command

Code	Description
S*	Default gateway.
R	Route to a remote network learned by RIP.
S	Static route to a remote network.
C	Local network of a routing interface.

Note
RIP routes have an additional option which indicates the time lapsed in hours: minutes: seconds since the RIP entry was added. See Figure 73.

The elements of the static and RIP routes are identified in Figure 73.

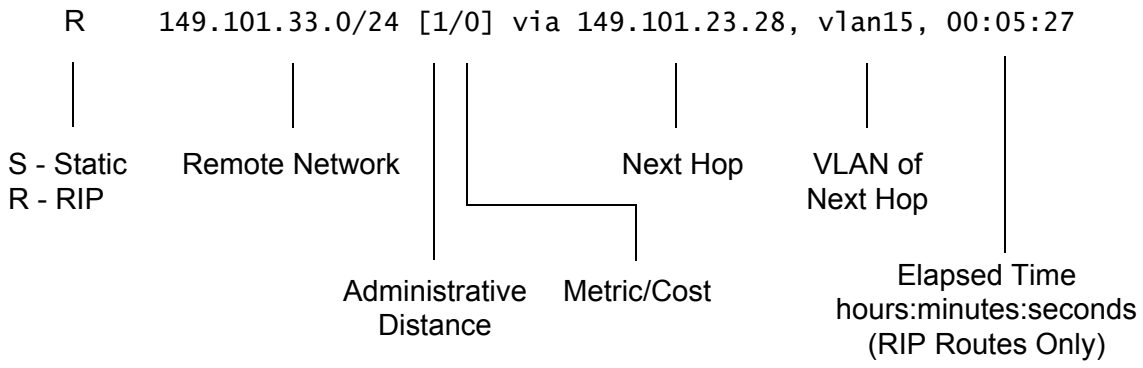

Figure 73. Static and RIP Route Elements

Example

The following example displays the routes on the switch:

```
awplus# show ip route
```

SHOW IPV6 INTERFACE

Syntax

```
show ipv6 interface
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the IPv6 management address on the switch. Figure 74 is an example of the information.

```
Interface      IPv6-Address                              Status       Protocol
VLAN3-0        832a:5821:b34a:0:0:0:187:95a/64           admin up     down
```

Figure 74. SHOW IPV6 INTERFACE Command

The fields are described in Table 31.

Table 31. SHOW IPV6 INTERFACE Command

Parameter	Description
Interface	The VID of the VLAN to which the management address is assigned.
IPv6 Address	The IPv6 management address of the switch.

Example

The following example displays the IPv6 management address:

```
awplus# show ipv6 interface
```

SHOW IPV6 ROUTE

Syntax

```
show ipv6 route
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the IPv6 management address and default gateway on the switch. Figure 75 is an example of the information. The default route is display first, followed by the management address.

```
IPv6 Routing Table
Codes: C - connected, S - static

S    0:0:0:0:0:0:0:0/0 via 832a:5821:b34a:0:0:0:187:14, vlan4-0

C    832a:5821:b34a:0:0:0:187:95a/64 via ::, vlan4-0
```

Figure 75. SHOW IPV6 ROUTE Command

Example

The following example displays the IPv6 management address and default gateway:

```
awplus# show ipv6 route
```

Chapter 15

DHCP Server with Port-Based IP Assignment

This chapter contains the following sections:

This chapter explains how to configure the Dynamic Host Configuration Protocol (DHCP) Server and Port-Based IP assignment.

Overview

DHCP Server with Port-Based IP Assignment allows a network switch to be provisioned to assign specific network parameters to connecting devices based on their physical port location, as shown in Figure 76.

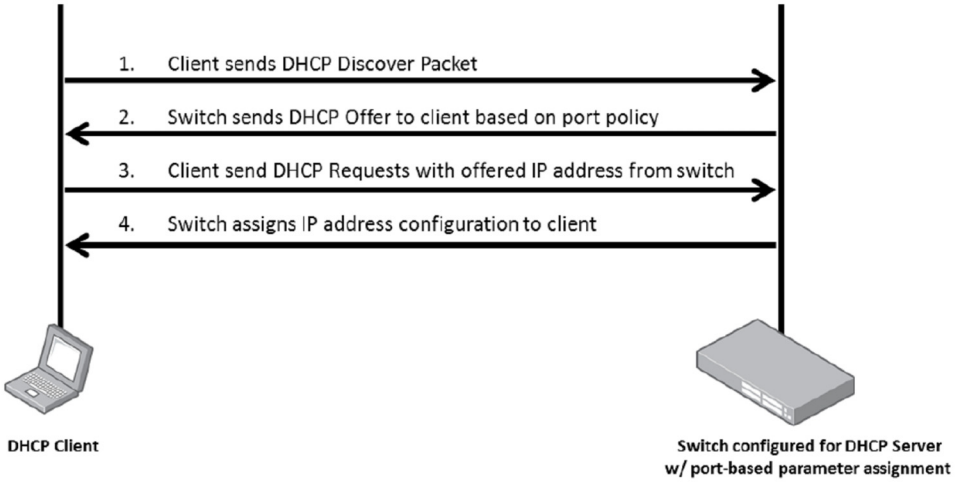

Figure 76. DHCP Server with Port-Based IP Assignment

This lets you configure individual, or ranges of, IP Addresses on a per-port basis. In this way, administrators will always know which address is assigned based on where the device is physically connected, regardless of its MAC address. Port-based IP address assignment with port description allows operators to easily identify the end device based on a criteria that works best for them.

Port-Based IP Assignment works in conjunction with DHCP server. Up to 254 clients can be configured per switch.

To configure Port-Based IP Assignment, a user must first configure the DHCP server.

Configuring the DHCP Server

To configure the DHCP server:

- Enable DHCP service on the switch as described in "Enabling Port-Based IP Assignment".
- Create a DHCP pool as described in "Creating a DHCP Pool".
- Define a network as described in "Defining a Network" on page 336.
- Define a range as described in "Defining a Range" on page 337.
- Set a lease time as described in "Setting a Lease Time" on page 337.
- Set the options as described in "Setting the Options" on page 338.
- Define which ports' IP addresses will be offered DHCP service as described in "Defining Ports' IP Addresses Offered DHCP Service" on page 340.

For an example of configuring a DHCP server, refer to "DHCP Server Configuration Example" on page 341.

Enabling Port-Based IP Assignment

Use the SERVICE DHCP-SERVER command in Global Configuration mode to enable DHCP service on the switch:

```
awplus# configure terminal

awplus(config)# service dhcp-server
```

To disable DHCP service on the switch, use the NO SERVICE DHCP-SERVER command in Global Configuration mode:

```
awplus# configure terminal

awplus(config)# no service dhcp-server
```

Creating a DHCP Pool

The command to create a DHCP address pool is the IP DHCP POOL command.

Here is the format of the command:

```
ip dhcp pool <pool-name>
```

The POOL-NAME parameter is used to identify a DHCP pool. Valid characters are any printable character. Spaces are not accepted.

This command is performed from Global Configuration mode on the switch. It 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.

The NO form of this command deletes a specific DHCP pool.

This example creates a DHCP pool named P1 and enters DHCP Configuration mode.

```
awplus> enable
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)#
```

Defining a Network

The command to configure a network to which the DHCP pool applies is the NETWORK command.

Here is the format of the command:

```
network {<ip-subnet-address/prefix-length>|<ip-subnet-
address/mask>}
```

> **Note**
> A pool can belong to only one network.

The IP-SUBNET-ADDRESS/PREFIX-LENGTH parameter is the IPv4 subnet address in dotted decimal notation followed by the prefix length in CIDR slash notation.

The IP-SUBNET-ADDRESS/MASK parameter is the IPv4 subnet address in dotted decimal notation followed by the subnet mask in dotted decimal notation.

This command is performed from DHCP Configuration mode.

The NO form of this command removes the network (subnet) from the DHCP pool.

This command fails if it makes existing ranges invalid, for example, if they are not within the new network you are configuring.

The NO form of this command fails 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.

Defining a Range

The command to add an address range to the DHCP pool you are configuring is the RANGE command.

Here is the format of the command:

```
range <ip-address> [<ip-address>]
```

The IP-ADDRESS parameter is the 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 DHCP pool.

This command is performed from DHCP Configuration mode.

The DHCP server responds to client requests received from the pool's network. It assigns IP addresses within the specified range. The IP address range must be 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 form of this command removes an address range from the DHCP pool. The NO RANGE ALL command removes all address ranges from the DHCP pool.

This example adds an address range of 192.168.100.2 to 192.168.100.20 to the pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# range 192.168.100.2 192.168.100.20
```

Setting a Lease Time

The command to set the lease expiration time for the DHCP pool you are configuring is the LEASE command.

Here is the format of the command:

```
lease <days> <hours> <minutes> [<seconds>]
```

```
lease infinite
```

The DAYS parameter is the number of days, from 0 to 120, for the lease expiry time. The default is 1 day.

The HOURS parameter is the number of hours, from 0 to 24, for the lease expiry time. The default is 0 hours.

The MINUTES parameter is the number of minutes, from 0 to 60, for the lease expiry time. The default is 0 minutes.

The SECONDS parameter is the number of seconds, from 0 to 60, for the lease expiry time. The default is 0 seconds.

The LEASE INFINITE command sets the lease to never expire.

This command is performed from DHCP Configuration mode.

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.

Use the LEASE INFINITE command to set the lease expiry time to infinite (lease never expires).

Use the NO form of this command to return the lease expiration time to the default of 1 day.

This example sets the lease expiration time for pool P1 to 35 minutes.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# lease 0 0 35
```

Setting the Options

The optional commands for configuring a DHCP server are:

- SUBNET-MASK - refer to “SUBNET-MASK”
- DEFAULT-ROUTER - refer to “DEFAULT-ROUTER” on page 339
- DNS-SERVER - refer to “DNS-SERVER” on page 339
- DOMAIN-NAME - refer to “DOMAIN-NAME” on page 340

These commands are performed from DHCP Configuration mode.

SUBNET-MASK

The command to set the subnet mask to be sent to the DHCP client is SUBNET-MASK.

This command specifies the client’s subnet mask as defined in RFC 950.

Here is the format of the command:

```
subnet-mask <mask>
```

The MASK parameter is a valid IPv4 subnet mask, in dotted decimal notation.

Use the NO form of this command to remove the subnet mask option from a DHCP pool. The pool reverts to using the pool’s network mask.

This example sets the set the subnet mask option to 255.255.255.0 for pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# subnet-mask 255.255.255.0
```

DEFAULT-ROUTER

The command to add a default router to the DHCP pool is DEFAULT-ROUTER.

Here is the format of the command:

```
default-router <ip-address>
```

The IP-ADDRESS parameter is the IPv4 address of the default router, in dotted decimal notation.

You can use this command multiple times to create a list of default routers on the client's subnet.

Use the NO form of this command to remove either the specified default router, or all default routers, from the DHCP pool.

This example adds a default router with IP address 192.168.1.2 to the pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# default-router 192.168.1.2
```

DNS-SERVER

The command to add a Domain Name System (DNS) server to the DHCP pool is DNS-SERVER.

Here is the format of the command:

```
dns-server <ip-address>
```

The IP-ADDRESS parameter is the IPv4 address of the DNS server, in dotted decimal notation.

You can use this command multiple times to create a list of DNS name servers available to the client.

Use the NO form of this command to remove either the specified DNS server, or all DNS servers, from the DHCP pool.

This example adds a DNS server with the assigned IP address 192.168.1.1 to the pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# dns-server 192.168.1.1
```

DOMAIN-NAME

The command to add a domain name to the DHCP pool is DOMAIN-NAME.

This command specifies the domain name a client should use when resolving host names using the DNS.

Here is the format of the command:

```
domain-name <domain-name>
```

The domain-name parameter is the domain name you want to assign to the DHCP pool. Valid characters are any printable character. The name should not contain spaces.

Use the NO form of this command to remove the domain name from the DHCP pool.

This example adds the domain name Branch-Office to pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# domain-name Branch-Office
```

Defining Ports' IP Addresses Offered DHCP Service

The command to enable DHCP service to assign IP address(es) on a switch port is DHCP-OFFER IP.

This command enables DHCP service on a switch port and defines the IP address that will be offered on this port.

Here is the format of the command:

```
dhcp-offer ip <x.x.x.x> [<x.x.x.x>]
```

Where <*x.x.x.x*> is one IPv4 address (in dotted decimal notation), and <*x.x.x.x*> [<x.x.x.x>] is an IPv4 address range. The first IP address is the low end of the range; the second IP address is the high end.

Use the NO form of this command to disable DHCP service on a switch port.

> **Note**
> Disabling DHCP service on a port removes all lease bindings for the port.

This command is performed from Interface Configuration mode.

This example enables DHCP service to assign IP address 192.168.1.100 on switch port 1.0.1.

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# dhcp-offer ip 192.168.1.100
```

This example enables DHCP service to assign an IP address range of 192.168.1.101 to 192.168.1.110 on switch port 1.0.10.

```
awplus# configure terminal
awplus(config)# interface port1.0.10
awplus(config-if)# dhcp-offer ip 192.168.1.101 192.168.1.110
```

DHCP Server Configuration Example

The following is an example of configuring a DHCP server.

`awplus> enable`	Enter the Privileged Executive mode from User Exec mode.
`awplus# configure terminal`	Enter Global Configuration mode.
`awplus(config)# service dhcp-server`	Enable DHCP service on the switch.
`awplus(config)# ip dhcp pool P1`	Use the IP DHCP POOL command to create a DHCP pool named P1 and enter DHCP Configuration mode.
`awplus(dhcp-config)# network 192.168.100.0 255.255.255.0`	Use the NETWORK command to configure a network for DHCP pool P1, where the subnet is 192.168.100.0, and the mask is 255.255.255.0. Note: A VLAN interface must exist with an IP address in the same subnet as the IP address that is being offered via DHCP service.
`awplus(dhcp-config)# range 192.168.100.2 192.168.100.20`	Use the RANGE command to add an address range of 192.168.100.2 to 192.168.100.20 to DHCP pool P1.
`awplus(dhcp-config)# lease 0 0 35`	Use the LEASE command to set the lease expiration time for DHCP pool P1 to 35 minutes.

`awplus(dhcp-config)# subnet-mask 255.255.255.0`	Use the SUBNET-MASK command to set the subnet mask option to 255.255.255.0 for DHCP pool P1.
`awplus(dhcp-config)# default-router 192.168.1.2`	Use the DEFAULT-ROUTER command to add a default router with an IP address of 192.168.1.2 to DHCP pool P1.
`awplus(dhcp-config)# dns-server 192.168.1.1`	Use the DNS-SERVER command to add a DNS server with the assigned IP address 192.168.1.1 to DHCP pool P1.
`awplus(dhcp-config)# domain-name Branch-Office`	Use the DOMAIN-NAME command to add the domain name Branch-Office to DHCP pool P1.
`awplus(dhcp-config)# exit`	Return to Global Configuration mode.
`awplus(config)# interface port1.0.1`	Enter Port Interface mode for port 1.
`awplus(config-if)# dhcp-offer ip 192.168.1.100`	Use the DHCP-OFFER IP command to enable DHCP service to assign IP address 192.168.1.100 on switch port 1.0.1.
`awplus(config-if)# exit`	Return to Global Configuration mode.

Displaying Status of Port-Based IP Assignment

This section covers the following topics:

Displaying Lease Bindings

Use the following command in Privileged Exec mode to display all leases for every client in all DHCP pools:

```
awplus# show ip dhcp binding
```

Use the following command in Privileged Exec mode to display details for the leased IP address:

```
awplus# show ip dhcp binding <ip-address>
```

The IP ADDRESS parameter is the IPv4 address of a leased IP address, in dotted decimal notation.

Use the following command in Privileged Exec mode to display the leases from the DHCP pool:

```
awplus# show ip dhcp binding <address-pool>
```

The ADDRESS-POOL parameter is the name of a DHCP address pool.

The following is an example output of the SHOW IP DHCP BINDING command.

```
Pool P1 Network 172.16.2.0/24
Default gateway 172.16.2.1
DNS Server 172.16.2.5

DHCP Client Entries
Port IP Address ClientId Expiry
-----------------------------------------------------------------
Port1.0.1 172.16.2.100 0050.fc82.9ede 21 Sep 2015 19:02:58
Port1.0.2 172.16.2.101 000e.a6ae.7c14 Infinite
Port1.0.2 172.16.2.102 000e.a6ae.7c4c Infinite
Port1.0.3 172.16.2.103 000e.a69a.ac91 Infinite
Port1.0.3 172.16.2.104 00e0.189d.5e41 Infinite
Port1.0.4 172.16.2.150 00e0.2b04.5800 Infinite
Port1.0.5 172.16.2.167 4444.4400.35c3 21 Sep 2015 14:58:41
```

Figure 77. SHOW IP DHCP BINDING Command

Displaying DHCP Address Pool Configuration

Use the following command in Privileged Exec mode to display the configuration details and system usage of all DHCP address pools configured on the device:

```
awplus# show ip dhcp pool
```

Use the following command in Privileged Exec mode to display configuration details for a specified DHCP pool:

```
awplus# show ip dhcp pool [<address-pool>]
```

The ADDRESS-POOL parameter is the name of a DHCP address pool.

The following is an example output of the SHOW IP DHCP POOL command.

```
Pool P1 :

Total: 8
Leased: 2
Utilization: 25.0 %

network: 192.168.1.0/24
address ranges:
addr: 192.168.1.10 to 192.168.1.18
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
```

Figure 78. SHOW IP DHCP POOL Command

Displaying DHCP Server Statistics

Use the following command in Privileged Exec mode to display statistics related to the DHCP server:

```
awplus# show ip dhcp server statistics
```

The following is an example output of the SHOW IP 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 79. SHOW IP DHCP SERVER STATISTICS Command

Chapter 16

DHCP Server with Port-Based IP Assignment Commands

The DHCP Server with Port-Based IP Assignment commands are summarized in Table 32.

Table 32. DHCP Server with Port-Based IP Assignment

Command	Mode	Description
“DEFAULT-ROUTER” on page 349	DHCP Configuration	Adds a default router to the DHCP pool.
“DHCP-OFFER IP” on page 350	Interface Configuration	Enables DHCP service on a switch port and defines the IP address that will be offered on this port.
“DNS-SERVER” on page 351	DHCP Configuration	Adds a DNS server to the DHCP pool.
“DOMAIN-NAME” on page 352	DHCP Configuration	Adds a domain name to the DHCP pool.
“IP DHCP POOL” on page 353	Global Configuration	Creates or accesses a DHCP address pool.
“LEASE” on page 354	DHCP Configuration	Sets the lease expiration time for the DHCP pool.
“LEASE INFINITE” on page 355	DHCP Configuration	Sets the lease on a DHCP pool to never expire.
“NETWORK” on page 356	DHCP Configuration	Configures a network to which the DHCP pool applies.
“NO DEFAULT-ROUTER” on page 357	DHCP Configuration	Removes either the specified default router, or all default routers, from the DHCP pool.
“NO DHCP-OFFER IP” on page 358	Interface Configuration	Disables DHCP service for a switch port, an IP address on a switch port, or a range of IP addresses on a switch port.
“NO DNS-SERVER” on page 360	DHCP Configuration	Removes the specified DNS server or all DNS servers, from the DHCP pool.

Table 32. DHCP Server with Port-Based IP Assignment (Continued)

Command	Mode	Description
“NO DOMAIN-NAME” on page 361	DHCP Configuration	Removes the domain name from the DHCP pool.
“NO IP DHCP POOL” on page 362	Global Configuration	Removes a DHCP address pool.
“NO LEASE” on page 363	DHCP Configuration	Returns the lease expiration time to the default.
“NO NETWORK” on page 364	DHCP Configuration	Removes a network from the DHCP pool.
“NO RANGE” on page 365	DHCP Configuration	Removes an IP address or IP address range from a DHCP pool.
“NO RANGE ALL” on page 366	DHCP Configuration	Removes all IP addresses from a DHCP pool.
“NO SERVICE DHCP-SERVER” on page 367	Global Configuration	Disables DHCP service globally on the switch.
“NO SUBNET-MASK” on page 368	DHCP Configuration	Removes the subnet mask option from a DHCP pool.
“RANGE” on page 369	DHCP Configuration	Adds an address range to a DHCP pool.
“SERVICE DHCP-SERVER” on page 370	Global Configuration	Enables DHCP service globally on the switch.
“SHOW IP DHCP BINDING” on page 371	Privileged Exec	Displays leases for every client in all DHCP pools, a leased IP address, or leases from a DHCP pool.
“SHOW IP DHCP POOL” on page 373	Privileged Exec	Displays configuration details and system usage of all DHCP address pools configured on the device or configuration details for a specific DHCP pool.
“SHOW IP DHCP SERVER STATISTICS” on page 374	Privileged Exec	Displays statistics related to the DHCP server.
“SUBNET-MASK” on page 375	DHCP Configuration	Sets the subnet mask to be sent to the DHCP client.

DEFAULT-ROUTER

Syntax

```
default-router <ip-address>
```

Parameters

ip-address
IPv4 address of the default router, in dotted decimal notation.

Mode

DHCP Configuration

Description

Use this command to add a default router to the DHCP pool. You can use this command multiple times to create a list of default routers on the client's subnet.

Example

This example adds a default router with IP address 192.168.1.2 to the pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# default-router 192.168.1.2
```

DHCP-OFFER IP

Syntax

```
dhcp-offer ip <x.x.x.x> [<x.x.x.x>]
```

Parameters

<x.x.x.x>
: IPv4 address (in dotted decimal notation)

<x.x.x.x> [<x.x.x.x>]
: IPv4 address range. The first IP address is the low end of the range; the second IP address is the high end.

Mode

Interface Configuration

Description

Use this command to enable DHCP service on a switch port and define the IP address or range of IP addresses that will be offered on this port.

Example

This example enables DHCP service to assign IP address 192.168.1.100 on switch port 1.0.1.

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# dhcp-offer ip 192.168.1.100
```

This example enables DHCP service to assign an IP address range of 192.168.1.101 to 192.168.1.110 on switch port 1.0.10.

```
awplus# configure terminal
awplus(config)# interface port1.0.10
awplus(config-if)# dhcp-offer ip 192.168.1.101 192.168.1.110
```

DNS-SERVER

Syntax

```
dns-server <ip-address>
```

Parameters

ip-address
IPv4 address of the DNS server, in dotted decimal notation.

Mode

DHCP Configuration

Description

Use this command to add a Domain Name System (DNS) server to the DHCP pool. You can use this command multiple times to create a list of DNS name servers available to the client.

Example

This example adds a DNS server with the assigned IP address 192.168.1.1 to the pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# dns-server 192.168.1.1
```

DOMAIN-NAME

Syntax

```
domain-name <domain-name>
```

Parameters

domain-name
: Domain name you want to assign the DHCP pool. Valid characters are any printable character. Spaces are not accepted.

Mode

DHCP Configuration

Description

Use this command to add a domain name to the DHCP pool. This command specifies the domain name a client should use when resolving host names using the DNS.

Example

This example adds the domain name Branch-Office to pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# domain-name Branch-Office
```

IP DHCP POOL

Syntax

```
ip dhcp pool <pool-name>
```

Parameters

pool-name
: Identifies a DHCP pool. Valid characters are any printable character. Spaces are not accepted.

Mode

Global Configuration

Description

Use this command to create or access a DHCP address 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.

Example

This example creates a DHCP pool named P1 and enters DHCP Configuration mode.

```
awplus> enable
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)#
```

LEASE

Syntax

```
lease <days> <hours> <minutes> [<seconds>]
```

Parameters

days
: Number of days, from 0 to 120, for the lease expiry time. The default is 1 day.

hours
: Number of hours, from 0 to 24, for the lease expiry time. The default is 0 hours.

minutes
: Number of number of minutes, from 0 to 60, for the lease expiry time. The default is 0 minutes.

seconds
: Number of seconds, from 0 to 60, for the lease expiry time. The default is 0 seconds.

Mode

DHCP Configuration

Description

Use this command to set the lease expiration time for the DHCP pool.

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.

Example

This example sets the lease expiration time for pool P1 to 35 minutes.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# lease 0 0 35
```

LEASE INFINITE

Syntax

```
lease infinite
```

Parameters

None

Mode

DHCP Configuration

Description

Use this command to set the lease on a DHCP pool to never expire.

Example

This example sets the lease to never expire on DHCP pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# lease infinite
```

NETWORK

Syntax

```
network {<ip-subnet-address/prefix-length>|<ip-subnet-
address/mask>}
```

Parameters

ip-subnet-address/prefix-length
: IPv4 subnet address in dotted decimal notation followed by the prefix length in CIDR slash notation.

ip-subnet-address/mask
: IPv4 subnet address in dotted decimal notation followed by the subnet mask in dotted decimal notation.

Mode

DHCP Configuration

Description

Use this command to configure a network to which the DHCP pool applies.

This command fails if it makes existing ranges invalid, for example, if they are not within the new network you are configuring.

Example

This example configures a network for the DHCP pool P1, where the subnet is 192.168.100.0, and the mask is 255.255.255.0.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# network 192.168.100.0 255.255.255.0
```

NO DEFAULT-ROUTER

Syntax

```
no default-router [<ip-address>]
```

Parameters

ip-address
IPv4 address of the default router, in dotted decimal notation.

Mode

DHCP Configuration

Description

Use this command to remove either the specified default router, or all default routers, from the DHCP pool.

Example

This example removes a default router with IP address 192.168.1.2 from the pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# no default-router 192.168.1.2
```

This example removes all default routers from the pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# no default-router
```

NO DHCP-OFFER IP

Syntax

```
no dhcp-offer ip [<x.x.x.x>] [<x.x.x.x>]
```

Parameters

<x.x.x.x>
: IPv4 address (in dotted decimal notation)

<x.x.x.x> [<x.x.x.x>]
: IPv4 address range. The first IP address is the low end of the range; the second IP address is the high end.

Mode

Interface Configuration

Description

Use the NO DHCP-OFFER IP command to disable DHCP service on a switch port. Disabling DHCP service on a port removes all lease bindings for the port.

Use the NO DHCP-OFFER IP command with one X.X.X.X parameter to disable DHCP service for an IP address on a switch port.

Use the NO DHCP-OFFER IP command with two X.X.X.X parameters to disable DHCP service for a range of IP addresses on a switch port.

Example

This example disables DHCP service for switch port 1.0.1.

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# no dhcp-offer
```

This example disables DHCP service for IP address 192.168.1.100 on switch port 1.0.1.

```
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# no dhcp-offer ip 192.168.1.100
```

This example disables DHCP for IP addresses in the range of 192.168.1.101 to 192.168.1.110 on switch port 1.0.10.

```
awplus# configure terminal
awplus(config)# interface port1.0.10
awplus(config-if)# no dhcp-offer ip 192.168.1.101
192.168.1.110
```

NO DNS-SERVER

Syntax

```
no dns-server [<ip-address>]
```

Parameters

ip-address
: IPv4 address of the DNS server, in dotted decimal notation.

Mode

DHCP Configuration

Description

Use this command to remove either the specified DNS server, or all DNS servers, from the DHCP pool.

Example

This example removes all DNS servers from pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# no dns-server
```

NO DOMAIN-NAME

Syntax

```
no domain-name <domain-name>
```

Parameters

domain-name
Domain name you want to remove from the DHCP pool.

Mode

DHCP Configuration

Description

Use this command to remove a domain name from the DHCP pool.

Example

This example removes the domain name Branch-Office from pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# no domain-name Branch-Office
```

NO IP DHCP POOL

Syntax

```
no ip dhcp pool <pool-name>
```

Parameters

pool-name
: Identifies the DHCP pool you want to remove.

Mode

Global Configuration

Description

Use this command to remove the specified DHCP address pool.

Example

This example removes the DHCP pool named P1.

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip dhcp pool P1
```

NO LEASE

Syntax

```
no lease
```

Parameters

None

Mode

DHCP Configuration

Description

Use this command to return the lease expiration time to the default of 1 day.

Example

This example returns the lease expiration time to the default of 1 day for pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# no lease
```

NO NETWORK

Syntax

```
no network {<ip-subnet-address/prefix-length>|<ip-subnet-
address/mask>}
```

Parameters

ip-subnet-address/prefix-length
: IPv4 subnet address in dotted decimal notation followed by the prefix length in slash notation.

ip-subnet-address/mask
: IPv4 subnet address in dotted decimal notation followed by the subnet mask in dotted decimal notation.

Mode

DHCP Configuration

Description

Use this command to remove a network (subnet) from the DHCP pool.

This command fails if ranges still exist in the pool. You must remove all ranges in the pool before issuing this command to remove a network from the pool.

Example

This example removes a network for the DHCP pool P1, where the subnet is 192.168.100.0, and the mask is 255.255.255.0.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# no network 192.168.100.0 255.255.255.0
```

NO RANGE

Syntax

```
no range <ip-address> [<ip-address>]
```

Parameters

ip-address
: IPv4 address. The first IP address is the low end of the range; the second IP address is the high end.

Mode

DHCP Configuration

Description

Use this command to remove an IP address or IP address range from a DHCP pool.

Example

This example removes an address range of 192.168.100.2 to 192.168.100.20 from the DHCP pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# no range 192.168.100.2 192.168.100.20
```

NO RANGE ALL

Syntax

```
no range all
```

Parameters

None

Mode

DHCP Configuration

Description

Use this command to remove all IP addresses from a DHCP pool.

Example

This example removes all IP addresses from the DHCP pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# no range
```

NO SERVICE DHCP-SERVER

Syntax

```
no service dhcp-server
```

Parameters

None

Mode

Global Configuration

Description

Use this command to disable DHCP service globally on the switch.

Example

This example disables DHCP service on the switch.

```
awplus# configure terminal
awplus(config)# no service dhcp-server
```

NO SUBNET-MASK

Syntax

```
no subnet-mask
```

Parameters

None

Mode

DHCP Configuration

Description

Use this command to remove the subnet mask option from a DHCP pool. The pool reverts to using the pool's network mask.

Example

This example removes the subnet mask option from DHCP pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# no subnet-mask
```

RANGE

Syntax

```
range <ip-address> [<ip-address>]
```

Parameters

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.

Mode

DHCP Configuration

Description

Use this command to add an address range to a DHCP pool. Specify only one IP address to add an individual IP address to the DHCP pool.

The DHCP server responds to client requests received from the pool's network. It assigns IP addresses within the specified range. The IP address range must be within the network.

You can add multiple address ranges and individual IP addresses for a DHCP pool by using this command multiple times.

Example

This example adds an address range of 192.168.100.2 to 192.168.100.20 to the pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# range 192.168.100.2 192.168.100.20
```

SERVICE DHCP-SERVER

Syntax

```
service dhcp-server
```

Parameters

None

Mode

Global Configuration

Description

Use this command to enable DHCP service globally on the switch.

Example

This example enables DHCP service on the switch.

```
awplus# configure terminal
awplus(config)# service dhcp-server
```

SHOW IP DHCP BINDING

Syntax

```
show ip dhcp binding [<ip-address>|<address-pool>]
```

Parameters

ip-address
: IPv4 address of a leased IP address, in dotted decimal notation.

address-pool
: Name of a DHCP address pool.

Mode

Privileged Exec

Description

Use the SHOW IP DHCP BINDING command to display all leases for every client in all DHCP pools.

Use the SHOW IP DHCP BINDING command with the IP-ADDRESS parameter to display details for the leased IP address.

Use the SHOW IP DHCP BINDING command with the ADDRESS-POOL parameter to display the leases from the DHCP pool.

Figure 80 is an example of the information.

```
Pool P1 Network 172.16.2.0/24
Default gateway 172.16.2.1
DNS Server 172.16.2.5

DHCP Client Entries
Port IP Address ClientId Expiry
-----------------------------------------------------------------
Port1.0.1 172.16.2.100 0050.fc82.9ede 21 Sep 2015 19:02:58
Port1.0.2 172.16.2.101 000e.a6ae.7c14 Infinite
Port1.0.2 172.16.2.102 000e.a6ae.7c4c Infinite
Port1.0.3 172.16.2.103 000e.a69a.ac91 Infinite
Port1.0.3 172.16.2.104 00e0.189d.5e41 Infinite
Port1.0.4 172.16.2.150 00e0.2b04.5800 Infinite
Port1.0.5 172.16.2.167 4444.4400.35c3 21 Sep 2015 14:58:41
```

Figure 80. SHOW IP DHCP BINDING Command

Example

This example displays the leases from the DHCP pool P1.

```
awplus# show ip dhcp binding P1
```

SHOW IP DHCP POOL

Syntax

```
show ip dhcp pool [<address-pool>]
```

Parameters

address-pool
Name of a DHCP address pool.

Mode

Privileged Exec

Description

Use the SHOW IP DHCP POOL command to display the configuration details and system usage of all DHCP address pools configured on the device.

Use the SHOW IP DHCP POOL command with the ADDRESS-POOL parameter to display configuration details for a specified DHCP pool.

Figure 81 is an example of the information.

```
Pool P1 :

Total: 8
Leased: 2
Utilization: 25.0 %

network: 192.168.1.0/24
address ranges:
addr: 192.168.1.10 to 192.168.1.18
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
```

Figure 81. SHOW IP DHCP POOL Command

Example

This example displays configuration details for DHCP pool P1.

```
awplus# show ip dhcp pool P1
```

SHOW IP DHCP SERVER STATISTICS

Syntax

```
show ip dhcp server statistics
```

Parameters

None

Mode

Privileged Exec

Description

Use this command to display statistics related to the DHCP server.

Figure 82 is an example of the information.

```
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 82. SHOW IP DHCP SERVER STATISTICS Command

Example

This example displays statistics related to the DHCP server.

```
show ip dhcp server statistics
```

SUBNET-MASK

Syntax

```
subnet-mask <mask>
```

Parameters

mask
Valid IPv4 subnet mask, in dotted decimal notation.

Mode

DHCP Configuration

Description

Use this command to set the subnet mask to be sent to the DHCP client.

This command specifies the client's subnet mask as defined in RFC 950.

Example

This example sets the set the subnet mask option to 255.255.255.0 for pool P1.

```
awplus# configure terminal
awplus(config)# ip dhcp pool P1
awplus(dhcp-config)# subnet-mask 255.255.255.0
```

Chapter 17

Simple Network Time Protocol (SNTP) Client

This chapter contains the following information:

Overview

The switch has a Simple Network Time Protocol (SNTP) client for setting its date and time from an SNTP or NTP server on your network or the Internet. The date and time are added to the event messages that are stored in the event log and sent to syslog servers.

The switch polls the SNTP or NTP server for the date and time when you configure the client and when the unit is powered on or reset.

Here are the guidelines to using the SNTP client:

- ❒ You must specify the IP address of the SNTP or NTP server from which the switch is to obtain the date and time. You can specify only one IP address. For instructions, refer to “Activating the SNTP Client and Specifying the IP Address of an NTP or SNTP Server” on page 379.
- ❒ You must configure the client by specifying whether the locale of the switch is in Standard Time or Daylight Savings Time. For instructions, refer to “Configuring Daylight Savings Time and UTC Offset” on page 380.
- ❒ You must specify the offset of the switch from Coordinated Universal Time (UTC). For instructions, refer to “Configuring Daylight Savings Time and UTC Offset” on page 380.
- ❒ The switch must have a management IP address to communicate with an SNTP or NTP server. For instructions, refer to “Adding a Management IP Address” on page 82 or Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.
- ❒ The SNTP or NTP server must be a member of the same subnet as the management IP address of the switch or be able to access it through routers or other Layer 3 devices.
- ❒ If the management IP address of the switch and the IP address of the SNTP or NTP server are members of different subnets or networks, you must also assign the switch a default gateway. This is the IP address of a routing interface that represents the first hop to reaching the remote network of the SNTP or NTP server. For instructions, refer to “Adding a Management IP Address” on page 82 or Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.

Activating the SNTP Client and Specifying the IP Address of an NTP or SNTP Server

To activate the SNTP client on the switch and to specify the IP address of an NTP or SNTP server, use the NTP PEER command in the Global Configuration mode. You can specify the IP address of only one server.

This example of the command specifies 1.77.122.54 as the IP address of the server:

```
awplus> enable
awplus# configure terminal
awplus(config)# ntp peer 1.77.122.54
```

To display the date and time, use the SHOW CLOCK command in the User Exec and Privileged Exec modes.

```
awplus# show clock
```

Configuring Daylight Savings Time and UTC Offset

If the time that the NTP or SNTP server provides to the switch is in Coordinated Universal Time (UTC), it has to be converted into local time. To do that, the switch needs to know whether to use Standard Time (ST) or Daylight Savings Time (DST), and the number of hours and minutes it is ahead of or behind UTC, referred to as the UTC offset.

Note
To set the daylight savings time and UTC offset, you must first specify the IP address of an NTP server with the NTP PEER command. For instructions, refer to “Activating the SNTP Client and Specifying the IP Address of an NTP or SNTP Server” on page 379.

This table lists the commands you use to configure the daylight savings time and UTC offset.

Table 33. SNTP Daylight Savings Time and UTC Offset Commands

To	Use This Command	Range
Configure the client for Daylight Savings Time	CLOCK SUMMER-TIME	-
Configure the client for Standard Time.	NO CLOCK SUMMER-TIME	-
Configure the UTC offset.	CLOCK TIMEZONE *+hh:mm|-hh:mm*	+12 to -12 hours in increments of 15. (The hours and minutes must each have two digits.)

The commands are located in the Global Configuration mode. This example configures the client for DST and a UTC offset of -8 hours:

```
awplus> enable
awplus# configure terminal
awplus(config)# clock summer-time
awplus(config)# clock timezone -08:00
```

In this example, the client is configured for ST and a UTC offset of +2 hours and 45 minutes:

```
awplus> enable
awplus# configure terminal
awplus(config)# no clock summer-time
awplus(config)# clock timezone +02:45
```

Disabling the SNTP Client

To disable the SNTP client so that the switch does not obtain its date and time from an NTP or SNTP server, use the NO PEER command in the Global Configuration mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ntp peer
```

Displaying the SNTP Client

To display the settings of the SNTP client on the switch, use the SHOW NTP ASSOCIATIONS command in the Privileged Exec mode.

```
awplus# show ntp associations
```

The following is displayed:

```
SNTP Configuration:
   Status ..................... Enabled
   Server ..................... 149.134.23.154
   UTC Offset ................. +2
   Daylight Savings Time (DST) ... Enabled
```

Figure 83. SHOW NTP ASSOCIATIONS Command

The fields are described in Table 35 on page 393.

To learn whether the switch has synchronized its time with the designated NTP or SNTP server, use the SHOW NTP STATUS command. An example of the information is shown in Figure 84.

```
Clock is synchronized, reference is 149.154.42.190
Clock offset is -5
```

Figure 84. SHOW NTP STATUS Command

Displaying the Date and Time

To display the date and time, use the SHOW CLOCK command in the User Exec mode or Privileged Exec mode:

```
awplus# show clock
```

Chapter 18
SNTP Client Commands

The SNTP commands are summarized in Table 34.

Table 34. Simple Network Time Protocol Commands

Command	Mode	Description
“CLOCK SUMMER-TIME” on page 386	Global Configuration	Activates Daylight Savings Time on the SNTP client.
“CLOCK TIMEZONE” on page 387	Global Configuration	Sets the UTC offset value, the time difference in hours and minutes between local time and Coordinated Universal Time (UTC).
“NO CLOCK SUMMER-TIME” on page 388	Global Configuration	Deactivates Daylight Savings Time and enables Standard Time.
“NO NTP PEER” on page 389	Global Configuration	Disables the NTP client.
“NTP PEER” on page 390	Global Configuration	Specifies the IP address of the NTP or SNTP server from which the switch is to obtain the date and time.
“PURGE NTP” on page 391	Global Configuration	Restores the default settings to the SNTP client.
“SHOW CLOCK” on page 392	User Exec and Privilege Exec	Displays the date and time.
“SHOW NTP ASSOCIATIONS” on page 393	Privilege Exec	Displays the settings of the NTP client on the switch.
“SHOW NTP STATUS” on page 395	Privilege Exec	Displays whether the switch has synchronized its time with the specified NTP or SNTP server.

CLOCK SUMMER-TIME

Syntax

```
clock summer-time
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enable Daylight Savings Time (DST) on the SNTP client.

Note
The switch does not set the DST automatically. If the switch is in a locale that uses DST, you must remember to enable this when DST begins and disable when DST ends. If the switch is in a locale that does not use DST, set this option to disabled all the time. To disable DST on the client, refer to “NO CLOCK SUMMER-TIME” on page 388.

Confirmation Command

“SHOW NTP ASSOCIATIONS” on page 393

Example

The following example enables DST on the SNTP client:

```
awplus> enable
awplus# configure terminal
awplus(config)# clock summer-time
```

CLOCK TIMEZONE

Syntax

```
clock timezone +hh:mm|-hh:mm
```

Parameters

hh:mm

Specifies the number of hours and minutes difference between Coordinated Universal Time (UTC) and local time. HH are hours in the range of -12 to +12, and MM are minutes in the range of increments of 15. The value is specified as ahead of (positive) or behind (negative) UTC. You must include both the hours and minutes, and both must have two digits. The default is 00:00.

Mode

Global Configuration mode

Description

Use this command to set the UTC offset, which is used by the switch to convert the time from an SNTP or NTP server into local time. You must configure the NTP client with "NTP PEER" on page 390 before setting the UTC offset.

Confirmation Command

"SHOW NTP ASSOCIATIONS" on page 393

Examples

This example specifies a time difference of -2 hours between UTC and local time:

```
awplus> enable
awplus# configure terminal
awplus(config)# clock timezone -02:00
```

This example specifies a time difference of +4 hours and 15 minutes between UTC and local time:

```
awplus> enable
awplus# configure terminal
awplus(config)# clock timezone +04:15
```

NO CLOCK SUMMER-TIME

Syntax

```
no clock summer-time
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable Daylight Savings Time (DST) and activate Standard Time (ST) on the SNTP client.

Confirmation Command

“SHOW NTP ASSOCIATIONS” on page 393

Examples

The following example disables Daylight Savings Time (DST) and activates Standard Time (ST) on the SNTP client:

```
awplus> enable
awplus# configure terminal
awplus(config)# no clock summer-time
```

NO NTP PEER

Syntax

```
no ntp server
```

Parameter

None

Mode

Global Configuration mode

Description

Use this command to deactivate the SNTP client on the switch. When the client is disabled, the switch does not obtain its date and time from an SNTP or NTP server the next time it is reset or power cycled.

Confirmation Command

"SHOW NTP ASSOCIATIONS" on page 393

Example

The following example deactivates the SNTP client on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ntp peer
```

NTP PEER

Syntax

```
ntp peer ipaddress
```

Parameter

ipaddress
Specifies an IP address of an SNTP or NTP server.

Mode

Global Configuration mode

Description

Use this command to activate the NTP client on the switch and to specify the IP address of the SNTP or NTP server from which it is to obtain its date and time. You can specify only one SNTP or NTP server. After you enter this command, the switch automatically begins to query the network for the defined server.

Confirmation Command

“SHOW NTP ASSOCIATIONS” on page 393

Example

This example defines the IP address of the SNTP server as 1.77.122.54:

```
awplus> enable
awplus# configure terminal
awplus(config)# ntp peer 1.77.122.54
```

PURGE NTP

Syntax

```
purge ntp
```

Parameter

None

Mode

Global Configuration mode

Description

Use this command to disable the SNTP client, delete the IP address of the SNTP or NTP server, and restore the client settings to the default values.

Confirmation Command

"SHOW NTP ASSOCIATIONS" on page 393

Example

The following example disables the SNTP client, deletes the IP address of the SNTP or NTP server, and restores the client settings to the default values:

```
awplus> enable
awplus# configure terminal
awplus(config)# purge ntp
```

SHOW CLOCK

Syntax

```
show clock
```

Parameters

None

Modes

User Exec mode and Privileged Exec mode

Description

Use this command to display the switch's date and time.

Example

The following example displays the switch's date and time.

```
awplus# show clock
```

SHOW NTP ASSOCIATIONS

Syntax

```
show ntp associations
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the settings of the SNTP client. The information the command displays is shown in Figure 85.

```
NTP Configuration:
   Status ..................... Enabled
   Server ..................... 192.168.20.27
   UTC Offset ................. +02:00
   Daylight Savings Time (DST) ... Enabled
```

Figure 85. SHOW NTP ASSOCIATIONS Command

The information is described here:

Table 35. SHOW NTP ASSOCIATIONS Command

Parameter	Description
Status	The status of the SNTP client software on the switch. The status can be either enabled or disabled. If enabled, the switch seeks its date and time from an NTP or SNTP server. The default is disabled. To enable the client, use "NTP PEER" on page 390. To disable the client, refer to "NO NTP PEER" on page 389.
Server	The IP address of an NTP or SNTP server. This value is set with "NTP PEER" on page 390.

Table 35. SHOW NTP ASSOCIATIONS Command (Continued)

Parameter	Description
UTC Offset	The time difference in hours between UTC and local time. The range is -12 to +12 hours. The default is 0 hours. This value is set with “CLOCK TIMEZONE” on page 387.
Daylight Savings Time (DST)	The status of the daylight savings time setting. The status can be enabled or disabled. This value is set with “CLOCK TIMEZONE” on page 387.

Example

The following example displays the settings of the SNTP client:

```
awplus# show ntp associations
```

SHOW NTP STATUS

Syntax

```
show ntp status
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the status of an NTP or SNTP server assigned to the switch. The display states whether or not the switch has synchronized its time with an NTP or SNTP server. An example of the display is shown in Figure 86.

```
Clock is synchronized, reference is 192.168.20.27
Clock offset is +2:00
```

Figure 86. SHOW NTP STATUS Command

The IP address above is the address of the NTP or SNTP server specified with the NTP PEER command. See "NTP PEER" on page 390. The clock offset is configured with the CLOCK TIMEZONE command. See "CLOCK TIMEZONE" on page 387.

Example

The following example displays the status of the NTP or SNTP server assigned to the switch:

```
awplus# show ntp status
```

Chapter 19

Domain Name System (DNS)

Overview

The Domain Name System (DNS) is a naming system that allows you to access remote systems using host names that consist of text or text-based rather than IP addresses. DNS creates a mapping between a domain name, such as “www.alliedtelesis.com,” and its IP address, for example, 207.135.120.89. These mappings are held on DNS servers.

To access remote systems using domain names instead of IP addresses, you must have a DNS server on your network and configure DNS servers on the switch.

Domain name parts

Domain names, such as “www.alliedtelesis.com,” consist of two or more name segments. The format of a domain name is the same as the host portion of a Uniform Resource Locator (URL), and each segment is separated by a period.

The hierarchy of a domain name descends from right to left. The segment on the far right is a top-level domain name shared by many hosts. For example, the “alliedtelesis” of “www.alliedtelssis.com” belongs to the top-level domain “com” and the “www” belongs to the “alliedtelesis”.

The following diagram shows an example of DNS hierarchy.

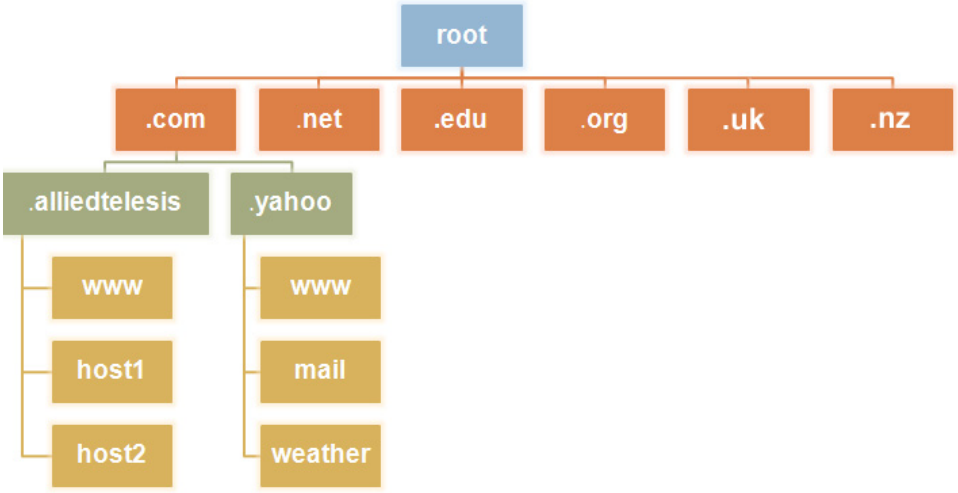

Figure 87. DNS Hierarchy

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.

DNS Sever List

The DNS server list is a set of DNS servers that a DNS client on the switch sends a request to. When you enter a domain name in the CLI as a part of the command, for example, `ping www.alliedtelesis.com`, the DNS client on the switch sends a DNS query to DNS servers on the DNS server list to resolve the host name. To use domain names instead of IP addresses on the switch, you must have at least one server on the DNS server list. You can add a DNS server using the IP NAME-SERVER command.

DNS List

You add top-level domains, such as "com" and "net" to the DNS list. The switch appends a domain to incomplete host names in DNS requests. Each domain in the DNS list is tried in DNS lookups. For example, when you use the `ping alliedtelesis` command, the switch sends a DNS request for "alliedtelesis.com." When no match is found, the switch tries "alliedtelesis.net." You can create the DNS list using the IP DOMAIN-LIST command.

Default Domain

The switch can have one default domain. The switch allows you to save typing of a domain in the CLI by setting a default domain. Once you set a default domain for the DNS, the DNS client appends this domain to incomplete host names in DNS requests. For example, you set "alliedtelesis.com" as a default domain. When you type the command `ping host2` in the CLI, the switch sends a DNS request for "host2.alliedtelesis.com."

If a domain exists in the DNS list, the switch does not use the default domain. The switch uses the default domain only when no domains are specified in the DNS list.

Adding a DNS Server to the Switch

The switch has a DNS client. When you add a DNS server to the switch, the DNS client allows you to use domain names instead of IP addresses when you use commands on the switch.

The switch cannot resolve a host name until you have added at least one server to the DNS server list on the switch. There is no limit on the number of servers you can add to the list.

To add the IP address of a DNS server, use the IP NAME-SERVER command. The following example adds the IP address of a DNS server, 10.8.4.75, to the list of DNS servers:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip name-server 10.8.4.75
```

To display the list of DNS servers, use the SHOW IP NAME-SERVER command in the Privileged Exec mode:

```
awplus# show ip name-server
```

Here is an example of the information the command displays.

```
DNS Name Servers:
10.8.4.75
```

Figure 88. SHOW IP NAME-SERVER Command Display

Enabling or Disabling the DNS Client

The DNS client on the switch allows you to use domain names instead of IP addresses when you enter commands on your switch. The DNS client on the switch is enable by default.

To disable the DNS client, use the NO IP DOMAIN-LOOKUP command:

```
awplus# no ip domain-lookup
```

To enable the DNS client, use the IP DOMAIN-LOOKUP command:

```
awplus> enable
awplus# ip domain-lookup
```

Adding a Domain to the DNS List

The switch allows you to create a list of domains to save typing the portion of a domain name on the CLI. Once you add domains to the DNS list, the switch appends a domain name to incomplete host names in DNS requests. Each domain in the DNS list is tried in DNS lookups. The first entry added to the DNS list is checked first. Then the second DNS list entry is checked and so forth.

For example, to add the top-level domains ".com" and ".net" to the DNS list, use the following commands:

```
awplus(config)# ip domain-list com
awplus(config)# ip domain-list net
```

If you enter the command `ping alliedtelesis`, the switch sends a DNS request for "alliedtelesis.com." When no match was found, the switch tries "alliedtelesis.net."

To view the entries in the DNS list, use the command:

```
awplus# show ip domain-name
```

Here is an example of the information the command displays.

```
DNS default domain: alliedtelesis.com
DNS domain list:
   domain com
   domain net
   domain oh.us
```

Figure 89. SHOW IP DOMAIN-NAME Command Display

Also, the SHOW HOSTS command displays the default domain name, a list of DNS domain names, and a list of DNS servers:

```
awplus# show hosts
```

Here is an example of the information the command displays.

```
DNS default domain: alliedtelesis.com
DNS domain list:
   domain com
   domain net
   domain oh.us
DNS Name Servers:
192.168.1.85
```

Figure 90. SHOW HOSTS Command Display

Setting a Default Domain Name for the DNS

The switch allows you to save typing of the portion of a domain name in the CLI by setting a default domain. Once you set a default domain for the DNS, the DNS client appends this domain to incomplete host-names in DNS requests. For example, you set "alliedtelesis.com" as a default domain. When you type the command `ping host2` in the CLI, the switch sends a DNS request for "host2.alliedtelesis.com."

If any domain exists in the DNS list, the switch does not use the default domain. The switch uses the default domain *only* when no domains are specified in the DNS list.

To set "alliedtelesis.com" as a default domain name, use the IP DOMAIN-NAME command:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip domain-name alliedtelesis.com
```

To display the default domain, use the SHOW IP DOMAIN-NAME command in the Privileged Exec mode:

```
awplus# show ip domain-name
```

Here is an example of the information the command displays.

```
DNS default domain: alliedtelesis.com
```

Figure 91. Displaying the Default Domain

Also, the SHOW HOSTS command displays the default domain name among other information:

```
awplus# show hosts
```

Here is an example of the information the command displays.

```
DNS default domain: alliedtelesis.com
```

Figure 92. SHOW HOSTS Command Display

Chapter 20

Domain Name System (DNS) Commands

The DNS commands are summarized in Table 36.

Table 36. DNS Commands

Command	Mode	Description
“IP NAME-SERVER” on page 406	Global Configuration	Adds a DNS server to the list of servers that the switch sends DNS queries to.
“IP DOMAIN-NAME” on page 408	Global Configuration	Adds a default domain name that is appended to DNS requests.
“IP DOMAIN-LIST” on page 409	Global Configuration	Adds a domain name to the DNS list that the switch tries starting with the first entry added.
“IP DOMAIN-LOOKUP” on page 411	Global Configuration	Enables the DNS client on the switch to use domain names instead of IP addresses in commands.
“SHOW IP NAME-SERVER” on page 412	Privileged Exec	Displays the list of DNS servers on the switch.
“SHOW IP DOMAIN-NAME” on page 413	Privileged Exec	Displays a default domain and a list of domains configured on the switch.
“SHOW HOSTS” on page 414	Privileged Exec	Displays the status of the DNS client, the configured DNS servers, and the default domain.

IP NAME-SERVER

Syntax

```
ip name-server <ip-address>
```

Parameters

ip-address
Specifies the IP address of a DNS server.

Mode

Global Configuration mode

Description

Use this command to add the IP address of a DNS server to the DNS server list on the switch. The DNS client on the switch sends DNS queries to servers on this list when trying to resolve a DNS host name. The switch cannot resolve a host name until you have added at least one server to this list. There is a maximum of three servers that you can add to the list.

When the switch is using its DHCP client for an interface, it can receive Option code 6 from the DHCP server. After a switch receives Option code 6 from a DHCP server, it automatically adds information about the DHCP server to the end of the existing domain list.

To delete a DNS server from the switch's server list, use the NO IP NAME-SERVER command with the IP address of the DNS server.

Confirmation Command

"SHOW IP NAME-SERVER" on page 412

Examples

To allow the switch to send DNS queries to a DNS server at 10.10.10.5, use the commands:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip name-server 10.10.10.5
```

To delete a DNS server with an IP address of 10.10.10.5 from the DNS server list, use the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip name-server 10.10.10.5
```

IP DOMAIN-NAME

Syntax

```
ip domain-name <domain-name>
```

Parameters

domain-name
Specifies a domain string, for example “alliedtelesis.com.”

Mode

Global Configuration mode

Description

Use this command to set a default domain for the DNS. The DNS client on the switch appends this domain to incomplete host names in DNS requests.

If a domain exists in the DNS list, the switch does not use the default domain you specify with this command. The switch uses the default domain only when no domains are specified in the DNS list. To view the DNS list, use the SHOW IP DOMAIN-NAME command.

When the switch is using its DHCP client for an interface, it can receive DHCP option 15 from the DHCP server. The option 15 replaces the domain name specified by the IP DOMAIN-NAME command with the domain name from the DHCP server.

Confirmation Command

“SHOW IP NAME-SERVER” on page 412

Example

The following command configures the domain name, “alliedtelesis.com:”

```
awplus> enable
awplus# configure terminal
awplus(config)# ip domain-name alliedtelesis.com
```

IP DOMAIN-LIST

Syntax

```
ip domain-list <domain-name>
```

Parameters

domain-name
Specifies a domain string, for example, "com."

Mode

Global Configuration mode

Description

Use this command to add a domain name to the DNS list on the switch. You can add up to three domain names to the list.

The domain is appended to incomplete host names in DNS requests. Each domain is tried in turn in DNS lookups. The first entry you create is checked first.

For example, when you add "com" first, then "net" to the DNS list, and enter the `PING ALLIEDTELESIS` command in the CLI, the switch appends "com" to "alliedtelesis" using "." as a separator and sends a DNS request for "alliedtelesis.com". When no match is found, the switch appends the second entry, "net" in the DNS list and tries "alliedtelesis.net".

Note
Do not include "." as a domain. The switch adds "." when appending a domain to an incomplete host name.

To delete a domain from the DNS list, use the NO IP DOMAIN-LIST command.

Confirmation Command

"SHOW IP DOMAIN-NAME" on page 413

Examples

To add the domains “com” and “net” to the DNS list, use the following commands:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip domain-list com
awplus(config)# ip domain-list net
```

To delete the domain “net” from the DNS list, use the following command:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip domain-list net
```

IP DOMAIN-LOOKUP

Syntax

```
ip domain-lookup
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enable the DNS client on the switch. The command allows you to use domain names instead of IP addresses in commands. The DNS client resolves a domain name into an IP address by sending a DNS query to the DNS server specified with the IP NAME-SERVER command.

The DNS client is enabled by default. However, it does not attempt DNS queries unless at least one DNS server is configured.

To disable the DNS client on the switch, use the NO IP DOMAIN-LOOKUP command.

Example

The following example enables the DNS client on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip domain-lookup
```

The following command disables the DNS client on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip domain-lookup
```

SHOW IP NAME-SERVER

Syntax

```
show ip name-server
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the list of DNS servers on the DNS server list on the switch. This command shows a static list configured using the IP NAME-SERVER command. An example of the information is shown in Figure 93.

```
DNS Name Servers:
10.8.4.75
```

Figure 93. SHOW IP NAME-SERVER Command

Example

To display the list of DNS servers configured using the IP NAME-SERVER command:

```
awplus# show ip name-server
```

SHOW IP DOMAIN-NAME

Syntax

```
show ip domain-name
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the default domain and a list of domains on the DNS list on the switch. This command shows information configured using the IP DOMAIN-NAME and IP DOMAIN-LIST commands. An example of the information is shown in Figure 94.

```
DNS default domain: alliedtelesis.com

DNS domain list:
 domain com
 domain net
```

Figure 94. SHOW IP DOMAIN-NAME Command

Example

This example displays the default domain and the list of domains:

```
awplus# show ip domain-name
```

SHOW HOSTS

Syntax

```
show hosts
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the default domain name, a list of DNS domain names, and a list of DNS servers. Figure 95 shows an example of the information.

```
DNS default domain: alliedtelesis.com
DNS domain list:
 domain com
 domain net
domain oh.us

DNS Name Servers:
192.168.1.85
```

Figure 95. SHOW HOSTS Command

Example

To display the information:

```
awplus# show hosts
```

Chapter 21

MAC Address Table

This chapter discusses the following topics:

Overview

The MAC address table stores the MAC addresses of all the network devices that are connected to the switch's ports. Each entry in the table consists of a MAC address, a port number where an address was learned by the switch, and an ID number of a VLAN where a port is a member.

The switch learns the MAC addresses of the network devices by examining the source addresses in the packets as they arrive on the ports. When the switch receives a packet that has a source address that is not in the table, it adds the address, along with the port number where the packet was received and the ID number of the VLAN where the port is a member. The result is a table that contains the MAC addresses of all the network devices that are connected to the switch's ports.

The purpose of the table is to allow the switch to forward packets more efficiently. When a packet arrives on a port, the switch examines the destination address in the packet and refers to its MAC address table to determine the port where the destination node of that address is connected. It then forwards the packet to that port and on to the network device.

If the switch receives a packet with a destination address that is not in the MAC address table, it floods the packet to all its ports, excluding the port where the packet was received. If the ports are grouped into virtual LANs, the switch floods the packet only to those ports that belong to the same VLAN from which the packet originated. This prevents packets from being forwarded to inappropriate LAN segments and increases network security. When the destination node responds, the switch adds the node's MAC address and port number to the MAC address table.

If the switch receives a packet with a destination address that is on the same port on which the packet was received, it discards the packet without forwarding it on to any port. Because both the source node and the destination node for the packet are located on the same port on the switch, there is no reason for the switch to forward the packet. This, too, increases network performance by preventing frames from being forwarded unnecessarily to other network devices.

MAC addresses learned by the switch are referred to as dynamic addresses. Dynamic MAC addresses are not stored indefinitely in the MAC address table. They are automatically deleted when they are inactive. A MAC address is considered inactive if the switch does not receive any frames from the network device after a specified period of time. The switch assumes that the node with that MAC address is no longer active and that its MAC address can be purged from the table. This prevents the MAC address table from becoming filled with addresses of nodes that are no longer active.

The period of time the switch waits before purging inactive dynamic MAC addresses is called the aging time. This value is adjustable on the switch. The default value is 300 seconds (5 minutes).

You can also enter addresses manually into the table. These addresses are referred to as static addresses. Static MAC addresses remain in the table indefinitely and are never deleted, even when the network devices are inactive. Static MAC addresses are useful for addresses that the switch might not learn through its normal learning process or for addresses that you want the switch to retain, even when the end nodes are inactive.

Adding Static MAC Addresses

The command for adding static unicast MAC addresses to the switch is MAC ADDRESS-TABLE STATIC in the Global Configuration mode. Here is the format of the command:

```
mac address-table static macaddress forward|discard
interface port [vlan vlan-name|vid]
```

Here are the variables of the command:

- *macaddress* - Use this variable to specify the unicast or multicast MAC address you want to add to the table. You can add only one address at a time. In the command, the address must be specified in either one of the following formats:

  xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

- forward|discard - Use these variables to specify whether the port is to forward or discard packets that have the designated source MAC address.
- *port* - Use this variable to specify the port to which the end node of an address is connected. You can specify just one port.
- *vlan-name* or *VID* - Use this variable to specify the name or the ID number of the VLAN of the port of the address. This information is optional in the command.

This example adds the static MAC address 00:1B:75:62:10:84 to port 12 in the Default VLAN. The port forwards the packets of the designated network device:

```
awplus> enable
awplus# configure terminal
awplus(config)# mac address-table static 00:1b:75:62:10:84
forward interface port1.0.12 vlan 1
```

This example adds the static MAC address 00:A2:BC:34:D3:67 to port 11 in the VLAN with the ID 4. The port forwards the packets of the designated network device:

```
awplus> enable
awplus# configure terminal
awplus(config)# mac address-table static 00:a2:bc:34:d3:67
forward interface port1.0.11 vlan 4
```

This example adds the static MAC address 00:A0:D2:18:1A:11 to port 7. The port discards the packets of the designated network device:

```
awplus> enable
awplus# configure terminal
awplus(config)# mac address-table static 00:a0:d2:18:1a:11
discard interface port1.0.7
```

Deleting MAC Addresses

To delete MAC addresses from the switch, use the CLEAR MAC ADDRESS-TABLE command in the Privileged Exec mode. The format of the command is:

```
clear mac address-table dynamic|static [address
macaddress]|[interface port]|[vlan vid]
```

Here are the variables:

- dynamic - This variable lets you delete dynamic addresses.
- static - This parameter lets you delete static addresses.
- address - You can use this parameter to delete specific addresses. You can delete just one address at a time. In the command, the address must be specified in either one of the following formats:

  xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

- interface - You can use this parameter to delete all of the static or dynamic addresses on a particular port. You can specify more than one port at a time.
- vlan - You can use this parameter to delete all of the static or dynamic addresses on the ports of a particular VLAN. You can specify just one VID at a time.

This example of the command deletes all of the dynamic addresses from the table:

```
awplus> enable
awplus# clear mac address-table dynamic
```

This example deletes all of the static addresses:

```
awplus> enable
awplus# clear mac address-table static
```

This example deletes a single dynamic address:

```
awplus> enable
awplus# clear mac address-table dynamic address
00:12:a3:68:79:b2
```

This example deletes a single static address:

```
awplus> enable
awplus# clear mac address-table static address
00:12:a3:d4:67:da
```

This example deletes all of the dynamic addresses learned on port 20:

```
awplus> enable
awplus# clear mac address-table dynamic interface port1.0.20
```

This example deletes all of the static addresses added to ports 2 to 5:

```
awplus> enable
awplus# clear mac address-table static interface port1.0.2-
port1.0.5
```

This example deletes all of the dynamic addresses learned on the ports of the VLAN with the VID 82:

```
awplus> enable
awplus# clear mac address-table dynamic vlan 82
```

This example deletes all of the static addresses added to the ports of the VLAN with the VID 18:

```
awplus> enable
awplus# clear mac address-table static vlan 18
```

Setting the Aging Timer

The aging timer defines the length of time that inactive dynamic MAC addresses remain in the table before they are deleted by the switch. The switch deletes inactive addresses to insure that the table contains only active and current addresses.

The aging timer does not apply to static addresses because static addresses are not deleted by the switch, even when the network devices are inactive.

To set the aging timer, use the MAC ADDRESS-TABLE AGEING-TIME command in the Global Configuration mode. Here is the format of the command:

```
mac address-table ageing-time value|none
```

The aging-time is expressed in seconds and has a range of 10 to 1000000 seconds. The default is 300 seconds (5 minutes). The value none disables the aging timer so that inactive MAC addresses are never deleted from the table.

To view the current setting for the MAC address aging timer, refer to “Displaying the MAC Address Table” on page 423.

This example sets the aging timer to 800 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# mac address-table ageing-time 800
```

Displaying the MAC Address Table

To view the aging time or the MAC address table, use the SHOW MAC ADDRESS-TABLE command in the Privileged Exec mode. Here is its format:

```
show mac address-table [interface port]|[vlan vid]
```

An example of the table is shown in Figure 96.

```
Aging Interval: 300 second(s)

Switch Forwarding Database
-------------------------------------------------------------
VLAN    Port        MAC              Fwd
-------------------------------------------------------------
1      1.0.5    0011.2495.53f8     forward     dynamic
1      1.0.5    0023.6c90.08b9     forward     dynamic
1      1.0.5    0024.36a0.1551     forward     dynamic
1      1.0.5    0025.00d7.8908     forward     dynamic
1      1.0.5    0050.50de.ad01     forward     dynamic


.
.
.
-------------------------------------------------------------

Total Number of MAC Addresses: 121

Multicast Switch Forwarding Database
Total Number of MCAST MAC FDB Addresses: 1

-------------------------------------------------------------------------
VLAN          MAC                      Port Maps (U:Untagged T:Tagged)
-------------------------------------------------------------------------
1      01:00:51:00:00:01    Static    U:18-24
                                      T:
```

Figure 96. SHOW MAC ADDRESS-TABLE Command

The columns in the window are described in "SHOW MAC ADDRESS-TABLE" on page 434.

This example of the command displays the entire MAC address table:

```
awplus# show mac address-table
```

This example displays the MAC addresses learned on port 2:

```
awplus# show mac address-table interface port1.0.2
```

This example displays the addresses learned on the ports in a VLAN with the VID 8:

```
awplus# show mac address-table vlan 8
```

Chapter 22

MAC Address Table Commands

The MAC address table commands are summarized in Table 37.

Table 37. MAC Address Table Commands

Command	Mode	Description
“CLEAR MAC ADDRESS-TABLE” on page 426	Privileged Exec	Deletes MAC addresses from the MAC address table.
“MAC ADDRESS-TABLE AGEING-TIME” on page 428	Global Configuration	Sets the aging timer, which is used by the switch to identify inactive dynamic MAC addresses for deletion from the table.
“MAC ADDRESS-TABLE STATIC” on page 430	Global Configuration	Adds static unicast MAC addresses to the table.
“NO MAC ADDRESS-TABLE STATIC” on page 432	Global Configuration	Deletes static unicast MAC addresses from the table.
“SHOW MAC ADDRESS-TABLE” on page 434	Privileged Exec	Displays the MAC address table and the aging timer.

CLEAR MAC ADDRESS-TABLE

Syntax

```
clear mac address-table dynamic|static [address
macaddress]|[interface port]|[vlan vid]
```

Parameters

dynamic
Deletes dynamic MAC addresses.

static
Deletes static addresses.

address
Deletes a specific address.

macaddress
Specifies the address to be deleted. The address must be specified in either one of the following formats: xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

interface
Deletes MAC addresses learned on a specific port.

port
Specifies the port the MAC addresses to be deleted was learned on. You can specify more than one port.

vlan
Deletes MAC addresses learned on a specific VLAN.

vid
Specifies the VID of the VLAN the MAC addresses to be deleted was learned on. You can specify just one VID.

Mode

Privileged Exec mode

Description

Use this command to delete addresses from the MAC address table.

Confirmation Command

“SHOW MAC ADDRESS-TABLE” on page 434.

Examples

This example deletes all of the dynamic addresses from the table:

```
awplus> enable
awplus# clear mac address-table dynamic
```

This example deletes all of the static addresses:

```
awplus> enable
awplus# clear mac address-table static
```

This example deletes a single dynamic address:

```
awplus> enable
awplus# clear mac address-table dynamic address
00:12:a3:34:8b:32
```

This example deletes a single static address:

```
awplus> enable
awplus# clear mac address-table static address
00:12:a3:d4:67:da
```

This example deletes all of the dynamic addresses learned on ports 17 to 20:

```
awplus> enable
awplus# clear mac address-table dynamic interface port1.0.17-
port1.0.20
```

This example deletes all of the static addresses added to port 19:

```
awplus> enable
awplus# clear mac address-table static interface port1.0.19
```

This example deletes all of the dynamic addresses learned on the ports of the VLAN with the VID 12:

```
awplus> enable
awplus# clear mac address-table dynamic vlan 12
```

This example deletes all of the static addresses added to the ports of the VLAN with the VID 56:

```
awplus> enable
awplus# clear mac address-table static vlan 56
```

MAC ADDRESS-TABLE AGEING-TIME

Syntax

```
mac address-table ageing-time value|none
```

Parameter

ageing-time
: Specifies the aging timer in seconds for the MAC address table. The range is 10 to 1000000 seconds. The default is 300 seconds (5 minutes).

Mode

Global Configuration mode

Description

Use this command to set the aging timer. The aging timer is used by the switch to delete inactive dynamic MAC addresses from the MAC address table, to prevent the table from becoming full of inactive addresses. An address is considered inactive if no packets are sent to or received from the corresponding node for the duration of the timer.

Setting the aging timer to none disables the timer. No dynamic MAC addresses are aged out, and the table stops learning new addresses after reaching its maximum capacity.

To return the aging timer to its default value, use the NO form of this command.

Confirmation Command

“SHOW MAC ADDRESS-TABLE” on page 434.

Examples

This example sets the aging timer to 500 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# mac address-table ageing-time 500
```

This example disables the aging timer so that the switch does not delete inactive dynamic MAC addresses from the table:

```
awplus> enable
awplus# configure terminal
awplus(config)# mac address-table ageing-time none
```

This example returns the aging timer to its default setting of 300 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# no mac address-table ageing-time
```

MAC ADDRESS-TABLE STATIC

Syntax

```
mac address-table static macaddress forward|discard
interface port [vlan vlan-name|vid]
```

Parameters

macaddress
: Specifies the static unicast address you want to add to the switch's MAC address table. The address must be specified in either one of the following formats: xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

forward
: Forwards packets containing the designated source MAC address.

discard
: Discards packets containing the designated source MAC address.

port
: Specifies the port(s) where the MAC address is to be assigned. A unicast MAC address can be added to only one port.

vlan-name
: Specifies the name of the VLAN where the node designated by the MAC address is a member.

vid
: Specifies the ID number of the VLAN where the node designated by the MAC address is a member. This parameter is optional.

Mode

Global Configuration mode

Description

Use this command to add static unicast MAC addresses to the switch's MAC address table. A static MAC address is never timed out from the MAC address table, even when the end node is inactive. You can add just one static MAC address at a time with this command.

The FORWARD and DISCARD parameters are used to specify whether the switch is to forward or discard packets containing the specified source MAC address.

Confirmation Command

"SHOW MAC ADDRESS-TABLE" on page 434

Examples

This example adds the static MAC address 44:c3:22:17:62:a4 to port 4 in the Production VLAN. The port forwards the packets from the specified node:

```
awplus> enable
awplus# configure terminal
awplus(config)# mac address-table static 44:c3:22:17:62:a4
forward interface port1.0.4 vlan Production
```

This example adds the static MAC address 00:a0:d2:18:1d:11 to port 7 in the Default_VLAN, which has the VID 1. The port discards the packets from the specified node:

```
awplus> enable
awplus# configure terminal
awplus(config)# mac address-table static 00:a0:d2:18:1a:11
discard interface port1.0.7 vlan 1
```

This example adds the static MAC address 78:1a:45:c2:22:32 to port 15 in the Marketing VLAN. The port forwards the packets:

```
awplus> enable
awplus# configure terminal
awplus(config)# mac address-table static 78:1a:45:c2:22:32
forward interface port1.0.15 vlan Marketing
```

NO MAC ADDRESS-TABLE STATIC

Syntax

```
no mac address-table static macaddress forward|discard
interface port [vlan vlan-name|vid]
```

Parameters

macaddress
: Specifies the static unicast address you want to delete from the switch's MAC address table. The address must be specified in either one of the following formats: xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

forward
: Forwards packets containing the designated source MAC address.

discard
: Discards packets containing the designated source MAC address.

port
: Specifies the port(s) where the MAC address is assigned.

vlan-name
: Specifies the name of the VLAN where the node of the MAC address is a member. This parameter is optional.

vid
: Specifies the ID number of the VLAN where the node of the MAC address is a member. You can omit this parameter when removing addresses from the Default_VLAN.

Mode

Global Configuration mode

Description

Use this command to delete dynamic or static unicast addresses from the switch's MAC address table. This command performs the same function as "CLEAR MAC ADDRESS-TABLE" on page 426.

Note
You cannot delete the switch's MAC address, an STP BPDU MAC address, or a broadcast address from the table.

Confirmation Command

"SHOW MAC ADDRESS-TABLE" on page 434

Examples

This example deletes the MAC address 00:A0:D2:18:1A:11 from port 12 in the Default_VLAN, which has the VID 1. The port is forwarding packets of the owner of the address:

```
awplus> enable
awplus# configure terminal
awplus(config)# no mac address-table static
00:a0:d2:18:1a:11 forward interface port1.0.12 vlan 1
```

This example deletes the MAC address 86:24:3c:79:52:32 from port 16 in the Sales VLAN. The port is discarding packets of the owner of the address:

```
awplus> enable
awplus# configure terminal
awplus(config)# no mac address-table static
86:24:3c:79:52:32 discard interface port1.0.16 vlan Sales
```

SHOW MAC ADDRESS-TABLE

Syntax

`show mac address-table begin|exclude|include [interface` *`port`*`]|[vlan` *`vid`*`]`

Parameters

begin

Specifies the first line that matches the MAC address is displayed. The address must be specified in either one of the following formats: xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

exclude

Indicates the specified MAC address is excluded from the display. The address must be specified in either one of the following formats: xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

include

Indicates the specified MAC address is included in the display. The address must be specified in either one of the following formats: xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

port

Specifies a port. You may specify more than one port.

vid

Specifies a VID. You may specify one VID.

Modes

Privileged Exec mode

Description

Use this command to display the aging timer and the unicast and multicast MAC addresses the switch has stored in the table. You may view all of the addresses in the table or only the addresses learned on a particular port or VLAN.

In addition, the software supports a GREP feature which allows you to specify a MAC address that is displayed or a MAC address that is not displayed by this command. You can also display MAC addresses that begin with a specified value.

An example of the table is shown in Figure 97.

```
Aging Interval: 300 second(s)

Switch Forwarding Database
-------------------------------------------------------------
VLAN    Port        MAC             Fwd
-------------------------------------------------------------
1      1.0.1    00a0.d218.1ac8     Forward     Dynamic
1      1.0.2    00a0.c416.3b80     Forward     Dynamic
1      1.0.3    00a0.12c2.10c6     Forward     Dynamic
1      1.0.4    00a0.c209.10d8     Forward     Dynamic
1      1.0.4    00a0.3343.a187     Forward     Dynamic
1      1.0.4    00a0.12a7.1468     Forward     Dynamic

.
.
.
-------------------------------------------------------------

Total Number of MAC Addresses: 121

Multicast Switch Forwarding Database
Total Number of MCAST MAC FDB Addresses: 1

-------------------------------------------------------------------------
VLAN          MAC                      Port Maps (U:Untagged T:Tagged)
-------------------------------------------------------------------------
1      01:00:51:00:00:01    Static    U:18-24
                                      T:
```

Figure 97. SHOW MAC ADDRESS-TABLE Command

The Aging Interval field at the top of the table displays the aging timer of the MAC address table.

The Switch Forwarding Database displays the static and dynamic unicast MAC addresses the switch has stored in the table. The first address is the MAC address of the switch. The columns are defined in Table 38.

Table 38. SHOW MAC ADDRESS-TABLE Command - Unicast Addresses

Parameter	Description
VLAN	The ID number of the VLAN where the port is an untagged member.
Port	The port where the address was learned or assigned. The MAC address with port 0 is the address of the switch.
MAC	The dynamic or static unicast MAC address learned on or assigned to the port.

Table 38. SHOW MAC ADDRESS-TABLE Command - Unicast Addresses

Parameter	Description
Fwd	The status of the address. MAC addresses have the status of Forward, meaning that they are used by the switch to forward packets.
(unlabeled)	The type of address: static or dynamic.

The Multicast Switch Forwarding Database contains the multicast addresses. The columns are defined in this table.

Table 39. SHOW MAC ADDRESS-TABLE Command - Multicast Addresses

Parameter	Description
VLAN	The ID number of the VLAN where the port is an untagged member.
MAC	The multicast MAC address.
(unlabeled)	The type of the address: static or dynamic.
Port Maps	The tagged and untagged ports on the switch that are members of the multicast group. This column is useful in determining which ports belong to different groups.

Examples

This example displays the entire MAC address table:

```
awplus# show mac address-table
```

This example displays the MAC addresses learned on ports 1 through 4:

```
awplus# show mac address-table interface port1.0.1-port1.0.4
```

This example displays the addresses learned on the ports in a VLAN with a VID of 22:

```
awplus# show mac address-table vlan 22
```

This example displays the MAC addresses that include a value of “90:08:B9:”

```
awplus# show mac address-table include 90:08:B9
```

Chapter 23

Enhanced Stacking

This chapter discusses the following topics:

Overview

Enhanced stacking is a management tool that allows you to manage different AT-FS970M Switches from one management session. With enhanced stacking you can start a management session on one switch and then redirect the session to any of the other switches in the stack, without having to start a new session.

It is important to understand that enhanced stacking is simply a management tool. The switches of an enhanced stack continue to function as stand-alone devices. As such, the switches operate independently of each other and must be configured individually. For a description of how the feature is used, refer to “Managing the Member Switches of an Enhanced Stack” on page 446.

Note
Enhanced stacking is *only* supported on standalone switches. A standalone switch is defined as a switch with a Device ID set to 0.

Command and Member Switches

An enhanced stack must have one command switch. This switch is your management access point to the other switches in a stack. To manage the switches of a stack, you start a local or remote management session on the command switch and then redirect the session, as needed, to the other switches.

The other switches in the stack are known as member switches. They can be managed either through the command switch with enhanced stacking or from local or remote management sessions.

Common VLAN

- The switches of an enhanced stack do not have to be connected together with a common VLAN. The command switch uses this VLAN to send out broadcast packets to search for the switches in the stack. The VLAN also carries your configuration commands to the switches. Here are several things to keep in mind when planning the common VLAN of an enhanced stack:
- The common VLAN can have any valid VLAN name and VLAN identifier (VID).
- A member switch can be connected indirectly to the command switch through other switches, so long as there is an uninterrupted path of the common VLAN to the command switch.
- The Default_VLAN can be used as the common VLAN.
- The common VLAN of the enhanced stack does not have to be dedicated solely to that feature. It can be used like any other VLAN.

- A member switch can be any distance from the command switch, so long as the distance adheres to Ethernet cabling standards.

For background information on port-based and tagged virtual LANs, refer to Chapter 62, "Port-based and Tagged VLANs" on page 927.

Guidelines

Here are the enhanced stacking guidelines for the AT-FS970M Switch:

- A stack can have up to 24 AT-FS970M Switches.
- The switches of an enhanced stack must be connected together with a common port-based or tagged VLAN.
- The common VLAN does not require the same VID on all of the switches.
- You can use tagged or untagged twisted pair or fiber optic ports of the common VLAN to connect the switches together.
- A member switch does not have to be connected directly to the command switch. It can be connected indirectly through other switches, so long as there is an uninterrupted path of the common VLAN to the command switch.
- There are not any distance limitations between the command switch and the member switches of a stack, other than those dictated by the Ethernet cabling standards.
- The command switch is not required to be assigned a management IP address. The member switches also do not require IP addresses.
- The enhanced stacking feature on the AT-FS970M Switch is not compatible with the same feature on other Allied Telesis switches, such as the AT-8400, AT-8500, and AT-9400 Series switches.
- Remote Telnet, SSH, or web browser management of an enhanced stack must be conducted through the subnet of the common VLAN. The remote management workstations must be members of that subnet or have access to it through routers or other Layer 3 devices.
- The IP address 172.16.16.16 is reserved for the enhanced stacking feature. It must not be assigned to any device on your network.

General Steps

Here are the general steps to implementing the enhanced stacking feature on the switches:

1. Select an AT-FS970M Switch to act as the command switch of the stack. This can be any AT-FS970M Switch.

2. On the switch chosen to be the command switch, activate enhanced stacking and change its stacking status to command switch. The commands are ESTACK RUN and ESTACK COMMAND-SWITCH, both in the Global Configuration mode.

3. On the member switches, activate enhanced stacking. You do not have to set the enhanced stacking mode on the member switch because the member mode is the default setting.

4. Create a common port-based or tagged VLAN on the command and member switches. This step is not necessary if you are using the Default_VLAN (VID 1) as the common VLAN.

5. Optionally, assign the command switch a management IP address in the common VLAN.

6. If you plan to remotely manage the stack from management workstations that are not members of the same subnet as the switch, assign the command switch a default gateway that defines the first hop to reaching the subnet of the workstations.

   Since an enhanced stack is managed through the command switch, only that switch must have a default gateway, and only if the remote management workstations are not members of the same subnet as the common VLAN of the stack.

7. Connect the devices together using twisted pair or fiber optic ports of the common VLAN.

Configuring the Command Switch

Here is an example on how to configure the switch as the command switch of the enhanced stack. The example creates a common VLAN and assigns it a management IP address. Here are the specifications for this command switch:

- Common VLAN name: Tech_Support
- VID: 12
- Untagged VLAN ports: 18 to 22
- Management IP address and subnet mask: 149.22.88.5 and 255.255.255.0
- Default gateway: 149.22.88.27

(A default gateway is optional, but including it allows you to manage the switch and the enhanced stack from remote workstations that are not in the same subnet as the command switch.)

1. This step creates the common VLAN.

`awplus> enable`	Enter the Privileged Exec mode from the User Exec mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# vlan database`	From the Global Configuration mode, enter the VLAN Interface mode.
`awplus(config-vlan)# vlan 12 name Tech_Support`	Create the Tech_Support VLAN and assign it the VID 12.
`awplus(config-vlan)# exit`	Return to the Global Configuration mode.
`awplus(config)# interface port1.0.18-port1.0.22`	Enter the Port Interface mode for ports 18 to 22.
`awplus(config-if)# switchport mode access`	Designate the ports as untagged ports.
`awplus(config-if)# switchport access vlan 12`	Add the ports to the Tech_Support VLAN.
`awplus(config-if)# end`	Return to the Privileged Exec mode.
`awplus# show vlan 12`	Verify the new VLAN.

2. After creating the common VLAN on the switch, assign it the management IP address and default gateway:

awplus# configure terminal	Enter the Global Configuration mode.
awplus(config)# interface vlan12	From the Global Configuration mode, enter the VLAN Interface mode for the Tech_Support VLAN.
awplus(config-if)# ip address 149.22.88.5/24	Assign the VLAN the management IP address, 149.22.88.5 and the subnet mask, 255.255.255.0.
awplus(config-if)# exit	Return to the Global Configuration mode.
awplus(config)# ip route 0.0.0.0/0 149.22.88.27	Assign the switch the default gateway 149.22.88.27.
awplus(config)# exit	Return to the Privileged Exec mode.
awplus# show ip interface	Confirm the IP address.
awplus# show ip route	Confirm the default route.

3. Use the ESTACK RUN command in the Global Configuration mode to activate enhanced stacking and the ESTACK COMMAND-SWITCH command to set the enhanced stacking mode of the switch to command.

awplus# configure terminal	Enter the Global Configuration mode.
awplus(config)# estack run	Activate enhanced stacking on the switch.
awplus(config)# estack command-switch	Assign the switch the enhanced stacking status of command switch.
awplus(config)# exit	Return to the Privileged Exec mode.
awplus# show estack	Confirm the stack mode of the switch.

4. To save the configuration, enter the WRITE command in the Privileged Executive mode.

`awplus# write`	Save the configuration.

Configuring a Member Switch

This example shows you how to configure the switch as a member switch of an enhanced stack. It configures the switch to be part of the same enhanced stack with the same common VLAN as the command switch in the previous example. Here are the specifications for the member switch:

- Common VLAN name: Tech_Support
- VID: 12
- Untagged VLAN ports: 4 and 5

1. This step creates the common VLAN.

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# vlan database`	Enter the VLAN Interface mode.
`awplus(config-vlan)# vlan 12 name Tech_Support`	Create the Tech_Support VLAN and assign it the VID 12.
`awplus(config-vlan)# exit`	Return to the Global Configuration mode.
`awplus(config)# interface port1.0.4-port1.0.5`	Enter the Port Interface mode for ports 4 to 5.
`awplus(config-if)# switchport mode access`	Designate the ports as untagged ports.
`awplus(config-if)# switchport access vlan 12`	Add ports 4 and 5 to the Tech_Support VLAN.
`awplus(config-if)# end`	Return to the Privileged Exec mode.
`awplus# show vlan 12`	Verify the new VLAN.

2. Use the ESTACK RUN command in the Global Configuration mode to activate enhanced stacking on the switch. It is not necessary to set the switch to the member mode because that is the default setting.

`awplus# configure terminal`	Enter the Global Configuration mode.

`awplus(config)# estack run`	Activate enhanced stacking on the switch.
`awplus(config)# exit`	Return to the Privileged Exec mode.
`awplus# show estack`	Confirm the stack mode of the switch.

3. To save the configuration, enter the WRITE command in the Privileged Executive mode.

`awplus# write`	Save the configuration.

4. Connect the switches together using ports of the common VLAN.

Managing the Member Switches of an Enhanced Stack

Here are the steps on how to manage the member switches of an enhanced stack.

1. Start a local or remote management session on the command switch of the enhanced stack. After logging on, you can view and configure the settings of just the command switch.

2. To manage a member switch in the enhanced stack, enter the SHOW ESTACK REMOTELIST command in the Privileged Exec mode.

   ```
   awplus> enable
   awplus# show estack remotelist
   ```

   This command displays all of the member switches in the stack. It does not display any command switches, including the command switch on which you started the management session. An example is shown here.

```
numOfNodes 2
Num  Mac Address        Name           Mode    Version          Model
-------------------------------------------------------------------------
01   eccd.6d4d.6dd5     dutC           Member  AWPLUS v2.3.1.0  AT-FS970M/8
02   eccd.6d4d.6dd0     dutB           Member  AWPLUS v2.3.1.0  AT-FS970M/48
```

Figure 98. SHOW ESTACK REMOTELIST Command

3. Use the RCOMMAND command in the Global Configuration mode to redirect the management session from the command switch to one of the member switches in the list. The format of the command is shown here:

   ```
   rcommand switch_id
   ```

   For example, to manage the dutB switch in the list, you would enter this command:

   ```
   awplus# configure terminal
   awplus(config)# rcommand 2
   ```

   You can manage just one member switch at a time.

4. When prompted, enter the login name and password of a manager account on the member switch you are accessing. Once you have logged on, the command prompt for the member switch is displayed.

5. Configure or view the settings of the member switch, as needed.

6. When you are finished managing the member switch, enter the EXIT command from the User Exec mode or Privileged Exec mode to return the management session to the command switch.

7. To manage another member switch in the enhanced stack, repeat this procedure starting with Step 2.

8. To end the management session, return to the User Exec mode or Privileged Exec mode on the command switch and enter the EXIT command.

Changing the Enhanced Stacking Mode

If you want to change the enhanced stacking mode of a switch from command to member, all you have to do is enter the NO ESTACK COMMAND-SWITCH command in the Global Configuration mode, as shown here:

```
awplus> enable
awplus# configure terminal
awplus(config)# no estack command-switch
```

You can enter this command even if the enhanced stack is functional. Of course, once you have changed the mode on the switch to member from command, you cannot use the switch to manage the member switches in the stack.

Changing the switch from the member mode to the command mode can be more problematic, particularly if the enhanced stack is functional. This is because a member switch will not allow you to change its mode to the command mode if it is part of an active stack.

The easiest way to determine whether the switch is part of an active stack is to use the SHOW ESTACK command. An example of the command is shown here:

```
Enhanced Stacking mode          Member [1]
Management IP address           0.0.0.0
Mac address                     ECCD.6D4D.6DD5
Model Type                      AT-FS970M/8
Version Number                  AWPLUS 2.3.1.0
```

Figure 99. SHOW ESTACK Command

If the brackets following “Member” are empty, the switch is not part of a stack, and you can use the ESTACK COMMMAND-SWITCH command in the Global Configuration mode to change its mode to command, as shown here:

```
awplus> enable
awplus# configure terminal
awplus(config)# estack command-switch
```

If there is a number in the brackets following “Member,” the switch is a member of an active enhanced stack, and it will not let you change its mode. Here are the steps to follow in this situation:

1. On the command switch, disable enhanced stacking with the NO ESTACK RUN command.

2. On the member switch, change its mode from member to command with the ESTACK COMMAND-SWITCH command.

3. On the original command switch, restart enhanced stacking with the ESTACK RUN command and, if desired, reestablish its command mode with the ESTACK COMMAND-SWITCH command. (Disabling enhanced stacking changes the mode on a command switch from command to member.)

Uploading Boot Configuration Files from the Command Switch to Member Switches

You may use the enhanced stacking feature to transfer boot configuration files from the file system in the command switch of the enhanced stack to member switches. This allows you to use the command switch as a central storage device for the configuration files of the member switches in the stack and to distribute the files to the switches in the event you need to restore their configuration settings.

There are three situations where you are likely to find this feature useful:

- To restore the configuration to an existing member switch that has lost its configuration or that has the wrong configuration.
- To configure a replacement switch for a failed unit.
- To configure a new switch that is to have the same configuration as another switch.

There are several ways to use the feature. If the member switches share the same basic configuration, you could create a generic configuration file that contains most of the configuration settings for the switches in the stack and store the file on the command switch. To restore the configuration of a member switch, you could download this file to it from the command switch and afterwards, manually configure whatever other settings are needed for that specific member switch.

If the switches have different configurations, a generic configuration file may not be that useful. Instead, you could store each switch's unique configuration file on the command switch so that you can fully restore the configuration of any of the units.

To use the feature, you first have to store the configuration files of the member switches on the command switch. You can upload the files from the switches using TFTP or Zmodem and then download them into the file system of the command switch, again using TFTP or Zmodem.

The command for transferring configuration files is the UPLOAD CONFIG REMOTELIST command in the Global Configuration mode. The command itself does not have any parameters. Instead, it displays two prompts for the necessary information. The first prompt is shown here:

```
Enter the configuration file name ->
```

When you see this prompt, enter the name of the boot configuration file you want to transfer from the command switch to the member switches. You may specify just one filename, and the name must include the extension .cfg.

The second prompt is shown here:

```
Enter the list of switches ->
```

At the prompt, enter the enhanced stack numbers of the member switches to receive the file. You may upload a file to more than one member switch at a time by separating the numbers with commas. The numbers are viewed with the SHOW ESTACK REMOTELIST command.

There are certain things to know prior to using this feature:

- The transfer works from the command switch to the member switches. You may not use this feature to transfer configuration files from member switches to the command switch.
- You have to store the configuration files of the member switches in the file system of the command switch. To do that, you have to upload the files from the member switches using TFTP or Zmodem and then download them onto the command switch.
- Uploading a configuration file that contains the IP ADDRESS or IPV6 ADDRESS command to more than one switch may cause an IP address conflict in your network, in which multiple switches have the same IP address.
- A member switch has to be configured for enhanced stacking before the command switch can upload a configuration file to it. This means you have to activate enhanced stacking on it, and if the common VLAN of the enhanced stack is not the Default VLAN, you have to create the common VLAN on the switch.
- When a member switch receives a boot configuration file from the command switch, it stores the file in its file system as BOOT.CFG.
- You may upload any configuration file from the command switch, even the active boot configuration file.

Here are two examples of the feature. The first example restores a configuration file to an existing member switch of an enhanced stack. The example makes the following assumptions:

- Enhanced stacking is already activated on the member switch.
- The member switch already has the common VLAN that links the switches of the enhanced stack together.
- The name of its configuration file on the command switch is Eng12c.cfg.
- The member switch uses BOOT.CFG as its active boot configuration file, meaning it will not be necessary to change the name of the configuration file after is transferred to the member switch.

Here are the steps to perform on the command switch to upload the configuration file from its file system to the member switch:

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# show estack remotelist`	Display the member switches of the enhanced stack with the SHOW ESTACK REMOTELIST command to learn the ID number of the switch to receive the configuration file.
`awplus# dir`	List the files in the file system of the command switch to confirm that it has the configuration file to upload to the member switch. In this example, the filename is Eng12c.cfg file.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# upload config remotelist`	Enter the UPLOAD CONFIG REMOTELIST command to begin the file transfer.
`Enter the configuration file name -> Eng12c.cfg`	At the prompt, enter the name of the configuration file the command switch is to upload to the member switch. The filename in this example is Eng12c.cfg.
`Enter the list of switches -> 3`	At the prompt, enter the enhanced stacking ID number of the member switch to receive the file. This number is learned with the SHOW ESTACK REMOTELIST command. The example assumes that the member switch has the ID number 3.
-	At this point, the command switch sends the file to the member switch, which stores it in its file system as BOOT.CFG.
`awplus(config_if)# reboot estack member 3`	Reboot the member switch so that it uses the new configuration file to set its parameters.

Here is another example of the feature. This example uploads a configuration file to a new switch in an enhanced stack, such as a replacement switch for a failed unit. This example is more complicated than the previous example because the stack is not using the Default VLAN as the common VLAN, and the new switch will not be using BOOT.CFG as the name of its active boot configuration file. The example makes the following assumptions:

- The common VLAN of the enhanced stack is called Network5a with the VID 25.
- The common VLAN will initially consist of just untagged port 1 on the new switch.
- The name of the boot configuration file to be downloaded to the new switch stored for the command switch is called SalesE4.cfg
- The name of the active boot configuration file on the new switch is to be actSalesE4.cfg

The first step is to create the common VLAN on the new switch. This is necessary because the enhanced stack is not using the Default VLAN as the common VLAN of the stack. To create the common VLAN and to activate enhanced stacking, perform these steps:

1. Start a local or remote management session on the new switch.
2. Create the common VLAN on the new switch with these commands.

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# vlan database`	Enter the VLAN Interface mode.
`awplus(config-vlan)# vlan 25 name Network5a`	Create the Network5a VLAN and assign it the VID 25.
`awplus(config-vlan)# exit`	Return to the Global Configuration mode.
`awplus(config)# interface port1.0.1`	Enter the Port Interface mode for port 1.
`awplus(config-if)# switchport mode access`	Designate the port as an untagged port.
`awplus(config-if)# switchport access vlan 25`	Add port 1 to the Network5a VLAN.

`awplus(config-if)# end`	Return to the Privileged Exec mode.
`awplus# show vlan 12`	Verify the new VLAN.

3. Use the ESTACK RUN command in the Global Configuration mode to activate enhanced stacking on the switch. It is not necessary to set the switch to the member mode because that is the default setting.

`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# estack run`	Activate enhanced stacking on the new switch.
`awplus(config)# exit`	Return to the Privileged Exec mode.
`awplus# show estack`	Confirm the stack mode of the switch.

4. To save the configuration, enter the WRITE command in the Privileged Executive mode.

`awplus# write`	Save the configuration.

5. Connect port 1 on the new switch to a port on another network device that is a member of the Network5A VLAN, such as the command switch.

Now that the replacement member switch is connected to the command switch through the common VLAN of the enhanced stack, you are ready to upload the SalesE4.cfg configuration file to it from the command switch with these steps:

1. Start a local or remote management session on the command switch of the enhanced stack.

2. Transfer the SalesE4.cfg configuration file from the command switch to the new member switch by performing these commands:

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# show estack remotelist`	Display the SHOW ESTACK REMOTELIST command to learn the stack ID number of the replacement member switch.

awplus# dir	List the files in the file system of the command switch to confirm that it has the configuration file you want to upload to the member switch. In this example, the filename is Eng12c.cfg file.
awplus# configure terminal	Enter the Global Configuration mode.
awplus(config)# upload config remotelist	Enter the UPLOAD CONFIG REMOTELIST command to begin the file transfer.
Enter the configuration file name -> SalesE4.cfg	At the prompt, enter the name of the configuration file the command switch is to upload to the member switch. In this example, the filename is SalesE4.cfg.
Enter the list of switches -> 3	At the prompt, enter the enhanced stacking ID number, learned with the SHOW ESTACK REMOTELIST command, of the member switch to receive the file. The example assumes that the ID number of the replacement member switch is 3.
-	At this point, the command switch sends the file to the member switch, which stores it in its file system as BOOT.CFG.

3. If the new member switch is to use BOOT.CFG as the name of its active boot configuration file, you complete the replacement procedure by resetting the switch to configure its parameters with the settings in the file. But because this example assumes that the name of the active boot configuration file has to be actSalesE4.cfg, you have to perform a few additional steps. You need to rename the BOOT.CFG file with the MOVE command and designate the file as the active boot configuration file with the BOOT CONFIG-FILE command. You can perform these tasks through enhanced stacking from the command switch, as shown in these steps:

awplus(config)# exit	On the command switch, return to the Privileged Exec mode.

awplus# show estack remotelist	Reconfirm the enhanced stacking ID number of the replacement member switch.
awplus# configure terminal	Enter the Global Configuration mode.
awplus(config)# rcommand 3	Use the RCOMMAND command to start a remote management session on the replacement member switch. In this example the ID number of the switch is 3.
Login: manager Password: ******	Log on the replacement member switch.
awplus> enable	Enter the Privileged Exec mode.
awplus(config)# move boot.cfg actSalesE4.cfg	Rename the boot.cfg configuration file to actSalesE4.cfg.
awplus(config)# boot config-file actSalesE4.cfg	Designate the actSalesE4 file as the active boot configuration file on the switch.
awplus(config)# exit	Return to the Privileged Exec mode.
awplus# exit	End your management session of the replacement member switch to return the session to the command switch.
awplus(config)# reboot estack member 3	From the command switch, reboot the replacement member switch so that it configures its parameters with the actSalesE4.cfg configuration file.

Uploading the Management Software from the Command Switch to Member Switches

You may use enhanced stacking to install new releases of the management software on the member switches from the command switch. After you update the command switch with the new management software, you can instruct it to upload the software to the member switches for you.

After you receive a new release of the management software and install it on the command switch, as explained in "Downloading New Management Software with TFTP" on page 609, you may use the UPLOAD IMAGE REMOTELIST command to upload the software to the member switches from the command switch. You may update specific member switches or all of the switches. The format of the command is shown here:

```
upload image remotelist
```

The command, located in the Global Configuration mode, does not have any parameters and displays this prompt:

```
Remote switches will reboot after load is complete...
Enter the list of switches ->
```

When you see this prompt, enter the enhanced stacking ID numbers of the member switches to receive the management software from the command switch. The numbers are viewed with the SHOW ESTACK REMOTELIST command in the Privileged Exec mode. You may update the management software on more than one member switch at a time. To specify more than one switch, separate the numbers with commas. To update all of the switches in the enhanced stack, enter ALL.

Here are the steps of the file transfer between the command switch and a member switch:

1. The command switch sends its management software to the member switch over the Ethernet link of the common VLAN that connects the switches of the enhanced stack.

2. After the member switch receives the entire file, it compares the version numbers of the new management software from the command switch and its current software.

3. If the version numbers are the same, the switch cancels the update and discards the file.

4. If the version numbers of the programs are different, the switch writes the new management software from the command switch into its flash memory. This phase may take up to one minute to complete.

5. After the file is written to flash memory, the member switch resets.

Caution
A member switch stops forwarding network traffic after it receives the management software from the command switch and begins writing it to flash memory. Some network traffic may be lost.

Caution
Do not power off a member switch while it is writing the software to flash memory.

Here in this example of the command, the command switch uploads its management software to two member switches that have the ID numbers, 5 and 6. The procedure assumes that the new management software is already installed on the command switch.

`awplus> enable`	Enter the Privileged Exec mode from the User Exec mode.
`awplus# show estack remotelist`	Display the enhanced stacking ID numbers of the member switches in the stack. You should perform this command even if you intend to update all of the member switches, to ensure that the command switch is aware of all of the member switches that comprise the stack.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# upload image remotelist`	Start the upload with the UPLOAD IMAGE REMOTELIST command.
`Remote switches will reboot after load is complete ...` `Enter the list of switches -> 5,6`	At the prompt, enter 5 and 6, the enhanced stacking ID numbers of the two member switches to be upgraded.

Disabling Enhanced Stacking

The command that disables enhanced stacking on a switch is the NO ESTACK RUN command in the Global Configuration mode, and the confirmation command is the SHOW ESTACK command in the Privileged Exec mode.

You may not use the NO ESTACK RUN command when you are managing a member switch through enhanced stacking. You may only use the command when you are managing a switch directly, from a local management session or a remote Telnet, SSH, or web browser session.

When you disable enhanced stacking on a command switch, you may not use the switch to manage the member switches of an enhanced stack. It should be noted that disabling enhanced stacking on a command switch returns the mode to the member switch mode. So if you reactivate enhanced stacking, the switch is a member switch, unless you change it again with the ESTACK COMMAND-STACK command.

Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# no estack run
```

Chapter 24

Enhanced Stacking Commands

The enhanced stacking commands are summarized in Table 40.

Table 40. Enhanced Stacking Commands

Command	Mode	Description
“ESTACK COMMAND-SWITCH” on page 463	Global Configuration	Designates the switch as the command switch.
“ESTACK RUN” on page 464	Global Configuration	Activates enhanced stacking on the switch.
“NO ESTACK COMMAND-SWITCH” on page 465	Global Configuration	Returns the switch to the state of being a member switch.
“NO ESTACK RUN” on page 466	Global Configuration	Disables enhanced stacking on the switch.
“RCOMMAND” on page 467	Global Configuration	Redirects the management session to a different switch in the enhanced stack.
“REBOOT ESTACK MEMBER” on page 468	Global Configuration	Reboots member switches of an enhanced stack from the command switch.
“SHOW ESTACK” on page 470	Privileged Exec	Displays whether the switch is a command or member switch and whether enhanced stacking is enabled or disabled.
“SHOW ESTACK COMMAND-SWITCH” on page 472	Privileged Exec	Displays enhanced stacking information about the command switch from a member switch.
“SHOW ESTACK REMOTELIST” on page 473	Privileged Exec	Displays the switches of an enhanced stack.
“UPLOAD CONFIG REMOTELIST” on page 475	Global Configuration	Uploads boot configuration files from the file system in the command switch of an enhanced stack to the member switches.

Table 40. Enhanced Stacking Commands

Command	Mode	Description
“UPLOAD IMAGE REMOTELIST” on page 476	Global Configuration	Uploads the management software on the command switch of an enhanced stack to the member switches.

ESTACK COMMAND-SWITCH

Syntax

```
estack command-switch
```

Parameter

None

Mode

Global Configuration mode

Description

- Use this command to set the enhanced stacking mode on the switch to the command mode. This command has the following guidelines:
- Enhanced stacking must be activated on the switch. To activate enhanced stacking, refer to "ESTACK RUN" on page 464.
- A switch that is a member of an active enhanced stack cannot be changed to the command mode. You must first disable enhanced stacking on the current command switch in the stack.
- You cannot use this command on a switch accessed through enhanced stacking. This command can only be used from a local or remote management session of the switch.

Confirmation Command

"SHOW ESTACK" on page 470

Example

This example activates enhanced stacking on the switch and sets the stacking status to command mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# estack run
awplus(config)# estack command-switch
```

ESTACK RUN

Syntax

```
estack run
```

Parameter

None

Mode

Global Configuration mode

Description

Use this command to activate enhanced stacking on the switch.

Confirmation Command

“SHOW ESTACK” on page 470

Example

The following example activates enhanced stacking on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# estack run
```

NO ESTACK COMMAND-SWITCH

Syntax

```
no estack command-switch
```

Parameter

None

Mode

Global Configuration mode

Description

Use this command to return the enhanced stacking mode on the switch to member switch from command switch. This command has the following guidelines:

- The default setting for the enhanced stacking mode on the switch is member. So you would only use this command if you set the mode to command mode and now want to return it to member mode.
- Enhanced stacking must be activated on the switch for you to use the command. To activate enhanced stacking, refer to "ESTACK RUN" on page 464.
- You cannot use this command on a switch accessed through enhanced stacking. This command can only be used from a local or remote management session of the switch.

To configure the switch as a command switch, refer to "ESTACK COMMAND-SWITCH" on page 463.

Confirmation Command

"SHOW ESTACK" on page 470

Example

This example returns the switch's stacking status to member switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no estack command-switch
```

NO ESTACK RUN

Syntax

```
no estack run
```

Parameter

None

Mode

Global Configuration mode

Description

Use this command to disable enhanced stacking on the switch. The switch cannot use enhanced stacking when the feature is disabled. If you disable enhanced stacking on the command switch, you cannot use that switch to manage the switches in the stack.

When you disable enhanced stacking on the command switch, its mode is reset to member mode. Consequently, you must set it back again to the command mode if you reactivate enhanced stacking.

Note
You should only use this command from a local or remote management session of the switch. You should not issue this command on a member switch that you accessed through enhanced stacking. Otherwise, your management session will be interrupted.

Confirmation Command

“SHOW ESTACK” on page 470

Example

This example deactivates enhanced stacking on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no estack run
```

RCOMMAND

Syntax

```
rcommand switch_id
```

Parameters

switch_id

Specifies the ID number of a member switch you want to manage in the enhanced stack. This number is displayed with "SHOW ESTACK REMOTELIST" on page 473. You can enter only one ID number.

Mode

Global Configuration mode

Description

Use this command to redirect the management session from the command switch to a member switch in the enhanced stack. The member switch is identified by its ID number, displayed with "SHOW ESTACK REMOTELIST" on page 473. You can manage only one member switch at a time.

Note
You must perform this command from the command switch of the stack. This command will not work on a member switch.

Note
You should perform the SHOW ESTACK REMOTELIST command before this command.

When you are finished managing a member switch, use the EXIT command to return to the command switch.

Example

This example starts a management session on switch number 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# rcommand 12
```

REBOOT ESTACK MEMBER

Syntax

```
reboot estack member id_number | all
```

Parameters

id_number

Specifies the enhanced stack ID number of a switch. The number is displayed with “SHOW ESTACK REMOTELIST” on page 473. You may specify the ID number of only one switch.

all

Specifies all of the switches of the enhanced stack, except the command switch.

Mode

Global Configuration mode

Description

Use this command from the command stack of an enhanced switch to reboot member switches. You may reboot individual member switches or all of the member switches of a stack. You must perform “SHOW ESTACK REMOTELIST” on page 473 prior to this command to determine the ID numbers of the switches.

Caution

A switch does not forward network traffic when it reboots and initializes its management software. Some network traffic may be lost. The reset can take from 10 seconds to two minutes, depending on the number and complexity of the commands in the active boot configuration file.

Note

Any configuration changes that are not saved to the active configuration file with the WRITE command are discarded when a switch reboots.

Caution

This command does not display a confirmation prompt. A member switch resets as soon as you enter the command.

Examples

This example reboots a member switch that has the ID number 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# reboot estack member 3
```

This example reboots all of the member switches of the enhanced stack:

```
awplus> enable
awplus# configure terminal
awplus(config)# reboot estack member all
```

SHOW ESTACK

Syntax

```
show estack
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display whether enhanced stacking is enabled or disabled on the switch and whether the switch's mode is command or member. Figure 100 is an example of the information the command displays.

```
Enhanced Stacking mode            Member [1]
MAC address                       00:15:77:cc:e2:42
Model Type                        AT-FS970M/24C
Version Number                    AWPLUS 2.3.1.0
```

Figure 100. SHOW ESTACK Command

The fields are described in Table 41 on page 470.

Table 41. SHOW ESTACK Command

Parameter	Description
Enhanced Stacking mode	The status of enhanced stacking on the switch and the mode of the switch. The possible modes are: ❒ Command - Enhanced stacking is enabled on the switch, and the switch is set to the command mode.

Table 41. SHOW ESTACK Command (Continued)

Parameter	Description
Enhanced Stacking mode (Continued)	❒ Member [1] - Enhanced stacking is enabled on the switch, and the switch is set to the member mode. If there is a number in the brackets, the switch detected a command switch on the common VLAN of the enhanced stack. The number is the switch's stack ID number. If the brackets are empty, the switch did not detect a command switch on the common VLAN and so does not consider itself part of an enhanced stack. ❒ Disabled - Enhanced stacking is disabled on the switch.
MAC address	The switch's MAC address.
Model Type	The model name of the switch.
Version Number	The name and version number of the management software on the switch. The name of the management software for the AT-FS970M Switch is displayed as AWPLUS, for AlliedWare Plus.

Example

The following example displays whether enhanced stacking is enabled or disabled on the switch and whether the switch's mode is command or member:

```
awplus> enable
awplus# show estack
```

SHOW ESTACK COMMAND-SWITCH

Syntax

```
show estack command-switch
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command on a member switch in an enhanced stack to display the enhanced stacking information about the command switch. This command is equivalent to issuing the SHOW ESTACK command on the command switch. Figure 101 is an example of the information the command displays.

```
Enhanced Stacking mode            Member [1]
Management IP address             0.0.0.0
Mac address                       ECCD.6D4D.6DD5
Model Type                        AT-FS970M/24C
Version Number                    AWPLUS 2.3.1.0
```

Figure 101. SHOW ESTACK COMMAND-SWITCH Command

The fields are described in Table 41 on page 470.

Example

The following example displays the enhanced stacking information about the command switch:

```
awplus> enable
awplus# show estack command-switch
```

SHOW ESTACK REMOTELIST

Syntax

```
show estack remotelist [name] [series]
```

Parameters

name
Sorts the list of switches by the host name.

series
Sorts the list of switches by the model name.

Mode

Privileged Exec mode

Description

Use this command on the command switch to display the member switches of an enhanced stack. You may sort the names by MAC address, host name, or model series. The default is MAC address. An example is shown in Figure 102.

```
numOfNodes 2
Num  Mac Address         Name           Mode   Version          Model
-------------------------------------------------------------------------
01   eccd.6d4d.6dd5     dutC           Member AWPLUS v2.3.1.0  AT-FS970M/24C
02   eccd.6d4d.6dd0     dutB           Member AWPLUS v2.3.1.0  AT-FS970M/48
```

Figure 102. SHOW ESTACK REMOTELIST Command

The list does not include the command switch on which you entered the command.

Note
This command only works on the command switch of the stack. It does not work on member switches.

Examples

This example displays the member switches of an enhanced stack by MAC address:

```
awplus> enable
awplus# show estack remotelist
```

This example sorts the switches by host name:

```
awplus> enable
awplus# configure terminal
awplus(config)# show estack remotelist name
```

This example sorts the switches by model series:

```
awplus> enable
awplus# configure terminal
awplus(config)# show estack remotelist series
```

UPLOAD CONFIG REMOTELIST

Syntax

```
upload config remotelist
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to upload boot configuration files from the file system in the command switch of an enhanced stack to the member switches. The member switches store the files in their file systems as BOOT.CFG.

The command displays two prompts. The first prompt is shown here:

```
Enter the configuration file name ->
```

When you see this prompt, enter the name of the boot configuration file to transfer from the command switch to the member switches. You may specify only one filename, and the name must include the extension .cfg.

The second prompt is shown here:

```
Enter the list of switches ->
```

At this prompt, enter the enhanced stack numbers of the member switches to receive the file. If you are uploading a file to more than one switch, separate the numbers with commas. The numbers are viewed with the SHOW ESTACK REMOTELIST command.

Example

This example uploads the Sw12a.cfg configuration file from the file system of the command switch to a member switch that has the ID number 3. The member switch stores the file as BOOT.CFG in its file system:

```
awplus> enable
awplus# configure terminal
awplus(config)# upload config remotelist
Enter the configuration file name -> sw12a.cfg
Enter the list of switches -> 3
```

UPLOAD IMAGE REMOTELIST

Syntax

```
upload image remotelist
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to upload the management software on the command switch of an enhanced stack to the member switches. The command displays the following prompt:

```
Remote switches will reboot after load is complete...
Enter the list of switches ->
```

When you see this prompt, enter the enhanced stack numbers of the member switches to receive the management software from the command switch. You may update the management software on more than one member switch at a time. To specify more than one switch, separate the numbers with commas. To update all of the switches in the enhanced stack, enter ALL. The numbers are viewed with the SHOW ESTACK REMOTELIST command in the Privileged Exec mode.

Here are the steps of the file transfer between the command switch and a member switch:

1. The command switch sends its management software to the member switch over the Ethernet link of the common VLAN that connects the switches of the enhanced stack.

2. After the member switch has received the entire file, it compares the version numbers of the new management software from the command switch and its current software.

3. If the version numbers are the same, the switch cancels the update and discards the file.

4. If the version numbers are different, the member switch writes the file to its flash memory. This phase may take up to one minute to complete.

5. After the file is written to flash memory, the member switch resets.

Caution
The member switches stop forwarding network traffic after they receive the management software from the command switch and as they write the file to their flash memory. Some network traffic may be lost.

Caution
Do not power off the member switches while they are writing the software to their flash memory.

Example

This example uploads the management software on the command switch to two member switches that have the ID numbers 1 and 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# upload image remotelist
Remote switches will reboot after load is complete...
Enter the list of switches -> 1,5
...Uploading 13316011 bytes. Please wait...

Upload image to Member Switches complete. <120 sec.>
```

Chapter 25

Link-flap Protection

This chapter explains link-flap protection. The sections in this chapter include:

Overview

A port that is unable to maintain a reliable connection to a network node may experience a condition referred to as link-flapping. This problem, which is usually caused by intermittent problems with network cables or network nodes, causes the state of a link on a port to fluctuate up and down.

A fluctuating link can disrupt more than the connectivity of a single port. Other switch operations may be affected as well. If, for instance, a fluctuating link is part of a spanning tree domain or a member of an LACP trunk, the switch attempts to compensate by redirecting traffic *away* from the link when it is down and *to* the link when it is up. Frequent traffic redistributions such as this are an inefficient use of the switch's resources and can result in the additional loss of traffic.

Link-flap protection minimizes the disruption to your network from this type of problem. It stabilizes the network topology by automatically disabling ports that experience link-flap events. A port that is disabled due to link-flap events remains disabled until you enable it again with the management software, such as with the standard NO SHUTDOWN command or the LINK-FLAP PROTECTION command. The switch notifies you of link-flap events by entering messages in the event logs and transmitting SNMP traps.

You define the rate and duration that constitute link-flap events. These values are set at the switch level. The rate defines the number of link changes that have to occur to signal a link-flap event. A link change is defined as any time a port loses a link or establishes a link to an end node. When a port establishes a link to a network node, that represents one link change. And when a port loses a link, that is another link change. The rate has a range of 4 to 65,535 changes.

The duration is the time period in which the changes must occur. It has a range of 20 to 65,535 seconds.

The default values are ten changes for the rate and 60 seconds for the duration. At these settings, a link-flap event is signaled when a port experiences ten link changes in one minute. If, as an example, you set the rate to five changes and the duration to 120 seconds, a link-flap event occurs when a port's link changes five times within two minutes.

While the rate and the duration are set at the switch level, link-flap protection is activated at the port level. This means you can activate it on just those ports where you believe the problem is most likely to occur or that are connected to devices that are critical to the functioning of your network. This feature requires only minimal processing by the switch and can be activated on all of the switch's ports without affecting network performance.

Guidelines

Here are the guidelines to link-flap protection:

- You can enable this feature on a per-port basis.
- The performance of the switch is not affected if you enable it on all of the ports.
- This feature is supported on the base ports and the SFP and XFP modules in the switches.
- Ports that have been disabled by the switch because of link-flap events do not forward traffic again until you enable them with the NO SHUTDOWN command or the LINK-FLAP PROTECTION command.

Configuring the Feature

Here are the commands that are used to configure the link-flap protection feature. They configure the feature such that link-flap events are defined as seven link changes in three minutes, and they activate the feature on ports 11 to 20. To configure this example, enter:

```
awplus> enable
awplus# configure terminal
awplus(config)# link-flap rate 7
awplus(config)# link-flap duration 180
awplus(config)# interface 1.11-1.20
awplus(config-if)# link-flap protection
awplus(config-if)# end
awplus# show link-flap
```

Chapter 26

Link-flap Protection Commands

The link-flap protection commands are summarized in the following table:

Table 42. Link-flap Protection Commands

Command	Mode	Description
“LINK-FLAP DURATION” on page 484	Global Configuration	Specifies the time period for link-flap events.
“LINK-FLAP PROTECTION” on page 485	Port Interface	Activates link-flap protection on the ports.
“LINK-FLAP RATE” on page 486	Global Configuration	Specifies the number of link state changes that constitute link-flap events.
“NO LINK-FLAP PROTECTION” on page 487	Port Interface	Disables link-flap protection on the ports.
“SHOW LINK-FLAP” on page 488	User Exec and Privileged Exec	Displays the status and settings of link-flap protection on the switch.

LINK-FLAP DURATION

Syntax

link-flap duration *<20 - 65535>*

Parameters

duration

Indicates the time period that defines a link flap event. The range is 20 to 65535 seconds. The default is 60 seconds.

Mode

Global Configuration mode

Description

Use this command to specify the time period the switch uses to determine whether a port has experienced a link flap event. A link flap event occurs on a port when its link state changes a defined number of times in a defined period of time. The number of link state changes, referred to as the rate, is set with “LINK-FLAP RATE” on page 486. The duration is set with this command.

Confirmation Command

“SHOW LINK-FLAP” on page 488

Example

This example sets the link-flap duration to two minutes:

```
awplus> enable
awplus# configure terminal
awplus(config)# link-flap duration 120
```

LINK-FLAP PROTECTION

Syntax

```
link-flap protection port
```

Parameter

port

Specifies a port for link-flap protection. You can configure more than one port at a time.

Mode

Port Interface mode

Description

Use this command to activate link-flap protection on the ports.

Confirmation Command

"SHOW LINK-FLAP" on page 488

Example

This example activates link-flap protection on ports 11 to 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11-port1.0.15
awplus(config-if)# link-flap protection
```

LINK-FLAP RATE

Syntax

```
link-flap rate <4 - 65535>
```

Parameters

rate

Specifies the number of link changes that constitute a link flap event on a port. The range is 4 to 65535 changes. The default is 10 changes.

Mode

Global Configuration mode

Description

Use this command to specify the number of link changes that constitute a link-flap event on a port. A link change is defined as any time a port loses a link to an end node or establishes a link.

You may want to use this command in conjunction with “LINK-FLAP DURATION” on page 484.

Confirmation Command

“SHOW LINK-FLAP” on page 488

Example

This example defines a link-flap event as eight link changes.

```
awplus> enable
awplus# configure terminal
awplus(config)# link-flap rate 8
```

NO LINK-FLAP PROTECTION

Syntax

no link-flap protection

Parameters

None

Mode

Port Interface mode

Description

Use this command to disable link-flap protection on the ports. Link-flap protection is disabled on the switch if it is disabled on all of the ports.

Confirmation Command

"SHOW LINK-FLAP" on page 488

Example

This example disables link-flap protection on ports 18 and 24:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.18,port1.0.24
awplus(config-if)# no link-flap protection
```

SHOW LINK-FLAP

Syntax

```
show link-flap
```

Parameters

None

Mode

User Exec and Privileged Exec modes

Description

Use this command to display the status and settings of link-flap protection on the switch. Here is an example of the information this command displays.

```
Link Flap Protection ............ On
Link Flap Member(s) ............. port1.0.1-port1.0.17
Duration ........................ 60
Rate ............................ 8
```

Figure 103. SHOW LINK-FLAP Command

Example

This example displays the status and settings of link-flap protection:

```
awplus> enable
awplus# show link-flap
```

Chapter 27

Port Mirror

This chapter discusses the following topics:

Overview

The port mirror is a management tool that allows you to monitor the traffic on one or more ports on the switch. It works by copying the traffic from designated ports to another port where the traffic can be monitored with a network analyzer. The port mirror can be used to troubleshoot network problems or to investigate possible unauthorized network access. The performance and speed of the switch is not affected by the port mirror.

To use this feature, you must designate one or more source ports and the destination port. The source ports are the ports whose packets are to be mirrored and monitored. The destination port is the port where the packets from the source ports are copied and where the network analyzer is connected. There can be only one destination port on the switch.

Here are the guidelines for the port mirror:

- The switch supports only one port mirror.
- The port mirror can have just one destination port.
- The port mirror can have more than one source port. This allows you to monitor the traffic on multiple ports at the same time. For example, you might monitor the traffic on all the ports of a particular VLAN.
- You can mirror the ingress traffic, the egress traffic or both on the source ports.
- The destination port should not be a member of a static port trunk or an LACP trunk.

Creating the Port Mirror or Adding New Source Ports

The command to create the port mirror is the MIRROR INTERFACE command. You must perform this command from the Port Interface mode of the destination port of the port mirror. The command has this format:

```
mirror interface source_ports direction
receive|transmit|both
```

This example configures the port mirror to copy the ingress traffic on the source port 3 to the destination port 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# mirror interface port1.0.3 direction
receive
```

The switch immediately begins to copy the monitored traffic from the source ports to the destination port as soon as you create the port mirror.

To add new source ports to the port mirror, return to the Port Interface mode of the destination port and enter the same command. For example, to monitor both the ingress and egress traffic on ports 11 and 12 to the destination port 5, you enter:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# mirror interface port1.0.11-port1.0.12
direction both
```

For reference information, refer to "MIRROR INTERFACE" on page 499.

Removing Source Ports or Deleting the Port Mirror

To remove source ports from the port mirror, enter the Port Interface mode of the destination port and issue the NO MIRROR INTERFACE command. Here is the format of the command:

```
no mirror interface source_ports
```

This example removes source port 2 from the port mirror. The destination port is port 11:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11
awplus(config-if)# no mirror interface port1.0.2
```

To stop port mirroring and return the destination port to normal network operations, remove all of the source ports from the port mirror. For example, if the source ports of the port mirror were ports 1 to 4, and the destination port was 18, you would enter these commands to stop the port mirror and reestablish normal network operations on the destination port:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.18
awplus(config-if)# no mirror interface port1.0.1-port1.0.4
```

For reference information, refer to “NO MIRROR INTERFACE” on page 501.

Combining the Port Mirror with Access Control Lists

You may combine the port mirror with an access control list to monitor a subset of the ingress traffic on a port. The access control list is used to specify the ingress traffic to be coped to the destination port of the port mirror. This feature only works on ingress packets because access control lists are only effective on those types of packets. You cannot use it to copy a subset of the egress packets on a port.

You first have to specify the destination port of the port mirror. The switch can have only one destination port. The command for specifying the destination port is the MIRROR command in the Port Interface mode. The mode in which to perform the command is the Port Interface mode of the port to be the destination port for the monitored traffic the access control list defines.

You then have to create the access control list and assign it to the port whose packets you want to monitor. When you create the access control list, you have to specify the copy-to-mirror action.

Here is an example of the feature. It assumes you want to monitor ports 14 and 15 for ingress packets that have the IP address 149.83.124.95 as their destination address. The traffic is to be copied to port 18, the destination port for the port mirror. The access control list is given the ID number 3008.

`awplus> enable`	Enter the Privileged Exec mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# interface port1.0.18`	Enter the Port Interface mode for port 18, the destination port for the port mirror.
`awplus(config-if)# mirror`	Enter the MIRROR command to designate port 18 as the destination port for the copied packets.
`awplus(config-if)# exit`	Return to the Global Configuration mode.
`awplus(config)# access-list 3008 copy-to-mirror ip any 149.83.124.95/32`	Create the access control list. The source address is ANY and the destination address is 149.83.124.95.

`awplus(config)# interface port1.0.14,port1.0.15`	Enter the Port Interface modes for ports 14 and 15.
`awplus(config-if)# access-group 3008`	Assign the access control list to the ports.
`awplus(config-if)# end`	Return to the Privileged Exec mode.

`awplus# show mirror`
 	
`Mirror-To-Port Name: Port1.0.18`
	Use the SHOW MIRROR command to confirm that port 18 is the destination port of the port mirror.

`awplus# show access-list`
 	
`Hardware IP access-list 3008`
`  copy-to-mirror ip any 149.83.124.95 mask 255.255.255.255`
`Total number of access-list = 1`
	Use the SHOW ACCESS-LIST command to confirm the configuration of the access control list.

`awplus# show interface port1.0.14,port1.0.15 access-group`
 	
`Interface port1.0.14`
`  access-group 3008`
`Interface port1.0.15`
`  access-group 3008`
	Use the SHOW INTERFACE ACCESS-GROUP command to confirm that the access control list is assigned to ports 14 and 15.

Displaying the Port Mirror

To display the port mirror, go to the Privileged Exec mode and enter the SHOW MIRROR command:

```
awplus# show mirror
```

In this example of the information, the port mirror is enabled, and the ingress and egress packets on ports 1 and 3, as well as the egress traffic on ports 11 to 13, are being copied to destination port 22.

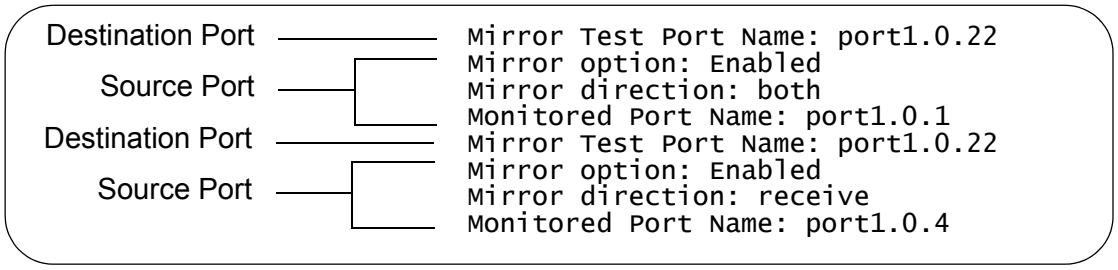

Figure 104. SHOW MIRROR Command

The fields are described in Table 44 on page 502.

If you are using the port mirror with access control lists to copy subsets of ingress packets on source ports, the SHOW MIRROR command displays only the destination port of the copied traffic. Here is an example.

```
Mirror-To-Port Name: port1.0.11
```

Figure 105. SHOW MIRROR Command and Access Control Lists

To view the access control lists and their port assignments, use "SHOW ACCESS-LIST" on page 1671 and "SHOW INTERFACE ACCESS-GROUP" on page 1673, respectively.

Chapter 28

Port Mirror Commands

The port mirror commands are summarized in Table 43.

Table 43. Port Mirror Commands

Command	Mode	Description
“MIRROR” on page 498	Port Interface	Designates the destination port for access control lists that use the copy-to-mirror action.
“MIRROR INTERFACE” on page 499	Port Interface	Creates the port mirror and adds ports to the port mirror.
“NO MIRROR INTERFACE” on page 501	Port Interface	Removes source ports from the port mirror and deletes the port mirror.
“SHOW MIRROR” on page 502	Privileged Exec	Displays the destination port and source ports of the port mirror.

MIRROR

Syntax

```
mirror
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to designate the destination port for the copy-to-mirror action in access control lists. You can designate only one destination port.

Confirmation Command

“SHOW MIRROR” on page 502

Example

This example designates port 21 as the destination port for packets from the copy-to-mirror action of access control lists:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# mirror
```

MIRROR INTERFACE

Syntax

```
mirror interface source_ports direction
receive|transmit|both
```

Parameters

source_ports

Specifies a source port for the port mirror. You can specify more than one source port.

direction

Specifies the traffic to be mirrored from a source port to the destination port. The options are:

receive: Copies the ingress packets on a source port.

transmit: Copies the egress packets on a source port.

both: Copies both the ingress and egress packets on a source port.

Mode

Port Interface mode

Description

Use this command to create the port mirror or to add ports to the port mirror. You must issue this command from the Port Interface mode of the destination port of the port mirror. The switch can have only one destination port.

Confirmation Command

"SHOW MIRROR" on page 502

Example

This example configures the port mirror to copy the ingress traffic on ports 3 and 4, the source ports, to port 5, the destination port. If port 5 is already acting as the destination port of the port mirror, the commands add ports 3 and 4 to the port mirror:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# mirror interface port1.0.3,port1.0.4
direction receive
```

NO MIRROR INTERFACE

Syntax

```
no mirror interface source_ports
```

Parameters

source_ports
: Specifies a source port of the port mirror. You can specify more than one source port at a time in the command.

Mode

Port Interface mode

Description

Use this command to remove source ports from the port mirror or to delete the port mirror. You should enter this command in the Port Interface mode of the destination port of the port mirror.

To delete the port mirror and return the destination port to normal operations, remove all of the source ports from the port mirror.

Confirmation Command

"SHOW MIRROR" on page 502

Example

These commands remove ports 7 and 8 from the port mirror. If these are the only source ports of the port mirror, the port mirror is deleted and the destination port, which in this example is port 11, resumes normal network operations:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11
awplus(config-if)# no mirror interface port1.0.7,port1.0.8
```

SHOW MIRROR

Syntax

```
show mirror
```

Parameters

None

Modes

Privileged Exec mode

Description

Use this command to display the source and destination ports of the port mirror on the switch. An example is shown in Figure 106.

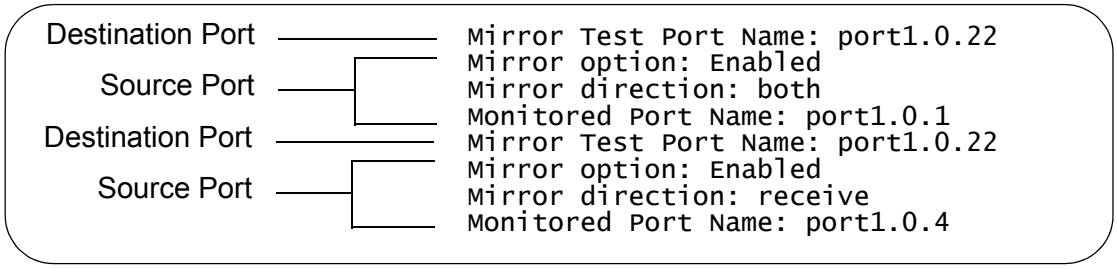

Figure 106. SHOW MIRROR Command

The fields are described in Table 44.

Table 44. SHOW MIRROR Command

Parameter	Description
Mirror Test Port Name	The destination port of the port mirror. The switch can have only one destination port.
Mirror option:	The status of the port mirror on the source port. This is always enabled.

Table 44. SHOW MIRROR Command (Continued)

Parameter	Description
Mirror direction	The packets to be mirrored to the destination port. The states are listed here: ❒ Receive - The ingress packets of the source port are mirrored to the destination port. ❒ Transmit - The egress packets of the source port are mirrored to the destination port. ❒ Both - Both the ingress and egress packets of the source port are mirrored to the destination port.
Monitored Port Name	A source port of the port mirror.

If you are using the port mirror with access control lists to copy subsets of ingress packets on source ports, the SHOW MIRROR command displays only the destination port of the copied traffic. Here is an example.

```
Mirror-To-Port Name: port1.0.11
```

Figure 107. SHOW MIRROR Command and Access Control Lists

To view the access control lists and their port assignments, use "SHOW ACCESS-LIST" on page 1671 and "SHOW INTERFACE ACCESS-GROUP" on page 1673, respectively.

Example

The following example displays the source and destination ports of the port mirror on the switch:

```
awplus# show mirror
```

Chapter 29

Loop Detection

This chapter contains the following sections:

This chapter discusses how to configure loop detection.

Overview

Loop detection can be enabled on the switch to detect loops and reduce negative effects on the local network.

Loop detection can be used along with, or instead of, the Spanning Tree Protocol.

To detect loops, a series of loop-detection frames (LDFs) are transmitted from each switch port into the network. If no loops exist, these frames do not 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 actions. Each loop-detection frame 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 loop-detection frame ID number.

You can set the detection mechanism to remember the loop-detection frame ID of up to five of the most recently transmitted loop-detection frames. Each of the five most recently transmitted frames is compared with every frame that arrives at that same port.

Loop detection can be configured on a switch to apply a specific action when a loop is detected. These actions are as follows:

- Block all traffic on the port that detected the loop and change the link state to down.
- Block all the traffic on the port that detected the loop, but keep the link state up.
- Take no action, but log the details.
- Take no action.

The amount of time that the configured action occurs after a loop is detected can also be configured. The range is 1 to 86400 seconds. The default time is 7 seconds.

You can enable or disable loop detection on a single port or a range of ports. Loop detection is disabled by default.

The following information can be viewed:

- Whether loop detection is configured on a single port or a range of ports.
- All loop-detection parameters configured on a port or a range of ports.
- Counters and statistics of all relevant frames of the loop detection.

Enabling Loop Detection and Configuring Global Detection Parameters

Use the LOOP-PROTECTION LOOP-DETECT command in Global Configuration mode to enable loop detection/protection on the switch. Here is the format of the command:

```
loop-protection loop-detect
```

Use the LOOP-PROTECTION LOOP-DETECT command with the following parameters in Global Configuration mode to enable loop detection/protection on the switch and configure the detection parameters. Here is the format of the command:

```
loop-protection loop-detect [ldf-interval <period>] [ldf-rx-window <frames>] [fast-block]
```

The LDF-INTERVAL parameter is the time, in seconds, between successive loop-detection frames being sent. The range is 1 to 600. The default is 10.

The LDF-RX-WINDOW parameter is the number of transmitted loop-detection frames whose details are held for comparing with frames arriving at the same port. The range is 1 to 5 frames. The default is 3 frames.

The FAST-BLOCK parameter blocks only one port if two ports are erroneously connected to form a loop; only one of the ports is blocked to retain connectivity.

Without the fast-block feature, if LDF packets are received on both ports of a switch, both ports are blocked by the LDF feature, and a PC cannot access a server when the blocking occurs. However, with the LDF fast-block feature, only one port is blocked: In this way, the PC can access the server after the blocking occurs.

Note
The fast-block feature applies to both transmit and receive traffic.

For example, if port 1 and port 2 are erroneously connected to form a loop, an LDF is first transmitted from port 1, then an LDF is transmitted from port 2, and the port 1's LDF is first received on port 2: Therefore the LDF transmitting port 1 is blocked. Later, when port 2's LDF frame is received at port 1, it is not blocked due to the fast-block feature.

Use the NO LOOP-PROTECTION command in Global Configuration mode to disable loop detection/protection on the switch. Here is the format of the command:

```
no loop-protection [loop-detect]
```

> **Note**
> The NO LOOP-PROTECTION and NO LOOP-PROTECTION LOOP-DETECT commands accomplish the same result.

This example enables loop detection/protection on the switch and generates loop-detection frames once every 5 seconds.

```
awplus# configure terminal
awplus(config)# loop-protection loop-detect ldf-interval 5
```

Configuring Protective Action

Use the LOOP-PROTECTION ACTION command in Interface Configuration mode to specify the protective action to apply when a network loop is detected on an interface. Here is the format of the command:

```
loop-protection action {link-down| log-only| none}
```

The LINK-DOWN parameter blocks all traffic on a port (or aggregated link) that detects the loop and takes down the link.

The LOG-ONLY parameter logs details of loop conditions, and no action is applied to the port (or aggregated link).

The NONE parameter applies no protective action.

Use the NO LOOP-PROTECTION ACTION command in Interface Configuration mode to reset the loop-protective action to the default action for a port.

This example sets port 4 to disable the port and bring the link down when a network loop is detected.

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# loop-protection action link-down
```

Setting Loop Protection Recovery Duration

Use the LOOP-PROTECTION TIMEOUT command in Interface Configuration mode to specify the loop-protection recovery action duration on a port. Here is the format of the command:

```
loop-protection timeout <duration>
```

The DURATION parameter is the time, in seconds, for which the configured action will apply before reverting the applied action. The range is 1 to 86,400 seconds (24 hours). The default is 7 seconds.

Use the NO LOOP-PROTECTION TIMEOUT command in Interface Configuration mode to set the loop-protection timeout to the default.

This example sets a loop-protection action timeout of 10 seconds for port 4.

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# loop-protection timeout 10
```

Displaying Loop Protection Setup

Use the following command in Privileged Exec mode to display the current configuration status for all ports on the switch:

```
awplus# show loop-protection
```

Use the following command in Privileged Exec mode to display the current configuration status for a port, a range of ports, or an aggregated link:

```
awplus# show loop-protection interface <port-list>
```

The PORT-LIST parameter is the port, range of ports, or aggregated link.

Use the following command in Privileged Exec mode to display counter information for a port, a range of ports, or an aggregated link:

```
awplus# show loop-protection interface <port-list> counters
```

The COUNTERS parameter is counter information for loop protection.

The following is an example output of the SHOW LOOP-PROTECTION INTERFACE COUNTERS command for port 1.

```
Interface     Tx         Rx      Rx Invalid     Last LDF Rx
-------------------------------------------------------------
port1.0.1
    vlan4000  7          0       0               -
```

Figure 108. SHOW LOOP-PROTECTION INTERFACE COUNTERS Command

Chapter 30

Loop Detection Commands

The Loop Detection commands are summarized in Table 45.

Table 45. Loop Detection

Command	Mode	Description
“LOOP-PROTECTION” on page 514	Global Configuration	Enables loop detection/protection on the switch and configures the detection parameters.
“LOOP-PROTECTION ACTION” on page 515	Interface Configuration	Specifies the protective action to apply when a network loop is detected on an interface.
“LOOP-PROTECTION TIMEOUT” on page 516	Interface Configuration	Specifies the loop-protection recovery action duration on a port.
“NO LOOP-PROTECTION” on page 517	Global Configuration	Disables loop detection/protection on the switch.
“NO LOOP-PROTECTION ACTION” on page 518	Interface Configuration	Resets the loop-protective action for a port to the default action.
“NO LOOP-PROTECTION TIMEOUT” on page 519	Interface Configuration	Resets the loop-protection timeout on a port to the default.
“SHOW LOOP-PROTECTION” on page 520	Privileged Exec	Displays the current configuration status or counter information for all ports on the switch, a port, range of ports, or an aggregated link.

LOOP-PROTECTION

Syntax

```
loop-protection loop-detect [ldf-interval <period>] [ldf-rx-
window <frames>] [fast-block]
```

Parameters

ldf-interval
: Time, in seconds, between successive loop-detection frames (LDFs) being sent. The range is 1 to 600. The default is 10.

ldf-rx-window
: Number of transmitted loop-detection frames whose details are held for comparing with frames arriving at the same port. The range is 1 to 5 frames. The default is 3 frames.

fast-block
: Blocks only one port if two ports are erroneously connected to form a loop; only one of the ports is blocked to retain connectivity.

Mode

Global Configuration

Description

Use this command to enable loop detection/protection on the switch and configure the detection parameters.

Example

This example enables loop detection/protection on the switch and generates loop-detection frames once every 5 seconds.

```
awplus# configure terminal
awplus(config)# loop-protection loop-detect ldf-interval 5
```

LOOP-PROTECTION ACTION

Syntax

```
loop-protection action {link-down| log-only | none}
```

Parameters

link-down
: Blocks all traffic on a port (or aggregated link) that detects the loop and takes down the link.

log-only
: Logs details of loop conditions, and no action is applied to the port (or aggregated link).

none
: Applies no protective action.

Mode

Interface Configuration

Description

Use this command to specify the protective action to apply when a network loop is detected on an interface.

Example

This example sets port 4 to disable the port and bring the link down when a network loop is detected.

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# loop-protection action link-down
```

LOOP-PROTECTION TIMEOUT

Syntax

```
loop-protection timeout <duration>
```

Parameters

duration

Time, in seconds, for which the configured action will apply before reverting the applied action. The range is 1 to 86,400 seconds (24 hours). The default is 7 seconds.

Mode

Interface Configuration

Description

Use this command to specify the loop-protection recovery action duration on a port.

Example

This example sets a loop-protection action timeout of 10 seconds for port 4.

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# loop-protection timeout 10
```

NO LOOP-PROTECTION

Syntax

```
no loop-protection [loop-detect]
```

Parameters

None

Mode

Global Configuration

Description

Use this command to disable loop detection/protection on the switch.

Note
The NO LOOP-PROTECTION and NO LOOP-PROTECTION LOOP-DETECT commands accomplish the same result.

Example

This example disables loop detection/protection on the switch.

```
awplus# configure terminal
awplus(config)# no loop-protection
```

NO LOOP-PROTECTION ACTION

Syntax

```
no loop-protection action
```

Parameters

None

Mode

Interface Configuration

Description

Use this command to reset the loop-protective action for a port to the default action.

Example

This example resets the loop-protective action to the default action for port 4.

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# no loop-protection action
```

NO LOOP-PROTECTION TIMEOUT

Syntax

```
no loop-protection timeout
```

Parameters

None

Mode

Interface Configuration

Description

Use this command to set the loop-protection timeout on a port to the default.

Example

This example sets the loop-protection timeout to the default on port 4.

```
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# no loop-protection timeout
```

SHOW LOOP-PROTECTION

Syntax

```
show loop-protection [interface <port-list>] [counters]
```

Parameters

interface
: Port, range of ports, or aggregated link.

counters
: Counter information for loop protection.

Mode

Privileged Exec

Description

Use the SHOW LOOP-PROTECTION command to display the current configuration status for all ports on the switch.

Use the SHOW LOOP-PROTECTION INTERFACE command with the PORT-LIST parameter to display the current configuration status for a port, a range of ports, or an aggregated link.

Use the SHOW LOOP-PROTECTION COUNTERS command to display the counter information for loop protection for all ports on the switch.

Use the SHOW LOOP-PROTECTION INTERFACE COUNTERS command with the PORT-LIST parameter to display counter information for loop protection for a port, a range of ports, or an aggregated link.

Figure 109 is an example of the information in the SHOW LOOP-PROTECTION INTERFACE COUNTERS command for port 1.

```
Interface     Tx         Rx      Rx Invalid     Last LDF Rx
-------------------------------------------------------------
port1.0.1
    vlan4000  7          0       0               -
```

Figure 109. SHOW LOOP-PROTECTION INTERFACE COUNTERS Command

Example

This example displays the current configuration status for all ports on the switch.

```
awplus# show loop-protection
```

This example displays the current configuration status for port 1.

```
awplus# show loop-protection interface port1.0.1
```

This example displays the counter information for port 1.

```
awplus# show loop-protection interface port1.0.1 counters
```

Chapter 31

DHCP Relay Overview

Overview

The switch has a DHCP relay agent to relay BOOTP messages between clients and DHCP or BOOTP servers.

A client that transmits a request for an IP configuration to a DHCP or BOOTP server has to send the request as a broadcast packet because it does not know the IP address of the server. This can present a problem when a client and DHCP or BOOTP server reside on different subnets, because broadcast packets do not cross subnet boundaries. One possible solution is to have a DHCP or BOOTP server on each subnet where there are clients, though this could be problematic if there happen to be many subnets. Another solution is to use a DHCP relay agent, which transfers client requests across subnet boundaries.

The relay agent does more than simply forward BOOTP requests from clients to servers. It modifies the requests so that, from the perspective of the server, it becomes the originator of the request. The responses from the servers are directed to the agent, which sends the messages on to the clients as either broadcast or unicast packets, depending on the requirements of the clients.

To implement the DHCP relay agent on the switch, you need to be familiar with routing interfaces, which route packets between different local subnets on the switch in the IPv4 packet routing feature. Each routing interface functions as the DHCP relay agent for the clients in its subnet, forwarding BOOTP requests from the clients and responses from the servers.

If you will be using the IPv4 packet routing feature on all the local subnets, then, by default, all of the clients will have access to a DHCP relay agent because each subnet will have a routing interface. However, if IPv4 packet routing will be limited to some but not all the local subnets of the switch, then only those BOOTP requests from clients on a subnet with a routing interface can be forwarded by a DHCP relay agent.

Here is an overview of the process. When a routing interface receives a BOOTP request with a value of 0.0.0.0 in the gateway (giaddr) field in the packet, it assumes the request originated from a client on its subnet. In response, it replaces the value in the field with its IP address and forwards the packet on to the server. If more than one IP address of DHCP or BOOTP servers are specified on the switch, the interface sends the same request to each server. If the client and server reside on the same subnet, the routing interface does not forward the request.

If an interface receives a BOOTP request with a non-zero value in the gateway field, it assumes the client who originated the request resides on another subnet, and so routes the request as a unicast packet without any change, other than incrementing the hop count.

A routing interface that receives a BOOTP reply from a server inspects the broadcast flag field in the packet to determine whether the client, in its original request to the server, set this flag to signal that the response must be sent as a broadcast datagram. Some older nodes have this dependency. If the flag is not set, the routing interface forwards the packet to the originating client as a unicast packet. If the flag is set, the packet is forwarded as a broadcast by the interface.

You configure the BOOTP relay agent on the switch by specifying the IP address of the BOOTP server on your network with the ADD BOOTP RELAY command. You can enter up to eight BOOTP or DHCP servers. The IP addresses apply to all the routing interfaces on the switch. BOOTP requests are forwarded to all the specified servers, simultaneously.

You activate the BOOTP relay agent on the switch with the ENABLE BOOTP RELAY command. As soon as the agent is enabled, the routing interfaces begin to forward BOOTP requests from the clients. Activating the client applies to all routing interfaces on the switch. You cannot activate the agent on some interfaces and not on others. The default setting for the agent on the switch is disabled.

To view the status of the agent and the IP addresses of the servers, use the SHOW BOOTP RELAY command.

These guidelines apply to the DHCP relay agent:

- You can specify up to five DHCP or BOOTP servers on the switch.
- Because both BOOTP and DHCP use BOOTP messages, the DHCP relay agents can relay both their packets.
- The relay agent supports IPv4 address interfaces, but not IPv6 address interfaces.

Configuring the DHCP Relay Agent

Here are the procedures to configuring the DHCP relay agent:

Adding the IP Addresses of the DHCP Servers

The first step to configuring the relay agent is to specify the IP addresses of the DHCP servers on your network, with the IP DHCP-RELAY SERVER-ADDRESS command in the Global Configuration mode. You can specify up to five addresses. This example of the command adds the two DHCP server addresses 149.23.22.143 and 149.23.104.23 to the relay agent.

`awplus> enable`	Enter the Privileged Exec mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# ip dhcp-relay server-address 149.23.22.143` `awplus(config)# ip dhcp-relay server-address 149.23.104.23`	Specify the IP addresses of the DHCP servers with the IP DHCP-RELAY SERVER-ADDRESS command.
`awplus(config)# exit`	Return to the Privileged Exec mode.
`awplus# show ip dhcp-relay`	Confirm the IP addresses with the SHOW IP DHCP-RELAY command.

```
DHCP Relay Service is disabled

List of Interfaces:
Maximum hop count is 10
Maximum DHCP message length is 576
List of servers: 149.23.22.143, 149.23.104.23
```

Adding DHCP Relay to the VLANs

A VLAN has to have an IP address interface before you can add the DHCP relay agent to it. The agent needs an IP address to add to the DHCP and BOOTP requests it relays from the VLAN. So, if the VLAN does not already have an IP address interface, you have to create it before adding the relay agent.

The command for adding an IP address interface to a VLAN is the IP ADDRESS command in the VLAN Configuration mode. A VLAN may have only one IP address. The format of the command is shown here:

`ip address` *`ipaddress/mask`*

The IPADDRESS parameter is the IPv4 management address the VLAN is to be assigned. The address is specified in this format:

nnn.nnn.nnn.nnn

Each NNN is a decimal number from 0 to 255. The numbers must be separated by periods.

The MASK parameter is a decimal number that represents the number of bits, from left to right, that constitute the network portion of the address. Here are a couple of basic examples:

- The decimal mask 16 is equivalent to the mask 255.255.0.0.
- The decimal mask 24 is equivalent to the mask 255.255.255.0.

After assigning the VLAN an IP address interface, you may add the DHCP relay agent to it with the IP DHCP-RELAY command. The command, found in the VLAN Configuration mode, does not have any parameters.

Here is an example of the commands. The DHCP relay agent is assigned to a VLAN with the VID 28, and the IP address 149.23.32.41 and mask 255.255.255.0:

`awplus> enable`	Enter the Privileged Exec mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# interface vlan28`	Enter the VLAN Configuration mode for the VLAN.
`awplus(config-if)# ip address 149.23.32.41/24`	Create the IP address interface with the IP ADDRESS command.
`awplus(config-if)# ip dhcp-relay`	Add the DHCP relay agent to the VLAN.

`awplus(config-if)# end`	Return to the Privileged Exec mode.
`awplus# show ip interface`	Confirm the IP address in the VLAN with the SHOW IP INTERFACE command.

```
Interface      IP Address          Status         Protocol
VLAN28-0       149.23.32.41        admin up       down
```

`awplus# show ip dhcp-relay interface vlan28`	Confirm the addition of the relay agent to the VLAN with the SHOW IP DHCP-RELAY command and the INTERFACE option.

```
DHCP Relay on interface VLAN28-0 is enabled.
```

Configuring the Maximum Hop Count

You may set a maximum hop count for DHCP requests. The relay agent discards DHCP requests that have hop counts that exceed the threshold. To set the maximum hop count, use the IP DHCP-RELAY MAXHOPS command in the Global Configuration mode, shown here:

```
ip dhcp-relay maxhops maxhops
```

The MAXHOPS parameter specifies the maximum hop count for DHCP requests. The range is 1 to 255, and the default is 10. This example sets the hop count to 25:

```
awplus> enable
awplus# configure terminal
awplus(config) ip dhcp-relay maxhops 25
```

Activating or Deactivating DHCP Relay on the Switch

To activate DHCP relay on the switch, enter the SERVICE DHCP-RELAY command in the Global Configuration mode:

```
awplus> enable
awplus# configure terminal
awplus(config) service dhcp-relay
```

To disable it, enter the NO SERVICE DHCP-RELAY command:

```
awplus> enable
awplus# configure terminal
awplus(config) no service dhcp-relay
```

Chapter 32

DHCP Relay Commands

The DHCP relay commands are summarized in Table 46.

Table 46. DHCP Relay Commands

Command	Mode	Description
“IP DHCP-RELAY” on page 530	VLAN Configuration	Adds the DHCP relay agent to VLANs.
“IP DHCP-RELAY MAX-MESSAGE-LENGTH” on page 531	Global Configuration	Sets the maximum permitted length in bytes of DHCP client requests.
“IP DHCP-RELAY MAXHOPS” on page 532	Global Configuration	Sets the hop count for DHCP requests.
“IP DHCP-RELAY SERVER-ADDRESS” on page 533	Global Configuration	Adds IP addresses of DHCP servers to the relay agent.
“NO IP DHCP-RELAY” on page 534	VLAN Configuration	Removes the DHCP relay agent from VLANs to stop them from forwarding any further DHCP requests.
“NO IP DHCP-RELAY SERVER-ADDRESS” on page 535	Global Configuration	Deletes the IP addresses of DHCP servers from the relay agent.
“NO SERVICE DHCP-RELAY” on page 536	Global Configuration	Disables the DHCP relay agent on the switch to stop the VLANs from forwarding any further DHCP requests.
“SERVICE DHCP-RELAY” on page 537	Global Configuration	Activates the DHCP relay agent on the switch.
“SHOW IP DHCP-RELAY” on page 538	Privileged Exec	Displays the settings of the DHCP relay agent.

IP DHCP-RELAY

Syntax

```
ip dhcp-relay
```

Parameters

None

Mode

VLAN Configuration mode

Description

Use this command to activate the DHCP relay agent on VLANs so that they forward DHCP requests. The VLANs must be assigned IP addresses.

Confirmation Command

“SHOW IP DHCP-RELAY” on page 538

Examples

This example activates the DHCP relay agent on the Default VLAN, which has the VID 1:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip dhcp-relay
```

This example activates DHCP relay on a VLAN with the VID 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan12
awplus(config-if)# ip dhcp-relay
```

IP DHCP-RELAY MAX-MESSAGE-LENGTH

Syntax

```
ip dhcp-relay max-message-length length
```

Parameters

length

Specifies the maximum length in bytes of DHCP client requests. The range is 548 to 1472 bytes. The default is 1400 bytes.

Mode

Global Configuration

Description

Use this command to set the maximum length in bytes of DHCP client requests.

To return the parameter to its default setting of 1400 bytes, use the NO form of this command.

Confirmation Command

"SHOW IP DHCP-RELAY" on page 538

Examples

This example sets the maximum DHCP request length to 578 bytes:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip dhcp-relay max-message-length 578
```

This example returns the maximum message length to the default 1400 bytes:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip dhcp-relay max-message-length
```

IP DHCP-RELAY MAXHOPS

Syntax

```
ip dhcp-relay maxhops maxhops
```

Parameters

maxhops
: Specifies the maximum hop count for DHCP requests. The range is 1 to 255.

Mode

Global Configuration Class

Description

Use this command to set the hop count for DHCP requests. The relay agent discards DHCP requests that have hop counts that exceed the threshold.

To return the parameter to its default setting of 10 hop counts, use the NO form of this command.

Confirmation Command

“SHOW IP DHCP-RELAY” on page 538

Examples

This example sets the maximum hop count to 25:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip dhcp-relay maxhops 25
```

This example returns the maximum hop count to the default 10 hops:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip dhcp-relay maxhops
```

IP DHCP-RELAY SERVER-ADDRESS

Syntax

```
ip dhcp-relay server-address ipaddress
```

Parameters

ipaddress
: Specifies the IP address of a DHCP server. You may specify only one IP address at a time with this command.

Mode

Global Configuration mode

Description

Use this command to add the IP addresses of DHCP servers to the relay agent. The agent can have up to five addresses, but you may add only one address at a time with this command.

Confirmation Command

"SHOW IP DHCP-RELAY" on page 538

Example

This example adds the IP address 149.22.12.56 of a DHCP server to the relay agent:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip dhcp-relay server-address 149.22.12.56
```

NO IP DHCP-RELAY

Syntax

```
no ip dhcp-relay
```

Parameters

None

Mode

VLAN Configuration mode

Description

Use this command to remove the DHCP relay agent from VLANs to stop them from forwarding any further DHCP requests.

Confirmation Command

“SHOW IP DHCP-RELAY” on page 538

Examples

This example removes the DHCP relay agent from the Default VLAN, which has the VID 1:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# no ip dhcp-relay
```

This example removes the DHCP relay agent from a VLAN with the VID 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan23
awplus(config-if)# no ip dhcp-relay
```

NO IP DHCP-RELAY SERVER-ADDRESS

Syntax

```
no ip dhcp-relay server-address ipaddress
```

Parameters

ipaddress
: Specifies the IP address of a DHCP server. You may specify only one IP address.

Mode

Global Configuration mode

Description

Use this command to delete the IP addresses of the DHCP servers from the relay agent. You may delete only one address at a time with this command. To display the IP addresses, refer to "SHOW IP DHCP-RELAY" on page 538.

Confirmation Command

"SHOW IP DHCP-RELAY" on page 538

Example

This example deletes the IP address 214.154.35.78 of a DHCP server from the relay agent:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip dhcp-relay server-address
214.154.35.78
```

NO SERVICE DHCP-RELAY

Syntax

```
no service dhcp-relay
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable the DHCP relay agent on the switch to stop the VLANs from forwarding any further DHCP requests.

Confirmation Command

“SHOW IP DHCP-RELAY” on page 538

Example

This example disables the DHCP relay agent:

```
awplus> enable
awplus# configure terminal
awplus(config)# no service dhcp-relay
```

SERVICE DHCP-RELAY

Syntax

```
service dhcp-relay
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate the DHCP relay agent on the switch.

Confirmation Command

"SHOW IP DHCP-RELAY" on page 538

Example

This example activates the DHCP relay agent:

```
awplus> enable
awplus# configure terminal
awplus(config)# service dhcp-relay
```

SHOW IP DHCP-RELAY

Syntax

```
show ip dhcp-relay [interface vlanid]
```

Parameters

vlanid

Specifies a VLAN ID number, such as vlan1. You may specify only one VLAN.

Mode

Privileged Exec mode

Description

Use this command to view the settings of the DHCP relay agent. Figure 110 is an example of the information.

```
DHCP Relay Service is enabled

List of Interfaces:
Maximum hop count is 10
Maximum DHCP message length is 576
List of servers: 149.187.132.21, 149.187.132.56
```

Figure 110. SHOW IP DHCP-RELAY Command

The fields are defined in Table 47.

Table 47. SHOW IP DHCP-RELAY Command

Field	Definition
DHCP Relay Service	The enabled or disabled status of the agent. The status is controlled with “SERVICE DHCP-RELAY” on page 537 and “NO SERVICE DHCP-RELAY” on page 536.
Maximum hop count	The hop count for discarding DHCP request messages from clients. The parameter is controlled with “IP DHCP-RELAY MAXHOPS” on page 532.

Table 47. SHOW IP DHCP-RELAY Command (Continued)

Field	Definition
Maximum DHCP message length	The maximum length permitted for DHCP requests from clients. This parameter is set with "IP DHCP-RELAY MAX-MESSAGE-LENGTH" on page 531.
List of servers	The IP addresses of the DHCP servers. The IP addresses are added and removed with "IP DHCP-RELAY SERVER-ADDRESS" on page 533 and "NO IP DHCP-RELAY SERVER-ADDRESS" on page 535, respectively.

The INTERFACE option may be used to determine the status of the agent on the VLANs. The status is either is enabled or disabled. (The agent is enabled and disabled on the VLANs with "IP DHCP-RELAY" on page 530 and "NO IP DHCP-RELAY" on page 534.)

Examples

This example displays the settings of the DHCP relay agent on the switch:

```
awplus> enable
awplus# show ip dhcp-relay
```

This example displays the status of the DHCP relay agent on a VLAN with the VID 5:

```
awplus> enable
awplus# show ip dhcp-relay interface vlan5
```

Chapter 33

Group Link Control

This chapter provides the following sections:

Overview

Group link control is designed to improve the effectiveness of the redundant systems in a network. It enables the switch to alert network devices about problems they might not otherwise detect or respond to, so that they can implement their redundant systems, automatically.

The feature works by duplicating the link states of ports on other ports. If a port does not have a link or loses a link, the switch duplicates the link state on one or more other ports by disabling them.

To use the feature, you create groups of ports. The ports in a group are referred to as upstream and downstream ports. In networking parlance, the term “upstream” points towards a network core and “downstream” points towards the edge of a network. So an upstream port would be connected to a device at or towards the core of a network while a downstream port would be connected to a device at or leading to the edge of a network.

These definitions may or may not apply to the ports in the groups you create with group link control. It all depends on how you use the feature. In some cases, the upstream port of a group will indeed be connected to a device that leads to a network core while the downstream port is connected to a different device at or towards the edge of a network. But in other cases, this might not be true because the ports are connected to the same device.

Instead, it might be better to think of the upstream port of a group as the control port because it determines the possible link states of the downstream port. The switch allows the downstream port in a group to establish a link to its network device only if the upstream port already has a link to a network node. If the upstream port does not have a link or loses its link, the switch disables the downstream port to prevent it from establishing a link. This notifies the device connected to the downstream port that there is no connectivity on the upstream port.

There are two basic approaches to using this feature. One approach is to create groups of ports that lead to different devices on the switch. This approach is useful with network servers. The second approach is to group ports that go to the same device. This is useful with static port trunks and LACP trunks in a spanning tree topology.

It should be noted that group link control does not control the switching of packets within the switch. It is just about the link states of the ports and about transferring the states to other ports. This feature is illustrated in the following figures.

In the first diagram a server with two teamed network adapter cards is connected to different switches, with the active link to switch 3. If there is a failure on the active link, the server can detect it directly and would respond by automatically transferring the traffic to the redundant network interface and the secondary path, which leads to switch 4.

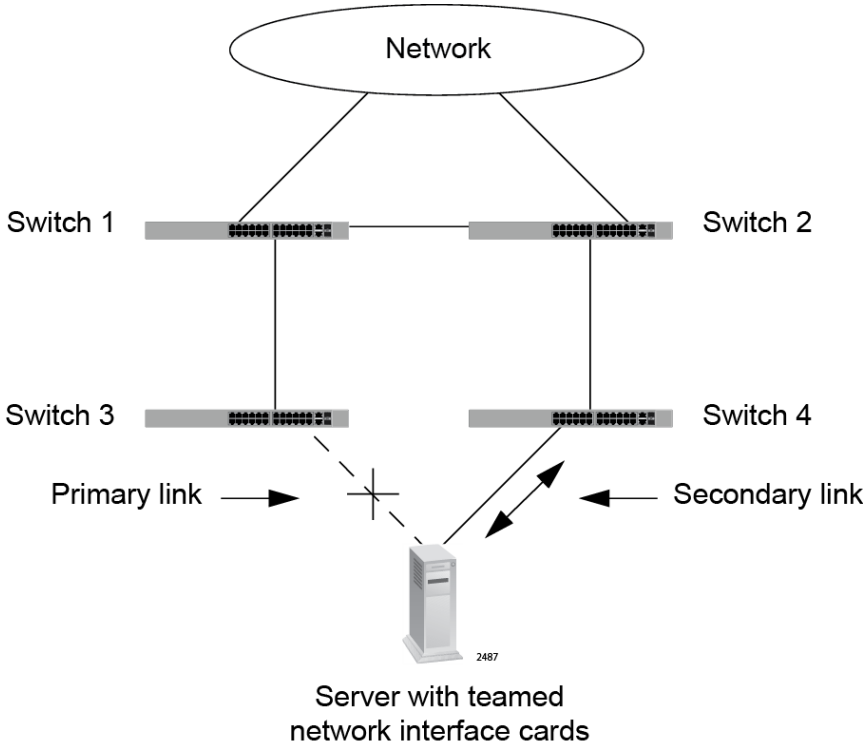

Figure 111. Group Link Control Example 1

But if the failure occurs further upstream between switches 1 and 3, as shown in Figure 112 on page 544, the server, unaware of the problem, loses connectivity to the network. It continues to transmit packets to switch 3, which discards the packets.

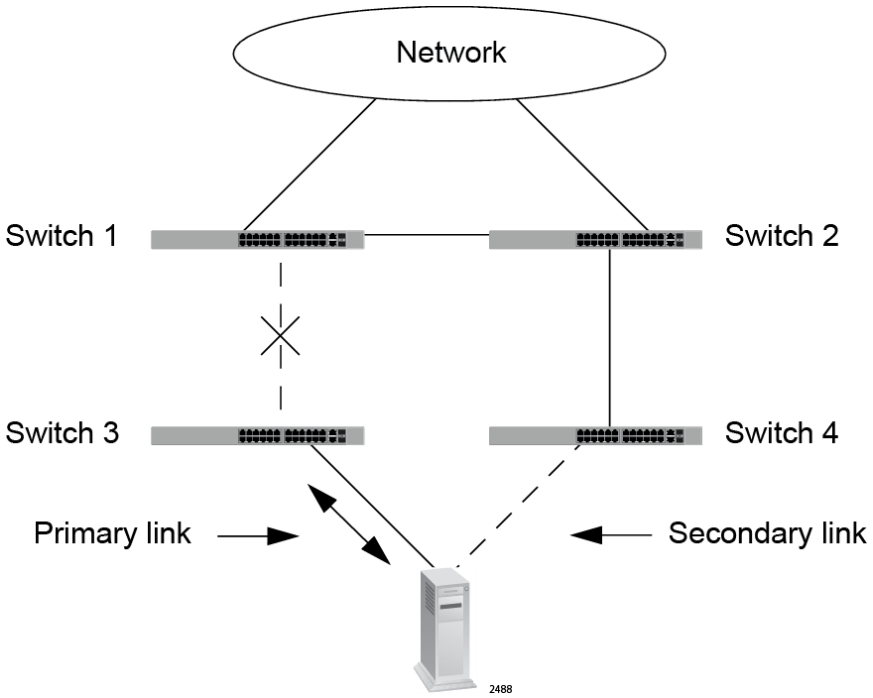

Figure 112. Group Link Control Example 2

With group link control you can address this problem by creating on switch 3 a group of the two ports that connect to switch 1 and the server. Thus, any change to the link state of the port connected to switch 1 is automatically transferred to the port connected to the server.

Assume that switch 3 is connected to switch 1 with port 17 and to the server with port 24, as shown in Figure 113 on page 545. If you group the two ports with group link control such that port 17 is the upstream or control port of the group and port 24 is the downstream port, a loss of the link on port 17 causes the switch to disable port 24, dropping the connection to the server. The server, having lost connectivity to switch 3, responds by activating its alternate network interface and transferring the traffic to switch 4.

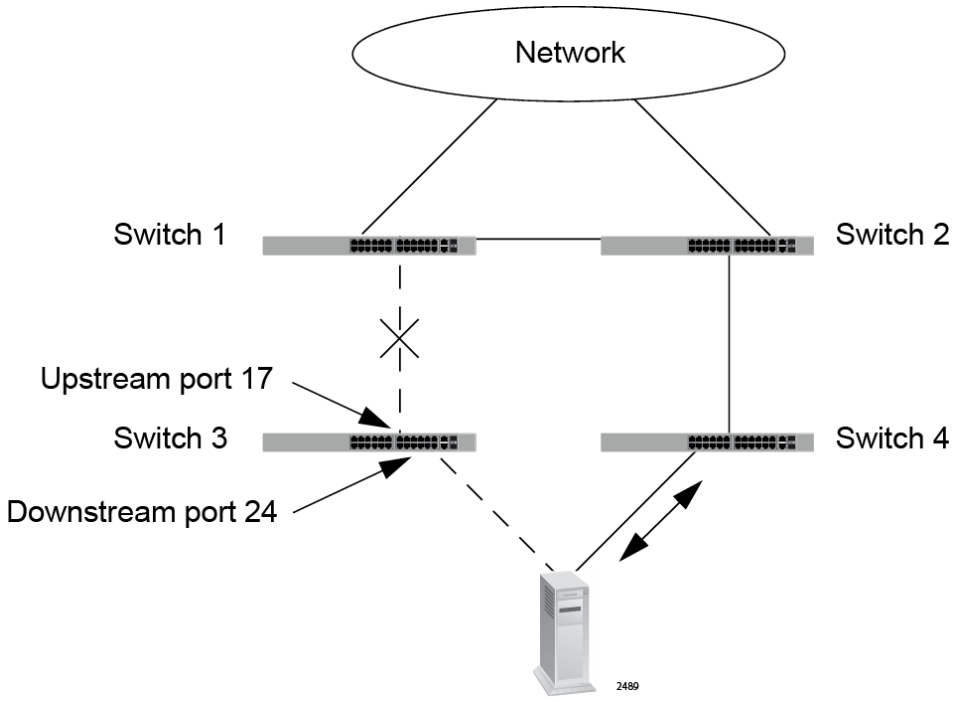

Figure 113. Group Link Control Example 3

When a link on an upstream port is reestablished, the switch automatically reactivates the downstream counterpart. Referring to the example, when the link on port 17 is reestablished, the switch enables port 24 again.

A link control group can have more than one upstream or downstream port. This enables it to support static port trunks and LACP trunks. When a group has two or more upstream ports, all of the upstream ports must lose connectivity before the switch disables the downstream ports. This is illustrated in Figure 114 on page 546 where a link control group on switch 3 has two upstream ports, ports 17 and 20, and two downstream ports, port 24 and 25. If connectivity is lost on just port 17, the downstream ports are not disabled.

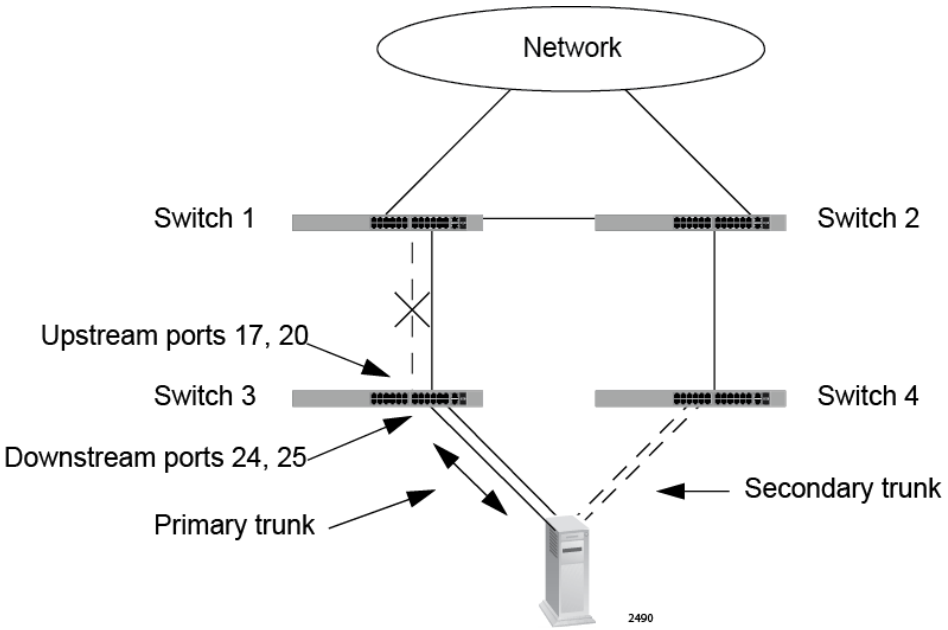

Figure 114. Group Link Control Example 4

If connectivity is lost on both ports 17 and 20, the downstream ports 24 and 25 are disabled.

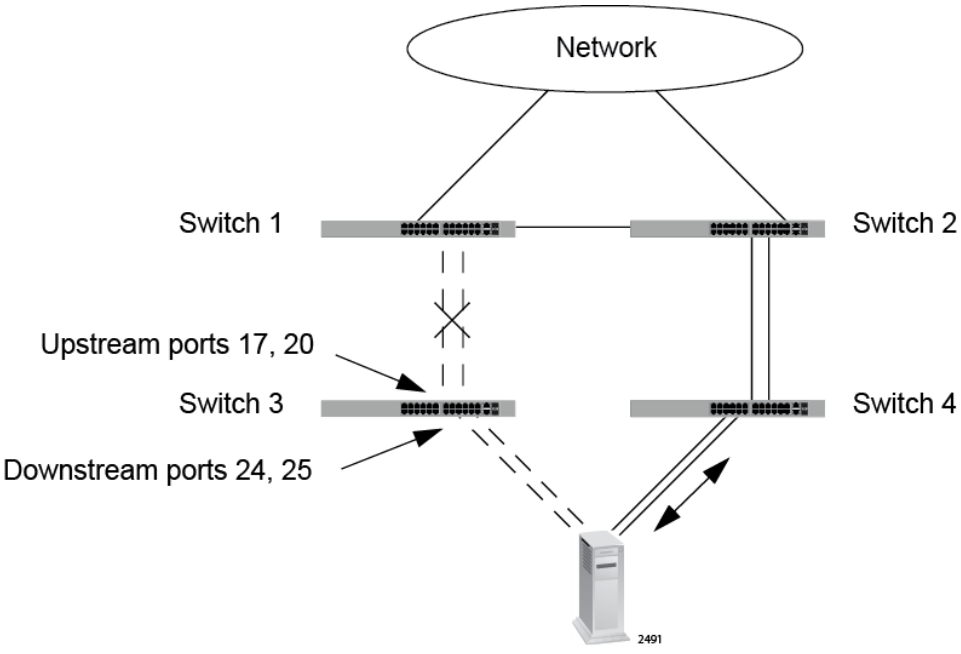

Figure 115. Group Link Control Example 5

In the previous examples, the ports of the groups on the switch are connected to different devices, making it possible for downstream devices to know whether or not there are links to upstream devices. Another

approach is to create groups in which the ports are connected to the same network node. This is useful in network topologies where redundant static port trunks or LACP trunks are controlled by the spanning tree protocol. If a primary trunk loses bandwidth capacity because connectivity is lost on one or more of the links and there is a redundant trunk held in the blocking state by the spanning tree protocol, it may be advantageous to shut down an impaired trunk and activate a redundant trunk, to restore full bandwidth.

This is illustrated in this figure. Switch 1 and switch 3 are connected with a static or LACP trunk of three links. A backup trunk from switch 2 to switch 3 is placed in the blocking state by the spanning tree protocol to prevent a network loop.

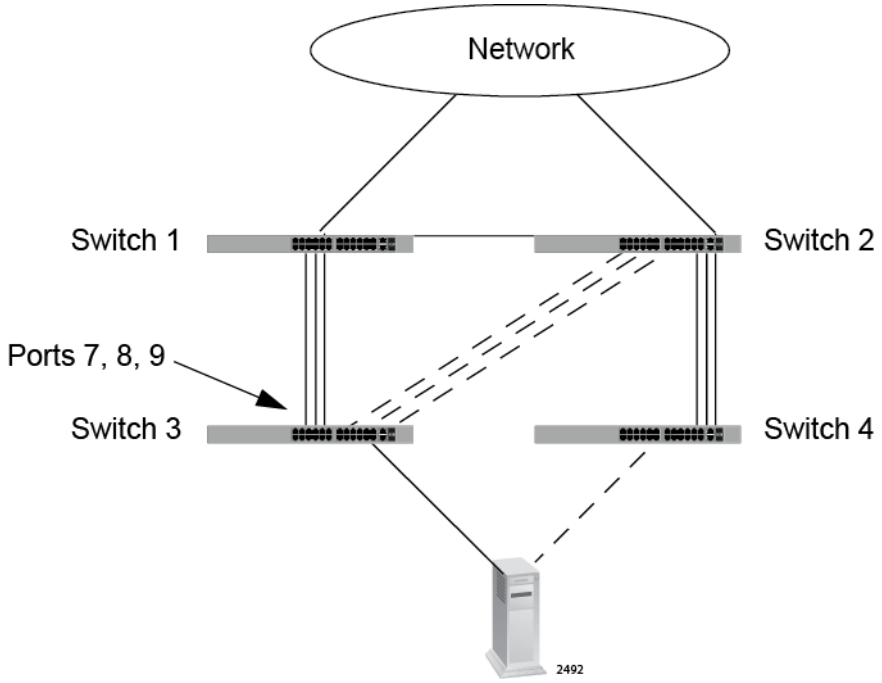

Figure 116. Group Link Control Example 6

Let's assume you want switch 3 to shut down the primary trunk to switch 1 if the active trunk loses one link. For this, you would create a series of groups to cover all of the possible combinations. Each port is designated as an uplink port in one group and a downstream port in the other groups. There are three possible combinations, as shown in this table. The order of the groups is unimportant.

Table 48. Link Control Groups on Switch 3 in Example 6

Link Control Group	Upstream Port	Downstream Ports
1	7	8, 9
2	8	7, 9

Table 48. Link Control Groups on Switch 3 in Example 6

Link Control Group	Upstream Port	Downstream Ports
3	9	7, 8

Only one group has to be true for the switch to shut down the ports of the trunk. If, for instance, port 8 loses connectivity, making group 2 true, the switch shuts down ports 7 and 9. When connectivity is restored on port 8, it enables ports 7 and 9 again.

In this example, the primary and backup trunks have four links each.

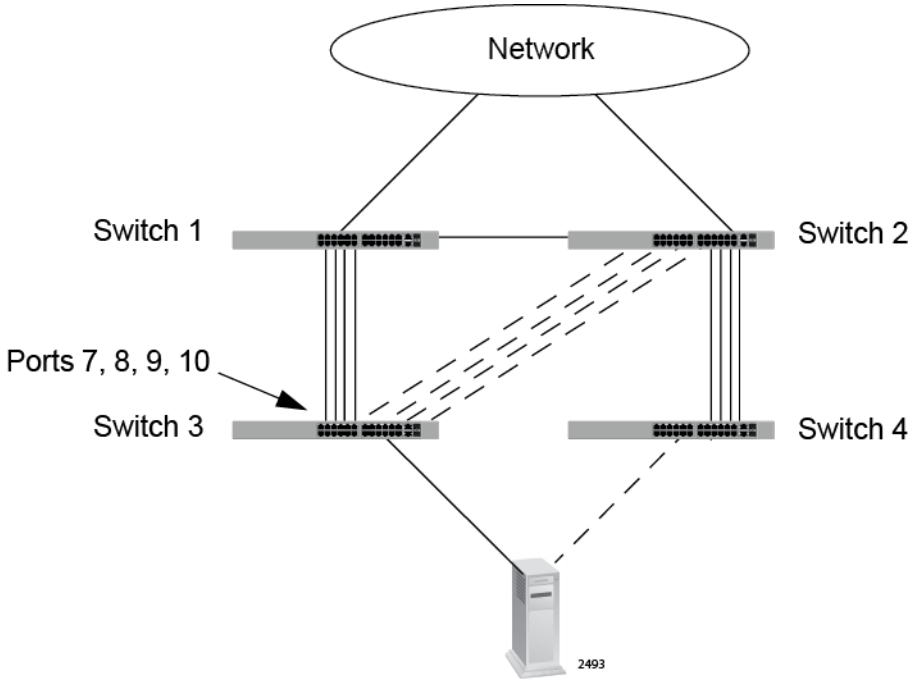

Figure 117. Group Link Control Example 7

If you want switch 3 to shut down the primary trunk if two links are lost, you create six groups to cover all of the possible combinations. The groups are listed in Table 49 on page 549. As mentioned previously, only one of the groups has to be true for the switch to disable the remaining ports in the trunk. For instance, a loss of connectivity on ports 8 and 10 makes group 5 true, causing the switch to disable ports 7 and 9, which shuts down the trunk. If a link is reestablished on either port 8 or 10, the switch activates ports 7 and 9 again.

Table 49. Link Control Groups on Switch 3 in Example 7

Link Control Group	Upstream Ports	Downstream Ports
1	7, 8	9, 10
2	8, 9	7, 10
3	9, 10	7, 8
4	7, 9	8, 10
5	8, 10	7, 9
6	7, 10	8, 9

Guidelines

Here are the guidelines to group link control:

- The switch or stack can support up to eight groups.
- A group can have any number of ports, up to the total number of ports on the switch.
- Ports can be members of more than one group. Ports can also be upstream and downstream ports in different groups. Ports, however, cannot be both upstream and downstream ports in the same group.
- When creating a new group, add the upstream ports before the downstream ports. Otherwise, the switch will disable the downstream ports.
- Group link control passes the link states of the upstream ports to the downstream ports, but not the reverse. Changes to the states of the downstream ports are not transferred to the upstream ports.
- A group is active as soon as you create it.
- The downstream ports of a new group immediately stop forwarding traffic if the upstream ports do not have links.
- When a downstream port is disabled by group link control, it remains in that state until the upstream port of the group establishes a link to a network device or you remove the downstream port from the group, or delete the group, and issue the NO SHUTDOWN command on the port. For instructions, refer to “Enabling or Disabling Ports” on page 186 or “NO GROUP-LINK-CONTROL” on page 560.
- You cannot prioritize the groups on the switch.

Configuration Examples

Table 50 lists the group link control commands.

Table 50. Group Link Control Commands

To Do This Task	Use This Command	Range
Create groups.	GROUP-LINK-CONTROL *group_id*	1 to 8
Add upstream ports.	GROUP-LINK-CONTROL UPSTREAM *group_id*	1 to 8
Add downstream ports.	GROUP-LINK-CONTROL DOWNSTREAM *group_id*	1 to 8
Remove upstream ports.	NO GROUP-LINK-CONTROL UPSTREAM *group_id*	1 to 8
Remove downstream ports.	NO GROUP-LINK-CONTROL DOWNSTREAM *group_id*	1 to 8
Display the groups.	SHOW GROUP-LINK-CONTROL [*group_id*]	1 to 8

Here are a few examples on how to configure the feature. The first example configures the group in Figure 113 on page 545 in which port 17 is the upstream port and port 24 is the downstream port. To create the group and verify the configuration, you enter:

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# group-link-control 1`	Create the new group with the GROUP-LINK-CONTROL command.
`awplus(config)# interface port1.0.17`	Move to the Port Interface mode for port 17.
`awplus(config-if)# group-link-control upstream 1`	Add port 17 as the upstream port to the group. (You should always add the upstream ports to a new group before the downstream ports.)

`awplus(config-if)# interface port1.0.24`	Move to the Port Interface mode for port 24.
`awplus(config-if)# group-link-control downstream 1`	Add port 24 as the downstream port to the group.
`awplus(config-if)# end`	Return to the Privileged Exec mode.
`awplus# show group-link-control`	Display the group to verify its configuration.

This example creates the three groups in Table 48 on page 547, for a static or LACP trunk. Each port is an upstream port in one group and a downstream port in the other groups so that the switch shuts down the trunk if any port loses its link. To create the three groups, you enter:

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.

`awplus(config)# group-link-control 1`
`awplus(config)# group-link-control 2`
`awplus(config)# group-link-control 3`
	Create the three groups with the GROUP-LINK-CONTROL command.

`awplus(config)# interface port1.0.7`	Move to the Port Interface mode for port 7.

`awplus(config-if)# group-link-control upstream 1`
`awplus(config-if)# group-link-control downstream 2`
`awplus(config-if)# group-link-control downstream 3`
	Add port 7 as an upstream port to group 1 and a downstream port to groups 2 and 3.

`awplus(config-if)# interface port1.0.8`	Move to the Port Interface mode for port 8.

`awplus(config-if)# group-link-control upstream 2`
`awplus(config-if)# group-link-control downstream 1`
`awplus(config-if)# group-link-control downstream 3`
	Add port 8 as an upstream port to group 2 and a downstream port to groups 1 and 3.

`awplus(config-if)# interface port1.0.9`	Move to the Port Interface mode for port 9.

`awplus(config-if)# group-link-control upstream 3`
`awplus(config-if)# group-link-control downstream 1`
`awplus(config-if)# group-link-control downstream 2`
	Add port 9 as an upstream port to group 3 and a downstream port to groups 1 and 2.

`awplus(config-if)# end`	Return to the Privileged Exec mode.

```
awplus# show group-link-control
```

Display the groups to verify their configurations.

```
ID ............................... 1
Status ........................... Down
Downstream (Link) Ports(s) ....... port1.0.8-port1.0.9
Upstream (Member) Ports(s) ....... port1.0.7

ID ............................... 2
Status ........................... Down
Downstream (Link) Ports(s) ....... port1.0.7-port1.0.9
Upstream (Member) Ports(s) ....... port1.0.8
ID ............................... 3
Status ........................... Down
Downstream (Link) Ports(s) ....... port1.0.7-port1.0.8
Upstream (Member) Ports(s) ....... port1.0.9
```

Chapter 34

Group Link Control Commands

The group link control commands are summarized in the following table and described in detail within the chapter.

Table 51. Group Link Control Commands

Command	Mode	Description
“GROUP-LINK-CONTROL” on page 556	Global Configuration	Creates groups.
“GROUP-LINK-CONTROL DOWNSTREAM” on page 557	Port Interface	Adds downstream ports to groups.
“GROUP-LINK-CONTROL UPSTREAM” on page 559	Port Interface	Adds upstream ports to groups.
“NO GROUP-LINK-CONTROL” on page 560	Global Configuration	Deletes groups.
“NO GROUP-LINK-CONTROL DOWNSTREAM” on page 561	Port Interface	Removes downstream ports from groups.
“NO GROUP-LINK-CONTROL UPSTREAM” on page 562	Port Interface	Removes upstream ports from groups.
“SHOW GROUP-LINK-CONTROL” on page 563	Privileged Exec	Displays the groups.

GROUP-LINK-CONTROL

Syntax

```
group-link-control group_id
```

Parameter

group_id
: Specifies the ID number of a new group. The range is 1 through 8. You can create only one group at a time.

Mode

Global Configuration mode

Description

Use this command to create new groups for group link control. To add ports to groups, refer to “GROUP-LINK-CONTROL DOWNSTREAM” on page 557 and “GROUP-LINK-CONTROL UPSTREAM” on page 559.

Use the NO form of this command to delete groups.

Confirmation Command

“SHOW GROUP-LINK-CONTROL” on page 563

Example

This example creates a group with the ID 1:

```
awplus> enable
awplus# configure terminal
awplus(config)# group-link-control 1
```

GROUP-LINK-CONTROL DOWNSTREAM

Syntax

```
group-link-control downstream group_id
```

Parameter

group_id
: Specifies a group ID number. The range is 1 through 8. The group must already exist.

Mode

Port Interface mode

Description

Use this command to add downstream ports to groups in group link control. You may add more than one port at a time. The group must already exist. For instructions on how to create groups, refer to "GROUP-LINK-CONTROL" on page 556.

> **Note**
> When creating a group on an active switch, you should add the upstream ports first to prevent group link control from disabling the downstream ports. If you add downstream ports to a group that does not have any upstream ports or whose upstream ports do not have links to network devices, group link control immediately disables the downstream ports.

Use the NO form of this command to remove downstream ports from groups.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

This example adds port 11 as a downstream port to group ID 2:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11
awplus(config-if)# group-link-control downstream 2
```

This example adds ports 15 and 16 as downstream ports to group ID 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15-port1.0.16
awplus(config-if)# group-link-control downstream 3
```

GROUP-LINK-CONTROL UPSTREAM

Syntax

```
group-link-control upstream group_id
```

Parameter

group_id
: Specifies a group ID number. The range is 1 through 8. The group must already exist.

Mode

Port Interface mode

Description

Use this command to add upstream ports to groups in group link control. You may add more than one port at a time. The group must already exist. For instructions on how to create groups, refer to "GROUP-LINK-CONTROL" on page 556.

Use the NO form of this command, NO GROUP-LINK-CONTROL UPSTREAM, to remove upstream ports from groups.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

This example adds port 5 as an upstream port to group ID 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# group-link-control upstream 4
```

This example assigns ports 20 through 22 as upstream ports to group ID 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.20-port1.0.22
awplus(config-if)# group-link-control upstream 8
```

NO GROUP-LINK-CONTROL

Syntax

```
no group-link-control group_id
```

Parameters

group_id
: Specifies the ID number of the group to be deleted. The range is 1 through 8. You can delete only one group at a time.

Mode

Global Configuration mode

Description

Use this command to delete groups from group link control.

Note
Downstream ports that group link control has disabled remain disabled even after a group is deleted. To manually activate them, use the NO SHUTDOWN command. For instructions, refer to “Enabling or Disabling Ports” on page 186 or “NO SHUTDOWN” on page 221.

Confirmation Command

“SHOW GROUP-LINK-CONTROL” on page 563

Example

This example deletes the group with ID 2:

```
awplus> enable
awplus# configure terminal
awplus(config)# no group-link-control 2
```

NO GROUP-LINK-CONTROL DOWNSTREAM

Syntax

```
no group-link-control group downstream group_id
```

Parameter

group_id
: Specifies a group ID number. The range is 1 through 8. The group must already exist.

Mode

Port Interface mode

Description

Use this command to remove downstream ports from groups in group link control. You may remove more than one port at a time from groups.

> **Note**
> Downstream ports that group link control has disabled remain disabled when removed from a group. To manually activate the ports, use the NO SHUTDOWN command. For instructions, refer to "Enabling or Disabling Ports" on page 186 or "NO SHUTDOWN" on page 221.

Confirmation Command

"SHOW GROUP-LINK-CONTROL" on page 563

Examples

This example removes downstream port 3 from group ID 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# no group-link-control downstream 5
```

This example removes downstream ports 14 and 15 from group ID 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.14,port1.0.15
awplus(config-if)# no group-link-control downstream 7
```

NO GROUP-LINK-CONTROL UPSTREAM

Syntax

```
no group-link-control upstream group_id
```

Parameter

group_id
Specifies a group ID number. The range is 1 through 8.

Mode

Port Interface mode

Description

Use this command to remove upstream ports from groups.

Note
Removing all of the upstream ports from a group disables the downstream ports.

Confirmation Command

“SHOW GROUP-LINK-CONTROL” on page 563

Examples

This example removes upstream port 15 from group ID 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# no group-link-control upstream 3
```

This example removes upstream ports 12 and 13 from group ID 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12-port1.0.13
awplus(config-if)# no group-link-control upstream 8
```

SHOW GROUP-LINK-CONTROL

Syntax

```
show group-link-control [group_id]
```

Parameters

group_id
Specifies a group ID number. The range is 1 through 8.

Mode

Privileged Exec mode

Description

Use this command to display the groups in group link control. Figure 118 is an example of the information.

```
ID.....................................1
Status.................................Up
Downstream (Link) Port(s)..............port1.0.22-port1.0.24
Upstream (Member) Port(s)...............port1.0.20-port1.0.22

ID.....................................2
Status.................................Up
Downstream (Link) Port(s)..............port1.0.7
Upstream (Member) Port(s)...............port1.0.9

ID.....................................3
Status...............................Down
Downstream (Link) Port(s)..............port1.0.11,port1.0.14
Upstream (Member) Port(s)...............port1.0.5
```

Figure 118. SHOW GROUP-LINK-CONTROL Command

The fields are defined in Table 52.

Table 52. SHOW GROUP-LINK-CONTROL Command

Field	Definition
ID	The group ID number.

Table 52. SHOW GROUP-LINK-CONTROL Command (Continued)

Field	Definition
Status	The status of the group. The possible states are listed here: ❒ Suspended - The group has no ports or has either upstream or downstream ports, but not both. ❒ Down - The group has upstream and downstream ports, but they do not have links to network devices. In the case of downstream ports, it may be because group link control disabled them because the upstream ports do not have links to network devices. ❒ Up - The upstream and downstream ports have links to network devices.
Downstream (Link) Port(s)	The downstream ports.
Upstream (Member) Port(s)	The upstream ports.

Examples

This example displays all of the groups on the switch:

```
awplus> enable
awplus# show group-link-control
```

This example displays group ID 7:

```
awplus> enable
awplus# show group-link-control 7
```

Chapter 35
Multicast Commands

The multicast commands are summarized in Table 53.

Table 53. Multicast Commands

Command	Mode	Description
“NO SWITCHPORT BLOCK EGRESS-MULTICAST” on page 566	Port Interface	Resumes forwarding egress multicast packets on ports.
“NO SWITCHPORT BLOCK INGRESS-MULTICAST” on page 567	Port Interface	Resumes forwarding ingress multicast packets on ports.
“SWITCHPORT BLOCK EGRESS-MULTICAST” on page 568	Port Interface	Blocks egress multicast packets on ports.
“SWITCHPORT BLOCK INGRESS-MULTICAST” on page 569	Port Interface	Blocks ingress multicast packets on ports.

NO SWITCHPORT BLOCK EGRESS-MULTICAST

Syntax

```
no switchport block egress-multicast
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to resume forwarding of egress multicast packets on ports. By default, this is the default setting on all of the ports on the switch.

Confirmation Command

“SHOW INTERFACE” on page 231

Example

This example resumes forwarding of egress multicast packets on port 19:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.19
awplus(config-if)# no switchport block egress-multicast
```

NO SWITCHPORT BLOCK INGRESS-MULTICAST

Syntax

```
no switchport block ingress-multicast
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to resume forwarding of ingress multicast packets on ports.

Confirmation Command

"SHOW INTERFACE" on page 231

Example

This example resumes forwarding of ingress multicast packets on ports 2 and 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2,port1.0.8
awplus(config-if)# no switchport block ingress-multicast
```

SWITCHPORT BLOCK EGRESS-MULTICAST

Syntax

```
switchport block egress-multicast
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to block egress multicast packets on ports. By default, all ports on the switch are set to *allow* multicast packets.

Note
This feature does not block multicast packets that have reserved multicast addresses in the range of 01:80:C2:00:00:00 to 01:80:C2:00:00:0F.

Note
If IGMP snooping is disabled on the switch, *all* reports are suppressed on a port even if you enable this command. By default, IGMP snooping is disabled on the switch. For more information about this feature, see Chapter 42, “Internet Group Management Protocol (IGMP) Snooping” on page 629.

Confirmation Command

“SHOW INTERFACE” on page 231

Example

This example blocks egress multicast packets on ports 20 and 22:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.20,port1.0.22
awplus(config-if)# switchport block egress-multicast
```

SWITCHPORT BLOCK INGRESS-MULTICAST

Syntax

```
switchport block ingress-multicast
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to block ingress multicast packets on ports.

Note
This feature does not block multicast packets that have reserved multicast addresses in the range of 01:80:C2:00:00:00 to 01:80:C2:00:00:0F.

Note
If IGMP snooping is disabled on the switch, *all* reports are suppressed on a port even if you enable this command. By default, IGMP snooping is disabled on the switch. For more information about this feature, see Chapter 42, "Internet Group Management Protocol (IGMP) Snooping" on page 629.

Confirmation Command

"SHOW INTERFACE" on page 231.

Example

This example blocks ingress multicast packets on ports 12 to 18:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12-port1.0.18
awplus(config-if)# switchport block ingress-multicast
```

Section III

File System

This section contains the following chapters:

Chapter 36

File System

This chapter discusses the following topics:

Overview

The file system in the switch stores the following types of files:

- Boot configuration files
- Encryption key pairs

The file system has a flat directory structure. All the files are stored in the root directory. The file system does not support subdirectories.

Table 54. File Extensions and File Types

Extension	File Type
.cfg	Configuration file
.cer	Certificate file
.pem	Certificate enrollment request
.key	Public encryption key
.log	Event log

Copying Boot Configuration Files

Maintaining a history of the configuration settings of the switch can prove useful in the event you need to undo recent changes and return the device to an earlier configuration. The best way to compile a configuration history of the unit is by periodically copying the active boot configuration file.

The command for copying boot configuration files is the COPY command in the Privileged Exec mode. Here is the format:

```
copy sourcefile.cfg destinationfile.cfg
```

The SOURCEFILE parameter *s*pecifies the name of the boot configuration file you want to copy. The DESTINATIONFILE parameter specifies the name of the new copy. The name can be up to 16 alphanumeric characters and must include the extension ".cfg". Spaces are not allowed.

This command creates a copy of the configuration file "unit12.cfg" in the switch's file system and names the copy "unit24.cfg":

```
awplus# copy unit12.cfg unit24.cfg
```

Note
Allied Telesis recommends that you periodically upload the active boot configuration file of the switch to a network device, so that if the switch should fail and become inoperable, the uploaded files will be available to quickly configure its replacement. For instructions on how to upload boot configuration files, refer to Chapter 40, "File Transfer" on page 607.

Renaming Boot Configuration Files

To rename boot configuration files in the file system, use the MOVE command, found in the Privileged Exec mode. Here is the format:

```
move filename1.cfg filename2.cfg
```

The FILENAME1 variable is the name of the file to be renamed and the FILENAME2 variable is the file's new name. The filenames cannot contain spaces or special characters.

This example renames the "Sales2sw.cfg" boot configuration file to "unit12a.cfg:"

```
awplus> enable
awplus# move Sales2sw.cfg unit12a.cfg
```

Note
If you rename the active boot configuration file, you will have to designate another active boot configuration file before the switch will allow you to save new parameter settings. For instructions on how to designate the active boot configuration file, refer to "Specifying the Active Boot Configuration File" on page 591.

Note
If you rename the active boot configuration file and reset the switch, the switch restores the default settings to all its parameter settings.

Deleting Boot Configuration Files

If the file system becomes cluttered with unnecessary configuration files, you use the DELETE command in the Privileged Exec mode to delete them. The format of the command is:

```
delete filename.ext
```

This example deletes the configuration file "unit2a.cfg":

```
awplus# delete unit2a.cfg
```

Note
If you delete the active boot configuration file, you will have to designate another active boot configuration file before the switch will allow you to save new parameter settings. If you delete the active boot configuration file and reset the switch, the switch returns to its default settings. For instructions on how to designate the active boot configuration file, refer to "Specifying the Active Boot Configuration File" on page 591.

Displaying the Specifications of the File System

The User Exec mode and the Privileged Exec mode have a command that lets you display the size of the file system, the amount of free space, and the amount of space used by the files currently stored in the file system. It is the SHOW FILE SYSTEMS command. Here is an example of the information.

```
Size (b)   Free (b)   Type    Flags     Prefixes   S/D/V    Lcl/Ntwk  Avail
-------------------------------------------------------------------------
2.0M       1.4M       flash   rw        /cfg/      static   local     Y
```

Figure 119. SHOW FILE SYSTEMS Command

The fields in the table are described in Table 56 on page 587.

Here is the command from the Privileged Exec mode:

```
awplus# show file systems
```

Listing the Files in the File System

To view the names of the files in the file system of the switch, use the DIR command in the Privileged Exec mode:

```
awplus# dir
```

The command does not accept wildcards.

Chapter 37

File System Commands

The file system commands are summarized in Table 55.

Table 55. File System Commands

Command	Mode	Description
“COPY” on page 582	Privileged Exec	Copies boot configuration files.
“DELETE” on page 583	Privileged Exec	Deletes boot configuration files from the file system.
“DELETE FORCE” on page 584	Privileged Exec	Deletes boot configuration files from the file system.
“DIR” on page 585	Privileged Exec	Lists the files in the file system.
“MOVE” on page 586	Privileged Exec	Renames files.
“SHOW FILE SYSTEMS” on page 587	Privileged Exec	Displays the amount of free and used memory in the file system.

COPY

Syntax

```
copy sourcefile.cfg destinationfile.cfg
```

Parameters

sourcefile.cfg
: Specifies the name of the boot configuration file you want to copy.

destinationfile.cfg
: Specifies the name of the new copy of the file. The filename can be from 1 to 16 alphanumeric characters. The extension must be ".cfg". Spaces and special characters are not allowed.

Mode

Privileged Exec mode

Description

Use this command to create copies of boot configuration files in the file system of the switch. Creating copies of the active boot configuration file is an easy way to maintain a history of the configurations of the switch. To display the name of the active boot configuration file, refer to "SHOW BOOT" on page 602.

If the destination filename is the same as the name of an existing file in the file system, the command overwrites the existing file.

Example

This command creates a copy of the boot configuration file "unit12.cfg" in the switch's file system and names the copy "unit12backup.cfg":

```
awplus# copy unit12.cfg unit12backup.cfg
```

DELETE

Syntax

```
delete filename.cfg
```

Parameter

filename.cfg

Specifies the name of the boot configuration file to be deleted. You can use the wildcard "*" to replace any part of a filename to delete multiple configuration files.

Mode

Privileged Exec mode

Description

Use this command to delete boot configuration files from the file system in the switch. This command is equivalent to "DELETE FORCE" on page 584.

Note
If you delete the active configuration file, the switch recreates it the next time you issue the WRITE command or the COPY RUNNING-CONFIG STARTUP-CONFIG command. To view the name of the active boot configuration file on the switch, refer to "SHOW BOOT" on page 602.

To view a list of the files in the file system, refer to "DIR" on page 585.

Examples

This command deletes the boot configuration file "unit12.cfg":

```
awplus# delete unit12.cfg
```

This command deletes all boot configuration files that start with "bldg":

```
awplus# delete bldg*.cfg
```

DELETE FORCE

Syntax

```
delete force filename.ext
```

Parameter

filename.ext
: Specifies the name of the boot configuration file to be deleted. You can use the wildcard "*" to replace any part of a filename to delete multiple configuration files.

Mode

Privileged Exec mode

Description

Use this command to delete boot configuration files from the file system in the switch. This command is equivalent to "DELETE" on page 583.

Note
If you delete the active configuration file, the switch recreates it the next time you issue the WRITE command or the COPY RUNNING-CONFIG STARTUP-CONFIG command. To view the name of the active boot configuration file on the switch, refer to "SHOW BOOT" on page 602.

To view a list of the files in the file system, refer to "DIR" on page 585.

Examples

This command deletes the boot configuration file "production_sw.cfg":

```
awplus# delete force production_sw.cfg
```

This command deletes all boot configuration files that start with "unit":

```
awplus# delete force unit*.cfg
```

DIR

Syntax

```
dir
```

Parameter

None

Mode

Privileged Exec mode

Description

Use this command to list the names of the files stored in the file system on the switch.

Example

The following command lists the file names stored in the file system:

```
awplus# dir
```

MOVE

Syntax

`move` *`filename1`*`.cfg` *`filename2`*`.cfg`

Parameters

filename1.cfg
: Specifies the name of the boot configuration file to be renamed.

filename2.cfg
: Specifies the new name for the file. The filename can be from 1 to 16 alphanumeric characters, not including the filename extension, which must be ".cfg". The filename cannot contain spaces or special characters.

Mode

Privileged Exec mode

Description

Use this command to rename boot configuration files in the switch's file system.

Note
If you rename the active boot configuration file, the switch recreates it the next time you issue the WRITE command or the COPY RUNNING-CONFIG STARTUP-CONFIG command.

Note
If you rename the active boot configuration file and reset the switch without specifying a new active boot configuration file or issuing the WRITE command or the COPY RUNNING-CONFIG STARTUP-CONFIG command, the switch returns to its default settings.

Example

This example renames the file "sw12.cfg" to "swrm102.cfg:"

```
awplus# move sw12.cfg swrm102.cfg
```

SHOW FILE SYSTEMS

Syntax

```
show file systems
```

Parameter

None

Mode

Privileged Exec mode

Description

Use this command to display the specifications of the file system in the switch. An example is shown in Figure 120.

```
Size (b)   Free (b)   Type   Flags     Prefixes   S/D/V    Lcl/Ntwk  Avail
-------------------------------------------------------------------------
2.0M       1.4M       flash  rw        /cfg/      static   local     Y
```

Figure 120. SHOW FILE SYSTEMS Command

The fields are described in Table 56.

Table 56. SHOW FILE SYSTEMS Command

Parameter	Description
Size (B)	The total amount of flash memory in the switch. The amount is given in megabytes (M) or kilobytes (k).
Free (B)	The amount of unused flash memory in the switch. The amount is given in megabytes (M) or kilobytes (k).
Type	The type of memory.
Flags	The file setting options.
Prefixes	The directory in which files are stored. This is always "cfg" for configuration file.
S/D/V	The memory type: static, dynamic, or virtual.

Table 56. SHOW FILE SYSTEMS Command (Continued)

Parameter	Description
Lcl/Ntwk	Whether the memory is located locally or via a network connection.
Y/N	Whether the memory is accessible: Y (yes), N (no), - (not appropriate)

Example

The following example displays the specifications of the file system:

```
awplus# show file systems
```

Chapter 38

Boot Configuration Files

This chapter discusses the following topics:

Overview

The changes that you make to the parameters settings of the switch are saved as a series of commands in a special file in the file system. The file is referred to as the active boot configuration file. This file is updated by the switch with your latest changes whenever you issue the WRITE command or the COPY RUNNING-CONFIG STARTUP-CONFIG command in the Privileged Exec mode.

Once the parameter settings are saved in the active boot configuration file, they are retained even when the switch is powered off or reset. This saves you from having to reconfigure the parameter settings every time you power off or reset the unit. The switch, as part of its initialization process whenever it is powered on or reset, automatically refers to this file to set its parameter settings.

You can store more than one boot configuration file in the file system on the switch, but only one file can be the active file at a time. The active boot configuration file is specified with the BOOT CONFIG-FILE command, in the Privileged Exec mode.

There are a couple of situations where you might want to specify a different active boot configuration file on the switch. You might want to reconfigure the switch with the settings in a new file that you downloaded into the file system. Or perhaps you want to restore a previous configuration on the switch, using a copy of an earlier version of the active boot configuration file.

Specifying the Active Boot Configuration File

To create or designate a new active boot configuration file for the switch, use the BOOT CONFIG-FILE command in the Global Configuration mode. Here is the format of the command;

```
boot config-file filename.cfg
```

The FILENAME.CFG parameter is the file name of the configuration file to act as the active boot configuration file for the switch. This can be the name of an entirely new file that does not exist yet in the file system, or an existing file. The filename can be from 1 to 16 alphanumeric characters and must include the ".cfg" extension. The filename is case sensitive. To verify the name of an existing file, use the DIR command in the Privileged Exec mode to display the names of the files in the file system.

The BOOT CONFIG-FILE command is unique from all the other commands that are used to configure the parameters on the switch. After you enter the command, the switch permanently remembers the filename of the new active boot configuration file, without you having to enter the WRITE command or the COPY RUNNING-CONFIG STARTUP-CONFIG command. In fact, you probably will not want to enter either of those commands after you specify a new active boot configuration file, because that would cause the switch to overwrite the settings in the file with the current settings.

After you enter the command, it does one of two things, depending on whether the filename is of a new or an existing file. If the filename is of an entirely new boot configuration file, the switch automatically creates it, stores the current parameter settings in it, and finally designates it as the active boot configuration.

If you specify the filename of an existing boot configuration file in the file system, the switch marks it as the active boot configuration file, at which point you need to make a choice.

- To reconfigure the switch with the settings in the newly designated active boot configuration file, reset the switch with the REBOOT command in the Privileged Exec mode.

Caution
The switch does not forward packets while it is initializing its management software. Some network traffic may be lost.

- To overwrite the settings in the file with the switch's current settings, enter the WRITE or COPY RUNNING-CONFIG STARTUP-CONFIG command in the Privileged Exec mode.

Here are a couple examples of the command. The first example creates a new active boot configuration file called “sw_product4.cfg”:

```
awplus> enable
awplus# configure terminal
awplus(config)# boot config-file sw_product4.cfg
```

After you enter the command, the switch creates the file in its file system, updates it with the current parameter settings, and finally marks it as the active boot configuration file. The file is now ready to store any new parameter settings you might make to the switch.

In this example, the settings of the switch are configured using a different boot configuration file in the file system. Perhaps it is an archive copy of an early configuration of the unit or perhaps a boot configuration file you downloaded from another switch. In either case, this will require rebooting the switch. The name of the file is “sw12_eng.cfg”:

```
awplus> enable
awplus# configure terminal
awplus(config)# boot config-file sw12_eng.cfg
awplus(config)# exit
awplus# reboot
```

Creating a New Boot Configuration File

It is a good idea to periodically make copies of the current configuration of the switch so that you can return the switch to an earlier configuration, if necessary. For this there is the COPY RUNNING-CONFIG command in the Privileged Exec mode. The command has this format:

```
copy running-config filename.cfg
```

The name of the new boot configuration file, specified with the FILENAME parameter, can be from 1 to 16 alphanumeric characters, not including the extension ".cfg". If you specify the name of an existing file, the new file overwrites the existing file.

It is important to understand that this command does not change the switch's active boot configuration file. That file remains unchanged. All this command does is create a new boot configuration file of the current parameter settings in the file system. If you want to change the active boot configuration file, use the BOOT CONFIG-FILE command, explained in "Specifying the Active Boot Configuration File" on page 591.

This example of the COPY RUNNING-CONFIG command creates a new boot configuration file called "sw_sales_archive.cfg" in the file system:

```
awplus> enable
awplus# copy running-config sw_sales_archive.cfg
```

Displaying the Active Boot Configuration File

To display the name of the active boot configuration file on the switch, go to the Privileged Exec mode and enter the SHOW BOOT command. Here is the command:

```
awplus# show boot
```

Here is an example of the information.

```
Current software   : v2.1.1
Current boot image : v2.1.1
Backup boot image  : Not set
Default boot config: /cfg/boot.cfg
Current boot config: /cfg/switch2.cfg (file exists)
```

Figure 121. SHOW BOOT Command

The “Current boot config” field displays the name of the active boot configuration file, which for the switch in the example is “switch2.cfg.” The rest of the fields are defined in Table 58 on page 602.

Chapter 39

Boot Configuration File Commands

The boot configuration file commands are summarized in Table 57 and described in detail within the chapter.

Table 57. Boot Configuration File Commands

Command	Mode	Description
“BOOT CONFIG-FILE” on page 596	Global Configuration	Designates or creates a new active boot configuration file for the switch.
“COPY RUNNING-CONFIG” on page 598	Privileged Exec	Creates new boot configuration files that contain the current settings of the switch.
“COPY RUNNING-CONFIG STARTUP-CONFIG” on page 599	Privileged Exec	Saves the switch’s current configuration to the active boot configuration file.
“ERASE STARTUP-CONFIG” on page 600	Privileged Exec	Returns the switch to its default settings.
“NO BOOT CONFIG-FILE” on page 601	Global Configuration	Designates the default BOOT.CFG file as the active boot configuration file on the switch.
“SHOW BOOT” on page 602	Privileged Exec	Displays the names of the active configuration file and the configuration file that was used by the switch during the last reset or power cycle.
“SHOW STARTUP-CONFIG” on page 604	Privileged Exec	Displays the contents of the active boot configuration file.
“WRITE” on page 605	Privileged Exec	Saves the switch’s current configuration to the active boot configuration file.

BOOT CONFIG-FILE

Syntax

`boot config-file` *`filename`*`.cfg`

Parameter

filename

Specifies the name of a boot configuration file that is to act as the active boot configuration file on the switch. The filename can be from 1 to 16 alphanumeric characters. The extension must be ".cfg".

Mode

Global Configuration mode

Description

Use this command to designate the active boot configuration file on the switch. The switch uses the file to save its parameter settings when you issue the WRITE or COPY RUNNING-CONFIG STARTUP-CONFIG command, and to restore its parameter settings when you reset or power cycle the unit.

To create a new active boot configuration file, enter a new filename in the command. The command automatically creates the file, updates it with the current settings of the switch, and designates it as the active boot configuration file.

To specify an existing boot configuration file as the new active file on the switch, include the file's name in the command. The switch marks it as the active boot configuration file. Afterwards, do one of the following:

- To reconfigure the switch with the settings in the newly designated active boot configuration file, reset the switch with the REBOOT command in the Privileged Exec mode.

Caution

The switch does not forward packets while it is initializing its management software. Some network traffic may be lost.

- To overwrite the settings in the file with the switch's current settings, enter the WRITE or COPY RUNNING-CONFIG STARTUP-CONFIG command in the Privileged Exec mode.

Confirmation Command

"SHOW BOOT" on page 602.

Examples

This example designates a file called "region2asw.cfg" as the switch's active configuration file. This example assumes that the file is completely new. The switch creates the file, with its current parameter settings, and then designates it as the active boot configuration file:

```
awplus> enable
awplus# configure terminal
awplus(config)# boot config-file region2asw.cfg
```

This example designates the file "sw12a.cfg" as the switch's active configuration file. The example assumes that the file already exists in the file system of the switch and that you want to reconfigure the switch according to the settings in the file:

```
awplus> enable
awplus# configure terminal
awplus(config)# boot config-file sw12a.cfg
awplus(config)# exit
awplus# reboot
```

This example designates the file "bldg4.cfg" as the active configuration file on the switch. This example assumes that instead of configuring the switch with the settings in the file, you want to overwrite the settings in the file with the current settings on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# boot config-file bldg4.cfg
awplus(config)# exit
awplus# write
```

COPY RUNNING-CONFIG

Syntax

```
copy running-config filename.cfg
```

Parameter

filename

Specifies a name for a new boot configuration file. The name can be from 1 to 16 alphanumeric characters. The extension must be ".cfg".

Mode

Privileged Exec mode

Description

Use this command to create new boot configuration files. Stored in the file system on the switch, the files contain the current settings of the switch. You might use this command to create a backup copy of the switch's current configuration.

This command does not change the active boot configuration file. To designate a different file as the active boot configuration file on the switch, refer to "BOOT CONFIG-FILE" on page 596.

Confirmation Command

"DIR" on page 585

Example

This example creates a new boot configuration file called "salesunit2_archive.cfg".

```
awplus> enable
awplus# copy running-config salesunit2_archive.cfg
```

COPY RUNNING-CONFIG STARTUP-CONFIG

Syntax

```
copy running-config startup-config
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to update the active boot configuration file with the switch's current configuration, for permanent storage. When you enter the command, the switch copies its parameter settings into the active boot configuration file. The switch saves only those parameters that have been changed from their default settings.

> **Note**
> Parameter changes that are not saved in the active boot configuration file are discarded when the switch is powered off or reset.

To view the name of the active boot configuration file, see "SHOW BOOT" on page 602.

This command is equivalent to "WRITE" on page 605.

Example

The following example updates the active boot configuration with the switch's current configuration:

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

ERASE STARTUP-CONFIG

Syntax

```
erase startup-config
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to restore the default settings to all the parameters on the switch. Review the following information before using this command:

- This command does not delete the files in the switch's file system or the encryption keys in the key database. To delete those files, refer to "DELETE" on page 583 and "CRYPTO KEY DESTROY HOSTKEY" on page 1460.
- This command does not change the settings in the active boot configuration file. To return the active configuration file to the default settings, you must enter the WRITE or COPY RUNNING-CONFIG STARTUP-CONFIG command after the switch reboots and after you have established a local management session. Otherwise, the switch reverts to the previous configuration the next time it is reset.
- To resume managing the switch, you must use the Console port. Remote management is not possible because the switch will not have a management IP address.

Caution
This command causes the switch to reset. The switch will not forward network traffic while it initializes its management software. Some network traffic may be lost.

Example

This example restores all the parameters on the switch to their default values:

```
awplus> enable
awplus# erase startup-config
```

NO BOOT CONFIG-FILE

Syntax

```
no boot config-file
```

Parameter

None

Mode

Global Configuration mode

Description

Use this command to configure the switch with the settings in the default BOOT.CFG file.

Caution
This command causes the switch to reset. It does not forward network traffic while it initializes the management software. Some network packets may be lost.

After the switch finishes initializing its management software, it uses the BOOT.CFG file to configure its parameter settings. To overwrite the settings in the active boot configuration file with the switch's current settings, enter the WRITE or COPY RUNNING-CONFIG STARTUP-CONFIG command in the Privileged Exec mode.

This command does not return the switch to its default settings if, at some earlier time, you used the BOOT.CFG file as the activate boot configuration file on the switch. To restore the default settings to the switch, refer to "ERASE STARTUP-CONFIG" on page 600.

Example

This example configures the switch with the settings in the default BOOT.CFG file:

```
awplus> enable
awplus# configure terminal
awplus(config)# no boot config-file
```

SHOW BOOT

Syntax

```
show boot
```

Parameter

None

Mode

Privileged Exec mode

Description

Use this command to display the name of the active boot configuration file and the version numbers of the management software and bootloader. Figure 122 is an example of the information.

```
Current software: v2.1.1
Current boot image: v2.1.1
Default boot config: /cfg/boot.cfg
Current boot config: /cfg/switch2.cfg (file exists)
```

Figure 122. SHOW BOOT Command

The fields are described in Table 58.

Table 58. SHOW BOOT Command

Field	Description
Current software	The version number of the AlliedWare Plus Management Software on the switch.
Current boot image	The version number of the bootloader.
Default boot config	The name of the boot configuration file used by the switch to configure its parameters after “NO BOOT CONFIG-FILE” on page 601. This parameter cannot be changed.
Current boot config	The name of the active boot configuration file on the switch.

Example

This command displays the name of the active boot configuration file and the version numbers of the management software and bootloader.

```
awplus# show boot
```

SHOW STARTUP-CONFIG

Syntax

```
show startup-config
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the contents of the active boot configuration file.

Example

The following example displays the contents of the active boot configuration file:

```
awplus# show startup-config
```

WRITE

Syntax

```
write
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to update the active boot configuration file with the switch's current configuration, for permanent storage. When you enter the command, the switch copies its parameter settings into the active boot configuration file. The switch saves only those parameters that have been changed from their default settings.

> **Note**
> Parameter changes that are not saved in the active boot configuration file are discarded when the switch is powered off or reset.

To view the name of the active boot configuration file, see "SHOW BOOT" on page 602.

This command is equivalent to "COPY RUNNING-CONFIG STARTUP-CONFIG" on page 599.

Example

The following example updates the active boot configuration file with the switch's current configuration:

```
awplus# write
```

Chapter 40

File Transfer

This chapter discusses the following topics:

Overview

This chapter discusses how to download files onto the switch and upload files onto the switch. You can download the following file types to the switch:

- New versions of the management software
- Boot configuration files (Refer to Chapter 38, “Boot Configuration Files” on page 589.)
- Public or private CA certificates (Refer to Chapter 96, “Secure HTTPS Web Browser Server” on page 1481.)

You can upload following file types from the switch:

- Boot configuration files
- CA certificate requests
- Technical support text files (Refer to “SHOW TECH-SUPPORT” on page 1948.)

You can use Zmodem or TFTP to transfer files. You must use local management sessions of the switch to transfer files using Zmodem. For TFTP, you can use local management sessions, or remote Telnet or SSH sessions. You can also transfer files with enhanced stacking.

Uploading or Downloading Files with TFTP

These procedures can be performed from a local management session or a remote Telnet or SSH session.

Here are the TFTP requirements:

- The switch must have a management IP address. For instructions, refer to Chapter 13, "IPv4 and IPv6 Management Addresses" on page 295.
- The switch's management IP address must include a default gateway if the switch and the TFTP server are members of different networks. The default gateway must specify the IP address of the first hop to the network of the TFTP server.
- There must be a TFTP server on your network.
- The TFTP server must be active.

Downloading New Management Software with TFTP

To use TFTP to download new management software to the switch:

Caution

This procedure causes the switch to reset. The switch does not forward network traffic while it writes the new software to flash memory and initializes the software. Some network traffic may be lost.

1. Obtain the new management software from the Allied Telesis web site and store it on the TFTP server on your network. For information on how to obtain management software from Allied Telesis, refer to "Contacting Allied Telesis" on page 50.
2. Start a local or remote management session on the switch.
3. To view the current version number of the management software on the unit to determine whether the switch needs the new firmware, use the SHOW SYSTEM command in the User Exec mode or the SHOW SWITCH command in the Privileged Exec mode.
4. The command for downloading files to the switch with TFTP is the COPY TFTP FLASH command in the Privileged Exec mode. Here is the format of the command:

   ```
   copy tftp flash ipaddress filename.img
   ```

The IPADDRESS parameter is the IP address of the TFTP server, and the FILENAME parameter is the name of the new management software file to be downloaded to the switch from the TFTP server. The filename must include the ".img" extension and cannot contain spaces.

In this example of the command, the IP address of the TFTP server is 149.11.124.5 and the filename of the new management software to be downloaded from the server is "at-FS970M_sw.img":

```
awplus# copy tftp flash 149.11.124.5 AT-FS970M_sw.img
```

After receiving the entire file from the TFTP server, the switch compares the version numbers of the new image file and its current management software. If the new image file has an earlier or the same version number as the current management software, the switch cancels the update procedure. If the new image file has a newer version number, the switch writes the file into flash memory and then resets.

5. Wait for the switch to write the new management software to flash memory.
6. To resume managing the switch, start a new management session after the switch has reset.
7. To confirm the new management software on the switch, use the SHOW SYSTEM command in the User Exec mode or the SHOW SWITCH command in the Privileged Exec mode to check the version number of the management software on the switch.

Downloading Files to the Switch with TFTP

To use TFTP to download boot configuration files or CA certificates to the switch:

1. Store the file on the TFTP server on your network.
2. Start a local management session or a remote Telnet or SSH management session on the switch.
3. The command for downloading files to the switch with TFTP is the COPY TFTP FLASH command in the Privileged Exec mode. Here is the format of the command:

   ```
   copy tftp flash ipaddress filename.exe
   ```

   The IPADDRESS parameter is the IP address of the TFTP server. The FILENAME parameter is the name of the file you want to download from the TFTP server to the switch. The filename extension must be ".cfg" for boot configuration files and ".pem" for CA certificates. The filename cannot contain spaces.

In this example of the command, the IP address of the TFTP server is 152.34.67.8, and the filename of the boot configuration to be downloaded from the server is "switch2a.cfg":

```
awplus# copy tftp flash 152.34.67.8 switch2a.cfg
```

After receiving the entire file, the switch stores it in the file system.

4. To confirm that the switch received the file, use the DIR command in the Privileged Exec mode to list the files in the file system.

5. If you downloaded a boot configuration file that you want to designate as the active boot configuration file on the switch, use the BOOT CONFIG-FILE command in the Global Configuration mode:

   ```
   boot config-file filename.cfg
   ```

   This example of the command designates "switch1a.cfg" as the switch's new active boot configuration file:

   ```
   awplus# configure terminal
   awplus(config)# boot config-file switch1a.cfg
   ```

6. At this point, do one of the following:

   - To configure the switch using the settings in the newly designated active boot configuration file, reset the switch with the REBOOT command in the Privileged Exec mode.

   

   Caution
   The switch does not forward packets while initializing the management software. Some network traffic may be lost.

   - To overwrite the settings in the file with the switch's current settings, enter the WRITE or COPY RUNNING-CONFIG STARTUP-CONFIG command in the Privileged Exec mode.

Uploading Files from the Switch with TFTP

You can upload three types of files from the file system of the switch:

- Boot configuration files (Refer to Chapter 38, "Boot Configuration Files" on page 589.)
- CA certificate requests (Refer to Chapter 96, "Secure HTTPS Web Browser Server" on page 1481.)
- Technical support text files (Refer to "SHOW TECH-SUPPORT" on page 1948.)

To upload a file from the file system of the switch using TFTP:

1. Start a local or remote management session on the switch.

2. Use the DIR command in the Privileged Exec mode to confirm the name of the file you want to upload from the file system in the switch.

3. The command for uploading files from the switch with TFTP is the COPY FLASH TFTP command in the Privileged Exec mode. Here is the format of the command:

   `copy flash tftp` *`ipaddress filename`*

   The IPADDRESS parameter is the IP address of the TFTP server residing on your network. The FILENAME parameter is the name of the file to be uploaded from the switch to the TFTP server. The filename can not contain spaces and must include the appropriate extension.

   This example of the command uploads the boot configuration file “sw_unit_12.cfg” from the file system to a TFTP server that has the IP address 123.32.45.3:

   ```
   awplus# copy flash tftp 123.32.45.3 sw_unit_12.cfg
   ```

   This example uploads the technical support file “tech-support-20100601091645.txt” from the file system to a TFTP server that has the IP address 149.152.201.25:

   ```
   awplus# copy flash tftp 149.152.201.25 tech-support-
   20100601091645.txt
   ```

   The upload should take only a few moments. The switch displays the Privileged Exec prompt again when it is finished uploading the file.

Uploading or Downloading Files with Zmodem

> **Note**
> You may not use Zmodem to download new versions of the management software to the switch. For that, you must use TFTP.

Downloading Files to the Switch with Zmodem

You may use Zmodem to download boot configuration files and encryption key certificates to the file system in the switch. To download a file using Zmodem:

1. Store the boot configuration file on the terminal or workstation you intend to use during the local management session of the switch.
2. Start a local management session on the switch. For instructions, refer to "Starting a Local Management Session" on page 76.
3. Enter this command in the Privileged Exec mode:

   ```
   awplus# copy zmodem
   ```

   You will see this prompt:

   ```
   Waiting to receive ...
   ```

4. Use your terminal or terminal emulator program to begin the download. The download must be Zmodem.

   After receiving the entire file, the switch stores it in the file system.
5. To confirm that the switch received the file, use the DIR command in the Privileged Exec mode to list the files in the file system.
6. If you downloaded a boot configuration file and want to designate it as the active boot configuration file on the switch, use the BOOT CONFIG-FILE command in the Global Configuration mode:

   ```
   boot config-file filename.cfg
   ```

   This example of the command designates "switch2a.cfg" as the switch's new active boot configuration file:

   ```
   awplus# configure terminal
   awplus(config)# boot config-file switch2a.cfg
   ```

7. At this point, do one of the following:

   - To configure the switch using the settings in the newly designated active boot configuration file, reset the switch with the REBOOT command in the Privileged Exec mode.

   Caution
   The switch does not forward packets while it is initializing its management software. Some network traffic may be lost.

   - To overwrite the settings in the file with the switch's current settings, enter the WRITE or COPY RUNNING-CONFIG STARTUP-CONFIG command in the Privileged Exec mode.

Uploading Files from the Switch with Zmodem

Here are the three types of files you can upload from the file system of the switch:

- Boot configuration files (Refer to Chapter 38, "Boot Configuration Files" on page 589.)
- CA certificate requests (Refer to Chapter 96, "Secure HTTPS Web Browser Server" on page 1481.)
- Technical support text files (Refer to "SHOW TECH-SUPPORT" on page 1948.)

To upload a file from the switch using Zmodem:

1. Start a local management session on the switch. For instructions, refer to "Starting a Local Management Session" on page 76.

2. Use the DIR command in the Privileged Exec mode to confirm the name of the file you want to upload from the file system of the switch.

3. Enter the COPY command in the Privileged Exec mode to upload the file. Here is the format of the command:

   ```
   copy filename zmodem
   ```

   The FILENAME parameter is the name of the configuration file you want to upload from the switch. The filename can not contain spaces and must include the appropriate extension.

   This example of the command uploads the configuration file "bldg2_sw.cfg":

   ```
   awplus# copy bldg2_sw.cfg zmodem
   ```

   This example of the command uploads the technical support text file "tech-support-20100718120918.txt:"

   ```
   awplus# copy tech-support-20100718120918.txt zmodem
   ```

After you enter the command, the switch displays this message:

```
Waiting to send ...
```

4. Use your terminal or terminal emulator program to begin the upload. The upload must be Zmodem. The upload should take only a few moments. The upload is finished when the Privileged Exec prompt is displayed again.

Downloading Files with Enhanced Stacking

If you are using the enhanced stacking feature, you can automate the process of updating the management software in the switches by having the command switch download its management software to the other switches in the stack.

Caution
The switch automatically resets when it receives a new version of the management software. It does not forward network traffic while it writes the new software to flash memory and initializes the software. Some network traffic may be lost.

To update the management software of the switches in an enhanced stack:

1. Update the management software on the command switch of the enhanced stack by performing one of the previous procedures in this chapter.

2. After you have updated the management software on the command switch, start a new local or remote session on it.

   Issue the SHOW ESTACK REMOTELIST command in the Privileged Exec mode to display all the switches in the enhanced stack, except for the command switch. Here is an example of the display.

```
Searching for slave devices. Please wait...

Num   MAC Address         Name           Mode     Version    Model
-------------------------------------------------------------------------
01    00:21:46:A7:B4:04   Production..   Slave    v1.0.0     AT-FS970M/48
02    00:21:46:A7:B4:43   Marketing      Slave    v1.0.0     AT-FS970M/8
03    00:30:84:00:00:02   Tech Suppo..   Slave    v1.0.0     AT-FS970M/8PS
```

Figure 123. SHOW ESTACK REMOTELIST

3. To have the command switch upload its management software to one or more of the other switches in the stack, enter the UPLOAD IMAGE REMOTELIST command in the Global Configuration mode. The command does not have any parameters. After you enter the command, this prompt is displayed:

   ```
   Remote switches will reboot after load is complete.
   Enter the list of switches ->
   ```

4. Enter the ID numbers of the switches to receive the management software from the command switch. The ID numbers are the numbers in the Num column in the SHOW ESTACK REMOTELIST command. You can update more than one switch at a time. For example, to update switches 1 and 2 in Figure 123 on page 616, you would enter:

   ```
   Remote switches will reboot after load is complete.
   Enter the list of switches -> 1,2
   ```

   The command switch starts the download process with the first switch. After downloading its management software to that switch, it repeats the process with the next switch, and so on.

   After a switch has received from the command switch the entire management software file, it compares the version numbers of the new image file and its current management software. If the new image file has an earlier or the same version number as the current management software, it cancels the update procedure. If the new image file has a newer version number, the switch writes the file into flash memory and then resets.

Chapter 41

File Transfer Commands

The file transfer commands are summarized in Table 59 and described in detail within the chapter.

Table 59. File Transfer Commands

Command	Mode	Description
“COPY FILENAME ZMODEM” on page 620	Privileged Exec	Uses Zmodem to upload files from the file system in the switch.
“COPY FLASH TFTP” on page 621	Privileged Exec	Uses TFTP to upload files from the switch.
“COPY TFTP FLASH” on page 622	Privileged Exec	Uses TFTP to download new versions of the management software, boot configuration files, or CA certificates to the switch.
“COPY ZMODEM” on page 624	Privileged Exec	Uses Zmodem to download new boot configuration files or CA certificates to the switch.
“UPLOAD IMAGE REMOTELIST” on page 625	Global Configuration	Uses enhanced stacking to download the management software on the command switch to other switches.

COPY FILENAME ZMODEM

Syntax:

```
copy filename.cfg zmodem
```

Parameters

filename

Specifies the filename of a configuration file to upload from the file system in the switch. The filename cannot contain spaces and include the extension ".cfg". You can specify one filename.

Mode

Privileged Exec mode

Description

Use this command together with a Zmodem utility to upload boot configuration files from the file system in the switch to your terminal or computer. This command must be performed from a local management session. For instructions on how to use this command, refer to "Uploading Files from the Switch with Zmodem" on page 614.

Example

This example uploads the configuration file "eng_sw.cfg" from the file system in the switch:

```
awplus> enable
awplus# copy eng_sw.cfg zmodem
```

This message is displayed:

```
Waiting to send ...
```

Use your Zmodem utility to transfer the file to your terminal or computer. The upload method must be Zmodem.

COPY FLASH TFTP

Syntax

```
copy flash tftp ipaddress filename
```

Parameters

ipaddress
Specifies the IP address of a TFTP server on your network.

filename
Specifies the filename of a configuration file to upload from the file system in the switch to a TFTP server. The filename cannot contain spaces and must include the extension ".cfg". You can specify one filename.

Mode

Privileged Exec mode

Description

Use this command to upload configuration files from the file system in the switch to a TFTP server on your network. You can perform the command from a local management session or a remote Telnet or SSH management session. For instructions on how to use this command, refer to "Uploading Files from the Switch with TFTP" on page 611.

Example

This example uploads the configuration file "west_unit.cfg" from the file system in the switch to a TFTP server that has the IP address 149.22.121.45:

```
awplus> enable
awplus# copy flash tftp 149.22.121.45 west_unit.cfg
```

COPY TFTP FLASH

Syntax

`copy tftp flash` *`ipaddress filename`*

Parameters

ipaddress
Specifies the IP address of a TFTP server on your network.

filename
Specifies the filename of the file on the TFTP server to download to the switch. The file can be a new version of the management software, a boot configuration file or a CA certificate. The filename extensions are ".img" for management software, ".cfg" for boot configuration files, and ".pem" for CA certificates. The filename cannot contain spaces. You can specify one filename.

Mode

Privileged Exec mode

Description

Use this command to download new versions of the management software, boot configuration files, or CA certificates to the switch, from a TFTP server on your network. You may perform the command from a local management session or a remote Telnet or SSH management session. For instructions on how to use this command, refer to the following procedures:

- "Downloading New Management Software with TFTP" on page 609
- "Downloading Files to the Switch with TFTP" on page 610

Caution
Downloading new management software causes the switch to reset. The switch does not forward network traffic while it writes the new software to flash memory and initializes the software. Do not interrupt the process by resetting or power cycling the switch. Some network traffic may be lost.

Examples

This example downloads the new management software file "atFS970M_app.img" to the switch from a TFTP server that has the IP address 149.22.121.45:

```
awplus> enable
awplus# copy tftp flash 149.22.121.45 atFS970M_app.img
```

This example downloads the boot configuration file "sw12a.cfg" to the switch from a TFTP server with the IP address 112.141.72.11:

```
awplus> enable
awplus# copy tftp flash 112.141.72.11 sw12a.cfg
```

COPY ZMODEM

Syntax

```
copy zmodem
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command together with a Zmodem utility to download boot configuration files or CA certificates to the file system in the switch. This command must be performed from a local management session. For instructions on how to use this command, refer to “Downloading Files to the Switch with Zmodem” on page 613.

Note
You may not use Zmodem to download new versions of the management software to the switch. For that, you must use TFTP.

Examples

```
awplus> enable
awplus# copy zmodem
```

The source file is not specified when downloading files with Zmodem. After you enter the command, the management software displays this message:

```
Waiting to receive.
```

Start the transfer by selecting the file with the Zmodem utility on your terminal or computer.

UPLOAD IMAGE REMOTELIST

Syntax

```
upload image remotelist
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to download the management software on the command switch to other switches in an enhanced stack. For background information on enhanced stacking, refer to Chapter 23, "Enhanced Stacking" on page 437. For instructions on how to use this command, refer to "Uploading the Management Software from the Command Switch to Member Switches" on page 457.

Caution

Downloading new management software causes the switch to reset. The switch does not forward network traffic while it writes the new software to flash memory and initializes the software. Do not interrupt the process by resetting or power cycling the switch. Some network traffic may be lost.

Example

The following example downloads the management software of the command switch to other switches:

```
upload image remotelist
```

Section IV

Snooping

This section contains the following chapters:

Chapter 42

Internet Group Management Protocol (IGMP) Snooping

This chapter discusses the following topics:

Overview

IGMP snooping allows the switch to control the flow of multicast packets from its ports. It enables the switch to forward packets of multicast groups to only ports that have host nodes that want to join the multicast groups.

IGMP is used by IPv4 routers to create lists of nodes that are members of multicast groups. (A multicast group is a group of end nodes that want to receive multicast packets from a multicast application.) The router creates a multicast membership list by periodically sending out queries to the local area networks connected to its ports.

A node that wants to become a member of a multicast group responds to a query by sending a report. A report indicates that an end node wants to become a member of a multicast group. Nodes that join a multicast group are referred to as host nodes. After joining a multicast group, a host node must continue to periodically issue reports to remain a member.

After the router has received a report from a host node, it notes the multicast group that the host node wants to join and the port on the router where the node is located. Any multicast packets belonging to that multicast group are then forwarded by the router out the port. If a particular port on the router has no nodes that want to be members of multicast groups, the router does not send multicast packets out the port. This improves network performance by restricting the multicast packets only to router ports where host nodes are located.

There are three versions of IGMP— versions 1, 2, and 3. One of the differences between the versions is how a host node signals that it no longer wants to be a member of a multicast group. In version 1, it stops sending reports. If a router does not receive a report from a host node after a predefined length of time, referred to as a *time-out value*, it assumes that the host node no longer wants to receive multicast frames and removes it from the membership list of the multicast group.

In version 2, a host node exits from a multicast group by sending a *leave request*. After receiving a leave request from a host node, the router removes the node from the appropriate membership list. The router also stops sending multicast packets out the port to which the node is connected if it determines there are no further host nodes on the port.

Version 3 adds the ability to register multiple groups using a group list within a single packet.

The IGMP snooping feature on the switch supports all three versions of IGMP. The switch monitors the flow of queries from routers, and reports leave messages from host nodes to build its own multicast membership lists. It uses the lists to forward multicast packets only to switch ports where there are host nodes that are members of multicast groups. This

improves switch performance and network security by restricting the flow of multicast packets to only those switch ports that are connected to host nodes.

If the switch is not using IGMP snooping and receives multicast packets, it floods the packets out all its ports, except the port on which it received the packets. Such flooding of packets can negatively impact network performance.

The switch maintains its list of multicast groups through an adjustable timeout value, which controls how frequently it expects to see reports from end nodes that want to remain members of multicast groups, and by processing leave requests.

Note
The default setting for IGMP snooping on the switch is enabled.

Understanding Multicast Traffic Settings

By default, IGMP snooping is disabled on the switch. As a result, this setting can impact multicast settings on a port. When you block egress or ingress multicast packets on a port and the switch is set to IGMP snooping disabled, the result is that *all* reports are suppressed on the specified ports except for reserved multicast addresses.

When you enable IGMP Snooping by executing the IP IGMP SNOOPING command, *all* unknown multicast traffic is unsuppressed and floods the switch ports except for IPv4 reserved addresses 224.0.0.1 through 224.0.0.255. To enable the suppression of unknown multicast traffic, see "Enabling the Suppression of Unknown Multicast Traffic".

For information about how to block egress and ingress multicast packets, see "SWITCHPORT BLOCK EGRESS-MULTICAST" on page 568 and "SWITCHPORT BLOCK INGRESS-MULTICAST" on page 569.

Enabling the Suppression of Unknown Multicast Traffic

IGMP snooping does not suppress all unknown multicast traffic except for IPv4 reserved addresses in the range of 224.0.0.1 to 224.0.0.255 by default. To suppress the flooding, use the NO IP IGMP SNOOPING FLOOD-UNKNOWN-MCAST command. When you execute this command, all unknown multicast traffic is suppressed prior to a join message. Once a join message is accepted for the specified multicast destination, it is no longer considered an unknown destination and, therefore, no longer floods. For more information about this command, see "IP IGMP SNOOPING FLOOD-UNKNOWN-MCAST" on page 644.

Host Node Topology

The switch has a host node topology setting. You use this setting to define whether there is more than one host node on each port on the switch. The switch refers to the topology to determine whether or not to continue transmitting multicast packets from ports that receive leave requests or where host nodes time out due to inactivity. The possible topology settings are:

- Single-host per port
- Multiple-hosts per port

Single-host Per Port

This is the appropriate setting when there is only one host node connected to each port on the switch. When this topology setting is enabled, the switch immediately stops sending multicast packets from ports on which host nodes have sent leave requests or have timed out. The switch responds by immediately ceasing the transmission of additional multicast packets out the ports.

Multiple-hosts Per Port

The multiple-hosts per port setting is appropriate when the ports are connected to more than one host node, such as when ports are connected to other Ethernet switches where there are multiple host nodes. With this setting selected, the switch continues sending multicast packets out a port even after it receives a leave request from a host node. This ensures that the remaining active host nodes on a port continue to receive the multicast packets. Only after all the host nodes connected to a switch port have transmitted leave requests, or have timed out, does the switch stop sending multicast packets out a port.

If the switch has a mixture of host nodes, that is, some connected directly to the switch and others through other Ethernet switches or hubs, you should select the multiple-hosts per port setting.

Enabling IGMP Snooping

The command to enable IGMP Snooping on the switch is the IP IGMP SNOOPING command in the Global Configuration mode. After you enter the command, the switch begins to build its multicast table as queries from the multicast router and reports from the host nodes arrive on its ports. To enable IGMP Snooping:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip igmp snooping
```

Configuring the IGMP Snooping Commands

This table lists the IGMP Snooping commands with the exception of the enable, disable, and display commands which are described in other sections of this chapter.

Table 60. IGMP Snooping Commands

To	Use This Command	Range
Clear all IGMP group membership records.	CLEAR IP IGMP	none
Specify the maximum number of multicast groups the switch will support.	IP IGMP LIMIT *multicastgroups*	0 to 255 multicast addresses
Specify the time period, in seconds, used by the switch to identify inactive host nodes and multicast routers.	IP IGMP QUERIER-TIMEOUT *timeout*	1 to 65535 seconds (default 255)
Disable the suppression of unknown multicast traffic.	IP IGMP SNOOPING FLOOD-UNKNOWN-MCAST	none
Specify ports that are connected to multicast routers.	IP IGMP SNOOPING MROUTER INTERFACE *port*	none
Specify the IGMP host node topology.	IP IGMP STATUS SINGLE|MULTIPLE	none
Remove static multicast router ports and reactivate auto-detection of router ports.	NO IP IGMP SNOOPING MROUTER INTERFACE *port*	none

Most of the commands are found in the Global Configuration mode. The following examples illustrate the commands. The first example clears all IGMP group membership records on all VLANs:

```
awplus> enable
awplus(config)# clear ip igmp
```

For more information about this command, see “CLEAR IP IGMP” on page 640.

This example limits the switch to two multicast groups and specifies that there is only one host node per port:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip igmp limit 2
awplus(config)# ip igmp status single
```

For more information about these commands, see "IP IGMP LIMIT" on page 641 and "IP IGMP STATUS" on page 647.

This example configures the switch to time out inactive host nodes after 50 seconds and designates port 4 as a multicast router port:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip igmp querier-timeout 50
awplus(config)# ip igmp snooping mrouter interface port1.0.4
```

For more information about these commands, see "IP IGMP QUERIER-TIMEOUT" on page 642 and "IP IGMP SNOOPING MROUTER" on page 646.

This example disables the suppression of unknown multicast traffic:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip igmp snooping
awplus(config)# ip igmp snooping flood-unknown-mcast
```

For more information about this command, see "IP IGMP SNOOPING FLOOD-UNKNOWN-MCAST" on page 644.

This example reactivates the auto-detection of multicast router ports by removing the static router port 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip igmp snooping mrouter interface
port1.0.4
```

For more information about this command, see "NO IP IGMP SNOOPING MROUTER" on page 649.

Disabling IGMP Snooping

The command to disable IGMP Snooping on the switch is the NO IP IGMP SNOOPING command in the Global Configuration mode. To disable IGMP Snooping:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip igmp snooping
```

When IGMP Snooping is disabled, the switch floods the multicast packets on all ports, except on ports that receive the packets.

Displaying IGMP Snooping

To display the settings of IGMP Snooping and its status, use the SHOW IP IGMP SNOOPING command in the User Exec mode or Privileged Exec mode:

```
awplus# show ip igmp snooping
```

Here is an example of the information the command displays:

```
IGMP Snooping Configuration:
  IGMP Snooping Status ............... Enabled
  Host Topology ...................... Single-Host/Port
  Host/Router Timeout Interval ....... 255 seconds
  Maximum IGMP Multicast Groups ...... 64
  Router Port(s) ..................... Auto Detect

Router List:
VLAN ID     Port/Trunk ID  RouterIP          Exp. Time
-------------------------------------------------
1           port1.0.31     10.0.0.254        110

Host List:
Number of IGMP Multicast Groups: 2

MulticastGroup  VLAN ID  Port/TrunkID HostIP        IGMP Ver Exp.Time
-------------------------------------------------------------
0100.5e7f.ffff  1        port1.0.1    192.169.20.50  v3      200
0100.5e7f.ffff  1        port1.0.30   172.16.20.222  v2      45
0100.5e64.3201  1        port1.0.15   10.10.5.01     v1      161
```

Figure 124. SHOW IP IGMP SNOOPING

The information in the window is described in Table 62 on page 651.

Chapter 43

IGMP Snooping Commands

The IGMP snooping commands are summarized in Table 61 and are described in detail within the chapter.

Table 61. Internet Group Management Protocol Snooping Commands

Command	Mode	Description
“CLEAR IP IGMP” on page 640	Privileged Exec	Clears all IGMP group membership records.
“IP IGMP LIMIT” on page 641	Global Configuration	Specifies the maximum number of multicast addresses the switch is allowed to learn.
“IP IGMP QUERIER-TIMEOUT” on page 642	Global Configuration	Specifies the time period in seconds used by the switch to identify inactive host nodes and multicast routers.
“IP IGMP SNOOPING” on page 643	Global Configuration	Enables IGMP snooping on the switch.
“IP IGMP SNOOPING FLOOD-UNKNOWN-MCAST” on page 644	Global Configuration	Disables the automatic suppression of unknown multicast traffic.
“IP IGMP SNOOPING MROUTER” on page 646	Global Configuration	Manually identifies the ports where multicast routers are connected.
“IP IGMP STATUS” on page 647	Global Configuration	Specifies the IGMP host node topology, of either single-host per port or multiple-host per port.
“NO IP IGMP SNOOPING” on page 648	Global Configuration	Disables IGMP snooping on the switch.
“NO IP IGMP SNOOPING MROUTER” on page 649	Global Configuration	Removes multicast router ports.
“SHOW IP IGMP SNOOPING” on page 650	Privileged Exec	Displays the parameter settings and operational details of IGMP snooping.

CLEAR IP IGMP

Syntax

```
clear ip igmp
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to clear all IGMP group membership records on all VLANs.

Example

This example clears all IGMP group membership records on all VLANs:

```
awplus> enable
awplus# clear ip igmp
```

IP IGMP LIMIT

Syntax

```
ip igmp limit multicastgroups
```

Parameter

multicastgroups
: Specifies the maximum number of multicast addresses the switch is allowed to learn. The range is 0 to 255 multicast addresses; the default is 64 addresses.

Mode

Global Configuration mode

Description

Use this command to specify the maximum number of multicast addresses the switch can learn. If your network has a large number of multicast groups, you can use this parameter to limit the number of multicast groups the switch supports.

Confirmation Command

"SHOW IP IGMP SNOOPING" on page 650

Example

This example sets the maximum number of multicast groups on the switch to 25:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip igmp limit 25
```

IP IGMP QUERIER-TIMEOUT

Syntax

```
ip igmp querier-timeout timeout
```

Parameters

timeout

Specifies the time period in seconds used by the switch to identify inactive host nodes and multicast routers. The range is from 0 to 65535 seconds. The default is 255 seconds. Setting the timeout to zero (0) disables the timer.

Mode

Global Configuration mode

Description

Use this command to specify the time period the switch uses to identify inactive host nodes and multicast routers. The time period is in seconds.

A host node is deemed inactive if the switch does not receive any IGMP reports from it for the duration of the timer. The switch stops transmitting multicast packets from a port of an inactive host node if there are no additional host nodes.

A multicast router is deemed inactive if the switch does not receive any queries from it for the duration of the timer.

The actual timeout may be 10 seconds less that the specified value. For example, a setting of 25 seconds can result in the switch classifying a host node or multicast router as inactive after only 15 seconds. A setting of 10 seconds or less can result in the immediate timeout of inactive host nodes or routers.

Confirmation Command

“SHOW IP IGMP SNOOPING” on page 650

Example

This example sets the timeout for inactive host nodes and multicast routers to 400 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip igmp querier-timeout 400
```

IP IGMP SNOOPING

Syntax

```
ip igmp snooping
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate IGMP snooping on the switch.

Caution
The IP IGMP SNOOPING FLOOD-UNKNOWN-MCAST command is enabled by default when IGMP Snooping is activated. This may cause a slow-down of network data. If you want to disable flooding of unknown multicast packets, you must enter the NO IP IGMP SNOOPING FLOOD-UNKNOWN-MCAST command.

Confirmation Command

"SHOW IP IGMP SNOOPING" on page 650

Example

This example enables IGMP Snooping on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip igmp snooping
```

IP IGMP SNOOPING FLOOD-UNKNOWN-MCAST

Syntax

```
ip igmp snooping flood-unknown-mcast
```

Parameter

None

Mode

Global Configuration mode

Description

This command disables the automatic suppression of unknown multicast traffic on the switch. By default, IGMP Snooping does not suppress all unknown multicast traffic except for IPv4 reserved addresses 224.0.0.1 through 224.0.0.255. When you enable the IP IGMP SNOOPING FLOOD-UNKNOWN-MCAST command, all unknown multicast traffic is flooded before a join message. Once a join message occurs for a particular multicast destination, it is no longer “unknown” and, therefore, no longer floods.

Use the no version of this command, NO IP IGMP SNOOPING FLOOD-UNKNOWN-MCAST, to enable the automatic suppression of unknown multicast traffic on the switch.

Caution
The IP IGMP SNOOPING FLOOD-UNKNOWN-MCAST command is enabled by default when IGMP Snooping is activated. This may cause a slow-down of network data. If you want to disable flooding of unknown multicast packets, you must enter the NO IP IGMP SNOOPING FLOOD-UNKNOWN-MCAST command.

Confirmation Command

“SHOW IP IGMP SNOOPING” on page 650

Examples

This example disables the automatic suppression of unknown multicast traffic on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip igmp snooping
awplus(config)# ip igmp snooping flood-unknown-mcast
```

This example enables the automatic suppression of unknown multicast traffic on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip igmp snooping flood-unknown-mcast
```

IP IGMP SNOOPING MROUTER

Syntax

```
ip igmp snooping mrouter interface port
```

Parameter

port

Specifies a port connected to a multicast router. You can specify more than one port.

Mode

Global Configuration mode

Description

Use this command to manually specify ports that are connected to multicast routers. Manually specifying multicast router ports deactivates auto-detect. To reactivate auto-detect, remove all static multicast router ports. For instructions, refer to “NO IP IGMP SNOOPING MROUTER” on page 649.

Confirmation Command

“SHOW IP IGMP SNOOPING” on page 650

Example

This example identifies ports 14 and 15 as multicast router ports:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip igmp snooping mrouter interface
port1.0.14,port1.0.15
```

IP IGMP STATUS

Syntax

```
ip igmp status single | multiple
```

Parameters

single
: Activates the single-host per port setting, which is used when the ports on the switch have only one host node each.

multiple
: Activates the multiple-host per port setting, which is used when the ports have more than one host node.

Mode

Global Configuration mode

Description

Use this command to specify the IGMP host node topology. For background information, refer to "Host Node Topology" on page 632.

Confirmation Command

"SHOW IP IGMP SNOOPING" on page 650

Examples

This example sets the host node topology to the single-host per port setting:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip igmp status single
```

This example sets the host node topology to the multiple-host per port setting:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip igmp status multiple
```

NO IP IGMP SNOOPING

Syntax

```
no ip igmp snooping
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to deactivate IGMP snooping on the switch.

When IGMP snooping is disabled, the switch floods multicast packets on all ports, except on ports that receive the packets.

Confirmation Command

“SHOW IP IGMP SNOOPING” on page 650

Example

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip igmp snooping
```

NO IP IGMP SNOOPING MROUTER

Syntax

```
no ip igmp snooping mrouter interface port
```

Parameter

port
Specifies a multicast router port.

Mode

Global Configuration mode

Description

Use this command to remove static multicast router ports. Removing all multicast router ports activates auto-detect.

Confirmation Command

"SHOW IP IGMP SNOOPING" on page 650

Examples

This example removes port 3 as multicast router ports:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip igmp snooping mrouter interface
port1.0.3
```

SHOW IP IGMP SNOOPING

Syntax

```
show ip igmp snooping
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the IGMP snooping parameters. Figure 125 illustrates the information.

```
IGMP Snooping Configuration:
  IGMP Snooping Status ............... Enabled
  Host Topology ...................... Single-Host/Port
  Host/Router Timeout Interval ....... 255 seconds
  Maximum IGMP Multicast Groups ...... 64
  Router Port(s) ..................... Auto Detect

Router List:
VLAN ID     Port/Trunk ID  RouterIP          Exp. Time
-------------------------------------------------
1           port1.0.31     10.0.0.254        110

Host List:
Number of IGMP Multicast Groups: 2

MulticastGroup  VLAN ID Port/TrunkID HostIP        IGMP Ver Exp.Time
-------------------------------------------------------------
0100.5e7f.ffff  1       port1.0.1    192.169.20.50  v3      200
0100.5e7f.ffff  1       port1.0.30   172.16.20.222  v2      45
0100.5e64.3201  1       port1.0.15   10.10.5.01     v1      161
```

Figure 125. SHOW IP IGMP SNOOPING Command

The information the command displays is explained in Table 62.

Table 62. SHOW IP IGMP SNOOPING Command

Parameter	Description
IGMP Snooping Configuration	
IGMP Snooping Status	The status of IGMP snooping on the switch. To enable or disable the feature, refer to "IP IGMP SNOOPING" on page 643 and "NO IP IGMP SNOOPING" on page 648, respectively.
Host Topology	The IGMP host node topology on the switch. The possible topologies are: singlehost— This is the single-host per port topology. This topology is appropriate when there is only one host node per port on the switch. This is the default setting. multihost— This is the multiple-host per port topology. This topology is appropriate when there is more than one host node per port on the switch. To set this parameter, refer to "IP IGMP STATUS" on page 647.
Host/Router Timeout Interval	The amount of time the switch uses to time out inactive host nodes and multicast routers. To set this parameter, refer to "IP IGMP QUERIER-TIMEOUT" on page 642.
Maximum IGMP Multicast Groups	The maximum number of multicast groups the switch supports. To set this parameter, refer to "IP IGMP LIMIT" on page 641.
Router Port(s)	The ports connected to multicast routers. The switch can learn the router ports automatically or you can assign them manually. To assign the ports manually, refer to "IP IGMP SNOOPING MROUTER" on page 646.
Router List	
VLAN ID	The ID numbers of the VLANs of the router ports.

Table 62. SHOW IP IGMP SNOOPING Command (Continued)

Parameter	Description
Port/Trunk ID	The port of a multicast router. If the switch learned a router on a port trunk, the trunk ID number, instead of a port number, is displayed.
Router IP	The IP addresses of the multicast routers.
Exp. Time	The number of seconds remaining before the switch times out a multicast router if there are no further IGMP queries from it.
Host List	
Number of IGMP Multicast Groups	The number of IGMP multicast groups that have active host nodes on the switch.
Multicast Group	The multicast addresses of the groups.
ID	The ID numbers of the VLANs of the host nodes.
Port/Trunk ID	The ports of the host nodes. If the host nodes are on port trunks, this field displays the trunk ID numbers instead of the port numbers.
HostIP	The IP addresses of the host nodes.
IGMP Ver.	The IGMP versions used by the host nodes.
Exp. Time	The number of seconds remaining before host nodes are timed out if they do not send IGMP reports.

Example

The following example displays the IGMP snooping parameters:

```
awplus# show ip igmp snooping
```

Chapter 44

IGMP Snooping Querier

This chapter covers the following topics:

Overview

Multicast routers are an essential part of IP multicasting. They send out queries to the network nodes to determine group memberships, route the multicast packets across networks, and maintain lists of the multicast groups and the ports where group members are located.

IGMP snooping querier can be used in place of multicast routers in situations where IP multicasting is restricted to a single LAN, without the need for routing. This feature enables the switch to mimic a multicast router by sending out general IGMP queries to the host nodes.

IGMP snooping querier supports IGMP version 2.

The switch must have an IP address to add to the queries as its source address. In addition, the address must be a member of the same network as the host nodes and the multicasting source. You assign an IP address to the switch by creating a routing interface in the VLAN. Then apply the IP address to the VLAN where it sends its queries, to enable IGMP snooping querier on the VLAN. Allied Telesis recommends using the Default VLAN which has a VID of 1.

IGMP snooping querier must be used in conjunction with IGMP snooping. Activate IGMP snooping on all of the switches in the LAN, including the switches running the IGMP snooping querier. The switches use IGMP snooping to monitor the responses of the host nodes to the general IGMP queries sent by the IGMP snooping querier. From the responses, they create lists of ports that have host nodes that want to join the various multicast groups and forward the multicast packets to only those ports. For background information, refer to Chapter 42, “Internet Group Management Protocol (IGMP) Snooping” on page 629.

Figure 126 on page 655 provides an example of IGMP snooping querier on a LAN. It consists of a single switch with one VLAN, the Default VLAN. Both IGMP snooping and IGMP snooping querier are enabled on the switch. You assign a routing interface to the VLAN, with an IP address that belongs to the same subnet as the multicast source and the host nodes.

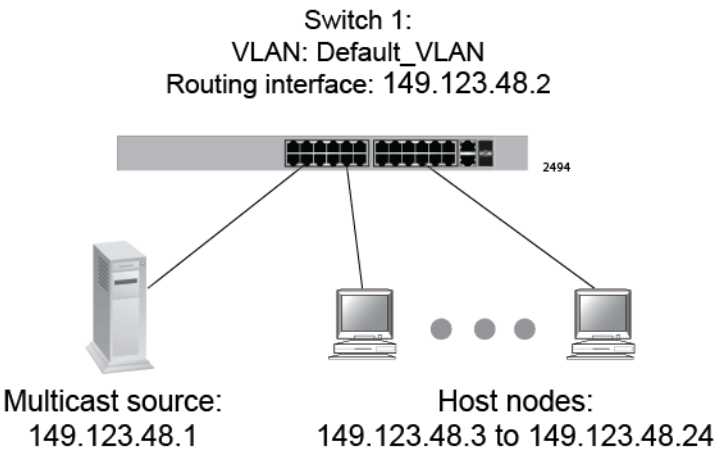

Figure 126. IGMP Snooping Querier with One Querier

Table 63 lists the switch settings that are illustrated in Figure 126.

Table 63. IGMP Snooping Querier with One Querier

Switch	Routing Address	IGMP Snooping	IGMP Snooping Querier	Querier Status
1	149.123.48.2	Enabled	Enabled	Active

Assigning Multiple Queriers

IGMP snooping querier supports multiple queriers. A total of three queriers are supported, one active querier and up to two standby queriers. The active querier is the querier with the lowest IP address. The standby querier has the second lowest IP address, and the switch with the highest IP address is the second standby querier.

The difference between the active and standby queriers is that only the active querier registers IGMP reports. A standby querier does not update its MAC tables, so IGMP reports are not registered on the switch.

When you assign multiple queriers to a LAN, the software must decide which is the active querier and which is the standby querier. This task falls to a switch in the network that has IGMP snooping enabled, but IGMP snooping querier disabled. Consequently, a LAN with multiple queriers requires this extra switch.

For example, to assign two queriers to a network, you need three switches. First, enable IGMP snooping on all three switches. Then enable IGMP snooping querier on two switches, for this example, switches 1 and 3. Switch 2 determines which of the querier-enabled switches has the lowest IP address and deems that switch the active querier. The switch with the second lowest IP address is made the standby querier, again by switch 2. In the case where there are three queriers, the switch in the

network with IGMP snooping enabled and IGMP querier disabled determines the standby querier and then the second standby querier by comparing their IP addresses.

The following example consists of a LAN with three switches. See Figure 127. IGMP snooping is enabled on all three switches. However, IGMP snooping querier is enabled on switches 1 and 3. Switch 2 determines that switch 1 has the lowest IP routing address and forwards all multicast packets to switch 1, making switch 1 the active querier. Switch 3 becomes the standby querier in case switch 1 stops transmitting query packets.

Note
Switches 1 and 3 are only sending queriers. Neither switch detects nor displays an opposing querier.

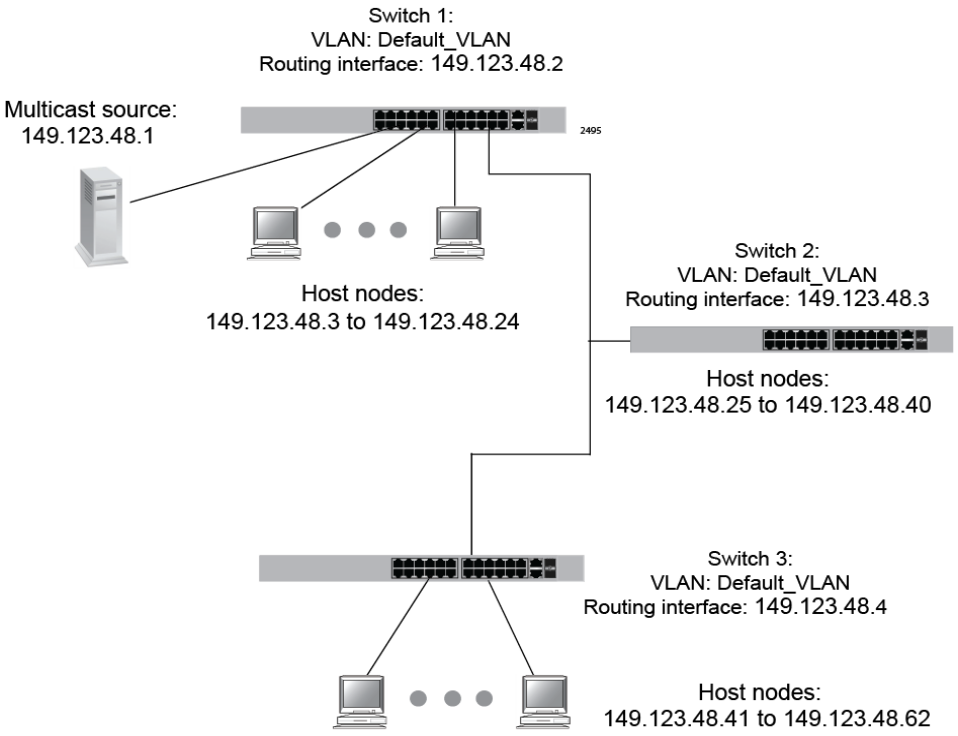

Figure 127. IGMP Snooping Querier with Two Queriers

Table 64 lists the switch settings that are illustrated in Figure 127.

Table 64. IGMP Snooping Querier with Two Queriers

Switch	Routing Address	IGMP Snooping	IGMP Snooping Querier	Querier Status
1	149.123.48.2	Enabled	Enabled	Active

Table 64. IGMP Snooping Querier with Two Queriers (Continued)

Switch	Routing Address	IGMP Snooping	IGMP Snooping Querier	Querier Status
2	149.123.48.3	Enabled	Disabled	None
3	149.123.48.4	Enabled	Enabled	Standby

Guidelines

The guidelines for IGMP snooping querier are listed here:

- The network can have only one LAN.
- The network can have up to three multicast routers.
- You must enable IGMP snooping on all of the switches that you assign a querier, plus one extra switch that has IGMP snooping querier disabled.
- You must enable IGMP snooping querier on all of the switches that you assign a querier.
- Apply IGMP snooping querier to the VLAN on which the queries are to be sent.
- The VLAN must be assigned a routing interface with an IP address that is a member of the same network as the host nodes and the source node of the multicast packets. The switch adds the IP address to the queries as its source address.
- IGMP snooping querier supports up to three queriers. The active querier has the lowest IP address.
- To assign multiple queriers to a LAN, you need one switch in the network that has IGMP snooping enabled and IGMP snooping querier disabled. This switch assigns the active querier by determining which of the IGMP snooping querier enabled switches has the lowest IP address.
- If you want to add or remove ports from the VLAN after activating IGMP snooping querier, you must disable IGMP snooping querier, modify the VLAN, and then enable it again.
- The switch supports IGMP versions 1, 2, and 3. The switch typically sends only version 2 messages. If the switch receives a version 1 message, it sends version 1 messages on all of the ports. If the switch does not receive any additional version 1 or version 3 messages for 255 seconds, the switch reverts to sending version 2 messages.
- If the switch receives a query either from a multicast router or from another switch with IGMP snooping querier, it suspends IGMP snooping querier and sends no further queries for 125 seconds. If the switch does not receive any further queries, it reactivates the feature and resumes sending queries.
- IGMP snooping querier is supported on the base ports and SFP modules.

Configuring the Feature

This section lists the IGMP snooping querier commands and describes how to configure one querier as well as multiple queriers. See the following procedures:

- "Configuring One Querier" on page 659
- "Configuring Multiple Queriers" on page 660

Table 65 lists the IGMP snooping querier commands.

Table 65. IGMP Snooping Querier Commands

To	Use This Command	Range
Activate IGMP snooping querier	IP IGMP SNOOPING QUERIER	none
Deactivate IGMP snooping querier	NO IP IGMP SNOOPING QUERIER	none
Set the interval at which IGMP general query messages are transmitted.	IP IGMP QUERY-INTERVAL *interval*	2 to 18000 seconds
Display the status of IGMP snooping querier.	SHOW IP IGMP INTERFACE *vlanid*	none

Configuring One Querier

This example configures switch 1 as shown in Figure 126 on page 655, with an additional step for changing the query interval.

Table 66. Configuring One Querier

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# ip igmp snooping`	Activate IGMP snooping on the switch. (The default setting for IGMP snooping is disabled.)
`awplus(config)# interface vlan1`	Enter the VLAN Interface mode for the Default VLAN.
`awplus(config-if)# ip address 149.123.48.2/24`	Assign the VLAN the IP address 149.123.48.2/24.
`awplus(config-if)# ip igmp snooping querier`	Activate IGMP snooping querier on the VLAN.

Table 66. Configuring One Querier (Continued)

Command	Description
`awplus(config-if)# ip igmp query-interval 500`	Set the interval at which IGMP general query messages are transmitted to 500 seconds.
`awplus(config-if)# end`	Return to the Privileged Exec mode.
`awplus# show ip interface`	Verify the IP address with the SHOW IP INTERFACE command. The columns are defined in “SHOW IP INTERFACE” on page 327.
`awplus# show ip igmp interface vlan1`	Use the SHOW IP IGMP STATISTICS INTERFACE command to verify that IGMP snooping and IGMP snooping querier are active. The fields are defined in Table 69 on page 667.

Configuring Multiple Queriers

This example configures two queriers in a LAN that consists of three switches as shown in Figure 127 on page 656.

Table 67. Configuring Multiple Queriers

Command	Description
Logon to switch 1.	
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode of switch 1.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# ip igmp snooping`	Activate IGMP snooping on the switch. (The default setting for IGMP snooping is disabled.)
`awplus(config)# interface vlan1`	Enter the VLAN Interface mode for the Default VLAN.
`awplus(config-if)# ip address 149.123.48.2/24`	Assign the VLAN the IP address 149.123.48.2/24.
`awplus(config-if)# ip igmp snooping querier`	Activate IGMP snooping querier on the VLAN.
`awplus(config-if)# exit`	Exit the Global Configuration mode.
`awplus(config)# exit`	Exit the User Executive mode.
`awplus# exit`	Exit the Privileged Executive mode and log out of switch 1.

Table 67. Configuring Multiple Queriers (Continued)

Command	Description
Log on to switch 2.	
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode of switch 2.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# ip igmp snooping`	Activate IGMP snooping on the switch.
`awplus(config)# interface vlan1`	Enter the VLAN Interface mode for the Default VLAN.
`awplus(config-if)# ip address 149.123.48.3/24`	Assign the VLAN the IP address 149.123.48.3/24.
`awplus(config-if)# exit`	Exit the Global Configuration mode.
`awplus(config)# exit`	Exit the User Executive mode.
`awplus# exit`	Exit the Privileged Executive mode and log out of switch 2.
Log on to switch 3	
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode of switch 3.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# ip igmp snooping`	Activate IGMP snooping on the switch.
`awplus(config)# interface vlan1`	Enter the VLAN Interface mode for the Default VLAN.
`awplus(config-if)# ip address 149.123.48.4/24`	Assign the VLAN the IP address 149.123.48.3/4.
`awplus(config-if)# ip igmp snooping querier`	Activate IGMP snooping querier on the VLAN.

Chapter 45

IGMP Snooping Querier Commands

The IGMP snooping querier commands are summarized in Table 68.

Table 68. IGMP Snooping Querier Commands

Command	Mode	Description
“IP IGMP QUERY-INTERVAL” on page 664	VLAN Interface	Sets the time interval at which the VLANs send out IGMP General Query messages.
“IP IGMP SNOOPING QUERIER” on page 665	VLAN Interface	Activates IGMP snooping querier on the VLANs.
“NO IP IGMP SNOOPING QUERIER” on page 666	VLAN Interface	Deactivates IGMP snooping querier on the VLANs.
“SHOW IP IGMP INTERFACE” on page 667	Privileged Exec	Displays the status of IGMP snooping querier in the VLANs.

IP IGMP QUERY-INTERVAL

Syntax

```
ip igmp query-interval interval
```

Parameter

interval

Specifies the time interval, in seconds, at which the switch transmits IGMP General Query messages from the VLANs. The range is 2 to 18,000 seconds. The default is 125 seconds.

Mode

VLAN Interface mode

Description

Use this command to set the time interval at which the VLAN sends out IGMP general query messages.

Use the NO form of this command to return the parameter to the default setting of 125 seconds.

Confirmation Command

“SHOW IP IGMP INTERFACE” on page 667

Examples

This example sets the query interval timer to 400 seconds on the Default VLAN:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip igmp query-interval 400
```

This example returns the query interval timer on an VLAN with an ID of 2 to the default value of 125 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip igmp query-interval
```

IP IGMP SNOOPING QUERIER

Syntax

```
ip igmp snooping querier
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to activate an IGMP snooping querier on an VLAN. Here are the guidelines:

- IGMP snooping must be enabled on the switch.
- The VLAN must already exist.
- The VLAN must have a routing interface.
- The IP address of the interface must be a member of the same subnet as the multicast source.

Note
You can create up to three queriers in your network. The querier with the lowest IP address is the active querier. The querier with the next lowest IP address is the standby querier. The querier with the highest IP address is the second standby querier.

Confirmation Command

"SHOW IP IGMP INTERFACE" on page 667

Example

This example activates IGMP snooping querier on the Default VLAN, which has an ID of 1:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip igmp snooping querier
```

NO IP IGMP SNOOPING QUERIER

Syntax

```
no ip igmp snooping querier
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to deactivate an IGMP snooping querier on the VLANs.

Confirmation Command

“SHOW IP IGMP INTERFACE” on page 667

Example

This example deactivates an IGMP snooping querier on the VLAN with an ID of 18:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan18
awplus(config-if)# no ip igmp snooping querier
```

SHOW IP IGMP INTERFACE

Syntax

```
show ip igmp interface vlanid
```

Parameters

vlanid

Specifies a VLAN ID, for example, "vlan3." You may specify only one VLAN.

Mode

Privileged Exec mode

Description

Use this command to display the status of IGMP snooping querier on the VLANs. Here is an example of the display:

```
Interface vlan1 (Index 0)
IGMP Enabled, Active, Version 2
IGMP query interval is 125 seconds
IGMP Snooping is globally enabled
IGMP Snooping querier is enabled
```

Figure 128. SHOW IP IGMP INTERFACE Command

Note
This command does not display information about multiple queriers.

The fields are defined in Table 69.

Table 69. SHOW IP IGMP INTERFACE Command

Field	Definition
Interface	The ID number of the selected VLAN.
IGMP	The status of the IGMP agent. The agent is automatically enabled when IGMP snooping querier is activated.
IGMP query interval	The time interval in seconds at which IGMP General Query messages are transmitted.

Table 69. SHOW IP IGMP INTERFACE Command (Continued)

Field	Definition
IGMP Snooping	The status of IGMP snooping on the switch. The commands for enabling and disabling this feature are “IP IGMP SNOOPING” on page 643 and “NO IP IGMP SNOOPING” on page 648.
IGMP snooping querier	The status of IGMP snooping querier in the VLAN. The commands for enabling and disabling the feature are “IP IGMP SNOOPING QUERIER” on page 665 and “NO IP IGMP SNOOPING QUERIER” on page 666, respectively.

Example

This example displays the status of IGMP snooping querier on the Default VLAN, which has the ID number 1:

```
awplus> enable
awplus# show ip igmp interface vlan1
```

Chapter 46

DHCP Snooping Commands

The DHCP commands are summarized in Table 70 and are described in detail within the chapter.

Table 70. DHCP Commands

Command	Mode	Description
“ARP SECURITY” on page 671	Port Interface mode	Enables ARP security on a port.
“ARP SECURITY VIOLATION” on page 672	Port Interface mode	Sets an action if an ARP security violation occurs.
“CLEAR ARP SECURITY STATISTICS” on page 674	Privileged Exec mode	Clears ARP security violations from the specified ports.
“CLEAR IP DHCP SNOOPING BINDING” on page 675	Privileged Executive mode	Removes dynamic entries from the DHCP snooping binding database.
“CLEAR IP DHCP SNOOPING STATISTICS” on page 677	Privileged Executive mode	Clears DHCP snooping statistics from the specified ports.
“IP DHCP SNOOPING” on page 678	Global Configuration mode	Enables DHCP snooping on VLANs.
“IP DHCP SNOOPING BINDING” on page 679	Privileged Exec mode	Manually adds a dynamic-like entry to the DHCP snooping database.
“IP DHCP SNOOPING DELETE-BY-CLIENT” on page 681	Global Configuration mode	Removes a dynamic entry from the DHCP database when it receives a valid DHCP message.
“IP DHCP SNOOPING DELETE-BY-LINKDOWN” on page 682	Global Configuration mode	Removes a dynamic entry from the DHCP snooping database when its port goes down.
“IP DHCP SNOOPING MAX-BINDINGS” on page 683	Port Interface mode	Sets the maximum number of DHCP lease entries that can be stored in the DHCP snooping database for each port.
“IP DHCP SNOOPING SUBSCRIBER-ID” on page 685	Port Interface mode	Sets a subscriber ID for a port.

Table 70. DHCP Commands (Continued)

Command	Mode	Description
“IP DHCP SNOOPING TRUST” on page 687	Port Interface mode	Sets ports to be DHCP snooping trusted ports.
“IP DHCP VERIFY MAC-ADDRESS” on page 688	Global Configuration mode	Verifies that the source MAC address and client hardware address match in DHCP packets received on untrusted ports.
“IP DHCP SNOOPING VIOLATION” on page 690	Port Interface mode	Specifies the action the switch takes when it detects a DHCP snooping violation.
“IP SOURCE BINDING” on page 692	Global Configuration mode	Adds or replaces a static entry in the DHCP snooping database.
“SERVICE DHCP SNOOPING” on page 694	Global Configuration mode	Enables the DHCP snooping service on the switch globally.
“SHOW ARP SECURITY” on page 696	Privilege Exec mode	Displays security configuration on the switch.
“SHOW ARP SECURITY INTERFACE” on page 698	Privilege Exec mode	Displays ARP security configuration for the ports specified.
“SHOW ARP SECURITY STATISTICS” on page 700	Privilege Exec mode	Displays the ARP security statistics for the specified ports.
“SHOW IP DHCP SNOOPING” on page 702	Privilege Exec mode	Displays the global DHCP snooping configuration on the switch.
“SHOW IP DHCP SNOOPING BINDING” on page 704	Privilege Exec mode	Displays all dynamic and static entries in the DHCP snooping binding database.
“SHOW IP DHCP SNOOPING INTERFACE” on page 706	Privilege Exec mode	Displays DHCP snooping information for a port or a list of ports.
“SHOW IP SOURCE BINDING” on page 708	Privilege Exec mode	Displays static entries in the DHCP snooping database.

ARP SECURITY

Syntax

```
arp security
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to enable ARP security on untrusted ports in VLANs. When the ARP SECURITY command is enabled, the port only responds to and forwards ARP packets with recognized IP and MAC Source addresses.

Use the no version of this command, NO ARP SECURITY command, to disable ARP security on a port.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example enables ARP security on port 9:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.9
awplus(config-if)# arp security
```

ARP SECURITY VIOLATION

Syntax

```
arp security violation link-down|log|trap
```

Parameters

violation

Specifies one of the following actions if an ARP security violation occurs:

link-down: Disables the port.

log: Generates a log message. Use the SHOW LOG command to display these messages. See “NO LOG BUFFERED” on page 727.

trap: Generates an SNMP notification or trap. To make this parameter active, configure SNMP and enable DHCP snooping notifications with the SNMP-SERVER ENABLE TRAP command. See “SNMP-SERVER ENABLE TRAP” on page 1198. Notifications are limited to one per second and to one per source MAC and violation.

Mode

Port Interface mode

Description

Use this command to set the an action if an ARP security violation occurs on a port.

Use the no version of this command, NO ARP SECURITY VIOLATION command, to cancel the ARP security violation action previously configured.

Confirmation Command

“NO LOG BUFFERED” on page 727

“SHOW RUNNING-CONFIG” on page 168

Example

This example generates a log message if port 17 experiences an ARP security violation:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17
awplus(config-if)# arp security
awplus(config-if)# arp security violation log
```

CLEAR ARP SECURITY STATISTICS

Syntax

```
clear arp security statistics interface port-list
```

Parameters

interface
Specifies a port list.

Mode

Privileged Exec mode

Description

Use this command to clear ARP security violations from the specified ports. For information about defining ARP security violations, see “ARP SECURITY VIOLATION” on page 672.

For instructions about how to specify ports, see “Port Numbers in Commands” on page 69.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example clears the ARP security violations on ports 20-24:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.20-port1.0.24
awplus(config-if)# clear arp security statistics
```

CLEAR IP DHCP SNOOPING BINDING

Syntax

```
clear ip dhcp snooping binding ipaddr interface <port-list>
vlan <vid-list>
```

Parameters

ipaddr
: Removes the entry for this client IP address.

interface
: Specifies a port list. Removes all entries for the ports specified. The port list may contain switch ports and static or dynamic link aggregators (channel groups).

vlan
: Removes all entries associated with the specified VLANs.

Mode

Privileged Exec mode

Description

Use this command to remove one or more dynamic entries from the DHCP snooping binding database. If you do not specify any of the parameters, all dynamic entries are removed from the database.

Dynamic entries can also be deleted with the NO IP SOURCE BINDING command. See "IP SOURCE BINDING" on page 692.

For instructions about how to specify ports, see "Port Numbers in Commands" on page 69.

Caution
If you remove entries from the DHCP snooping binding 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.

Confirmation Command

"SHOW IP DHCP SNOOPING BINDING" on page 704

Example

This example removes all of the dynamic lease entries from the DHCP snooping database for a client with an IP address of 192.168.1.2:

```
awplus> enable
awplus# clear ip dhcp snooping binding 192.168.1.2
```

CLEAR IP DHCP SNOOPING STATISTICS

Syntax

```
clear dhcp snooping statistics interface port-list
```

Parameters

interface
Specifies a port list.

Mode

Privileged Executive mode

Description

Use this command to clear DHCP snooping statistics from the ports specified.

For instructions about how to specify ports, see "Port Numbers in Commands" on page 69.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example clears the DHCP statistics from the ports 12 through 16:

```
awplus> enable
awplus# clear ip dhcp snooping statistics port1.0.12-
port1.0.16
```

IP DHCP SNOOPING

Syntax

```
ip dhcp snooping
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enable DHCP snooping on the VLAN interfaces specified.

Use the no version of the command, NO IP DHCP SNOOPING command, to disable DHCP snooping in the VLAN interfaces specified.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example enables DHCP snooping on VLAN interface 25:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip dhcp snooping
```

IP DHCP SNOOPING BINDING

Syntax

```
ip dhcp snooping binding ipaddr macaddr (vlan vid)
(interface port) (expiry expiry-time)
```

Parameters

ipaddr
: Specifies the client's IP address.

macaddr
: Specifies a client's MAC address in the HHHH.HHHH.HHHH format.

vlan
: Specifies a VLAN ID for the entry. The range is from 1 to 4094.

interface
: Indicates the port the client is connected to. The port can be a switch port or a static or dynamic link aggregation (a channel group).

expiry
: Specifies the expiry time for the entry. The range is 5 to 21473647 seconds.

Mode

Privileged Exec mode

Description

Use this command to manually add a dynamic-like entry (with an expiry time) to the DHCP snooping database. After it is added to the database, this entry is treated as dynamic entry and is stored in the DHCP snooping database backup file. This command is *not* stored in the switch's running configuration.

Caution
If you remove entries from the database for the current clients, they lose IP connectivity until they request and receive a new DHCP lease. If you clear all entries, all clients connected to untrusted ports lose connectivity.

To add or remove static entries from the database, use the IP SOURCE BINDING command. See "IP SOURCE BINDING" on page 692.

Use the no version of the command, the NO IP DHCP SNOOPING BINDING command, to restore the delete a dynamic entry for an IP address from the DHCP snooping database or to delete all dynamic entries from the database.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example restores an entry in the DHCP snooping database for a DHCP client with the IP address of 193.167.1.2, a MAC address of 0001.0002.0003, on port1.0.6 of VLAN 6 with an expiry time of 1 hour:

```
awplus> enable
awplus# ip dhcp snooping binding 193.167.1.2. 0001.0002.0003
vlan 6 interface port1.0.6 expiry 3600
```

IP DHCP SNOOPING DELETE-BY-CLIENT

Syntax

```
ip dhcp snooping delete-by-client
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to set the switch to remove a dynamic entry from the DHCP snooping database when it receives a valid DHCP message with matching IP address, VLAN ID, and client hardware on an untrusted port. In addition, setting this command causes the switch to discard release messages that do not match an entry in the database. This command is enabled by default.

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 version of the command, the NO DHCP SNOOPING DELETE-BY-CLIENT command, to ignore the release messages. Lease entries corresponding to ignored DHCP release messages eventually time out when the lease expires.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example sets the switch to delete DHCP snooping lease entries from the DHCP snooping database when a matching release message is received:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip dhcp snooping delete-by-client
```

IP DHCP SNOOPING DELETE-BY-LINKDOWN

Syntax

```
ip dhcp snooping delete-by-linkdown
```

Parameters

None

Mode

Global Configuration mode

Description

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 deleted only when all of the ports in the aggregated link are down.

If this command is enabled in a stack, and the master switch goes down and is replaced by a new master switch, entries in the DHCP snooping database for ports on the master are removed. There is one exception. If this command is enabled in a stack, and the master switch goes down and is replaced by a new master switch, entries in the database for ports on the master are *not* removed if they are part of link aggregators that are still up.

By default, this command is disabled. With this setting, the DHCP snooping bindings are not deleted when an interface goes down.

Use the no version of the command, the NO IP DHCP SNOOPING DELETE-BY-LINKDOWN command, to set the switch to not delete entries when ports go down.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example sets the switch to delete DHCP snooping lease entries from the DHCP snooping database when links go down:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip dhcp snooping delete-by-linkdown
```

IP DHCP SNOOPING MAX-BINDINGS

Syntax

```
ip dhcp snooping max-bindings <0 - 520>
```

Parameters

max-bindings
: Specifies the maximum number of bindings that are stored in the DHCP snooping binding database for the port specified. If 0 is specified, no entries are stored in the database.

Mode

Port Interface mode

Description

Use this command to set the maximum number of DHCP lease entries that can be stored in the DHCP snooping database for a port or a range of ports. After this value is reached, no additional DHCP lease allocations made to the devices on the port are stored in the database. The default value for the maximum number of DHCP lease entries is 1.

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.

In general, the default value of 1 works well on an edge port with a single-directly-connected-DHCP client. If the port is on an aggregated 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 of DHCP lease entries is shared between all of the VLANs on the specified port. For example, the default value 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.

Use the no version of the command, the NO IP DHCP MAX-BINDINGS command, to reset the maximum number of DHCP lease entries to the default of 1.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example sets the maximum number of bindings that can be stored in the DHCP snooping database to 10 per port for ports 15 to 19:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15-port1.0.19
awplus(config-if)# ip dhcp snooping max-bindings 10
```

IP DHCP SNOOPING SUBSCRIBER-ID

Syntax

```
ip dhcp snooping subscriber-id <sub-id>
```

Parameters

sub-id

Specifies a subscriber ID in an alphanumeric (ASCII) string of 1 to 50 characters. Spaces are permitted; however, they must be enclosed in double quotation marks. Wild cards are not permitted.

Mode

Port Interface mode

Description

Use this command to assign a subscriber ID to a port. By default, no subscriber IDs are assigned to any port on the switch.

Use the no version of the command, NO IP DHCP SNOOPING SUBSCRIBER-ID command, to remove the subscriber id assigned to a port.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

"SHOW IP DHCP SNOOPING INTERFACE" on page 706

Examples

This example assigns port 3 a subscriber ID of “room_534:”

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# ip dhcp snooping subscriber-id room_534
```

This example assigns port 17 a subscriber ID of “Campus A Building 3”

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17
awplus(config-if)# ip dhcp snooping subscriber-id “Campus A
Building 3”
```

This example assigns removes a subscriber ID from port 21

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.21
awplus(config-if)# no ip dhcp snooping subscriber-id
```

IP DHCP SNOOPING TRUST

Syntax

```
ip dhcp snooping trust
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to set ports as DHCP-snooping-trusted ports. 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. By default, all switch ports are untrusted.

Use the no version of this command, NO IP DHCP SNOOPING TRUST, to return a port to its default untrusted state.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

"SHOW IP DHCP SNOOPING INTERFACE" on page 706

Example

This example assigns ports 1 and 2 as trusted ports:

```
awplus> enable
awplus# configure terminal
awplus(config-if)# interface port1.0.1-port1.0.2
awplus(config)# ip dhcp snooping trust
```

IP DHCP VERIFY MAC-ADDRESS

Syntax

```
ip dhcp verify mac-address
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to verify that the source MAC address and client hardware address match in DHCP packets received on untrusted ports. By default, this command is enabled.

When MAC address verification is enabled, the switch treats DHCP packets with source MAC address and client hardware addresses 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. See “IP DHCP SNOOPING VIOLATION” on page 690.

Note
To bring the port up after any issues have been resolved, use the NO SHUTDOWN command. See “NO SHUTDOWN” on page 221.

Use the no version of the command, NO IP DHCP SNOOPNG VERIFY MAC-ADDRESS command, to disable source MAC address verification.

Confirmation Commands

“IP DHCP SNOOPING VIOLATION” on page 690

“SHOW RUNNING-CONFIG” on page 168

“SHOW IP DHCP SNOOPING” on page 702

Examples

This example enables MAC address verification on untrusted ports:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip dhcp verify mac-address
```

This example disables MAC address verification on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip dhcp verify mac-address
```

IP DHCP SNOOPING VIOLATION

Syntax

```
ip dhcp snooping violation log|trap|link-down
```

Parameters

log
: Generates a log message. Use the SHOW LOG command to display these messages. See “NO LOG BUFFERED” on page 727.

trap
: Generates an SNMP notification or trap. To make this parameter active, configure SNMP and enable DHCP snooping notifications with the SNMP-SERVER ENABLE TRAP command. See “SNMP-SERVER ENABLE TRAP” on page 1198. Notifications are limited to one per second and to one per source MAC and violation.

link-down
: Disables the port.

Mode

Port Interface mode

Description

Use this command to specify the action the switch takes when it detects an DHCP snooping violation by an DHCP packet on a port (or ports). You can set a switch to respond with more than one action. By default, DHCP packets that violate DHCP snooping are dropped, but no other violation action is taken.

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. See “NO SHUTDOWN” on page 221.

IP packets dropped by DHCP snooping filters do *not* result in other DHCP snooping violation actions.

Use the no version of the command, NO IP DHCP SNOOPING VIOLATION command, to disable the specified violation actions or all violation actions.

Confirmation Command

"NO LOG BUFFERED" on page 727

"SNMP-SERVER ENABLE TRAP" on page 1198.

Example

This example sets the switch to send an SNMP notification and sets the link status to link-down if it detects an DHCP snooping violation on switch ports 1 through 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server enable trap dhcpsnooping
awplus(config)# interface port1.0.1-port1.0.4
awplus(config)# ip dhcp snooping violation trap link-down
```

IP SOURCE BINDING

Syntax

`ip source binding <ipaddr> <macaddr> vlan <vid> interface <port>`

Parameters

ipaddr
: Specifies the client's IP address. If there is already an entry in the DHCP snooping database for the IP address, then this option replaces it with the new entry.

macaddr
: Specifies a client's MAC address in the HHHH.HHHH.HHHH format.

vlan
: Specifies a VLAN ID for the entry. The range is from 1 to 4094.

interface
: Indicates the port the client is connected to.

Mode

Global Configuration mode

Description

Use this command to add or replace a static entry in the DHCP snooping database. In addition, you can use this command to delete all of the static entries in the DHCP snooping database.

Use the no version of the command, NO IP SOURCE BINDING command, to delete the specified static entry or all static entries from the database.

To remove dynamic entries from the DHCP snooping database, use the CLEAR IP DHCP SNOOPING BINDING command (see "IP DHCP SNOOPING" on page 678) or NO IP DHCP SNOOPING BINDING command (see "IP DHCP SNOOPING BINDING" on page 679).

Confirmation Commands

"SHOW IP DHCP SNOOPING BINDING" on page 704

"SHOW IP SOURCE BINDING" on page 708

Examples

This example adds a static entry to the DHCP snooping database for a client with the IP address of 192.168.1.2 and a MAC address of 0001.0002.0003 on port 6 of VLAN 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip source binding 192.168.1.2 0001.0002.0003
vlan 7 interface port1.0.6
```

This example removes the static entry for IP address 192.168.1.2 from the DHCP snooping database:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip source binding 192.168.1.2
```

This example removes all static entries from the DHCP snooping database:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip source binding
```

SERVICE DHCP SNOOPING

Syntax

```
service dhcp snooping
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enable the DHCP snooping service on the switch globally. You must enable the SERVICE DHCP-SNOOPING command *before* entering other DHCP snooping commands. By default, DHCP snooping is disabled on the switch.

For DHCP snooping to operate on a VLAN, it must be enabled on the switch by using this command and also enabled on the specified VLAN by using the IP DHCP SNOOPING command. See “IP DHCP SNOOPING” on page 678.

For DHCP snooping to operate on a VLAN, it must:

- ❒ Be enabled globally on the switch with this command
- ❒ Be enabled on the specified VLAN with the IP DHCP SNOOPING command (see “IP DHCP SNOOPING” on page 678)
- ❒ Have at least one port connected to a DHCP server that is configured as a trusted port using the IP DHCP SNOOPING TRUST command (see “IP DHCP SNOOPING TRUST” on page 687)

If you disable the DHCP snooping service by using the NO SERVICE DHCP SNOOPING 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 your reenable the service, the switch repopulates the DHCP snooping database from the dynamic lease entries in the database backup file (in NVS by default). 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:

- Web authentication (using the AUTH-WEB ENABLE command)
- Guest VLAN authentication (using the AUTH GUEST-VLAN command)

In addition, you cannot enable any of the above features if you have DHCP snooping enabled on the switch.

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 a 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 using the NO ACCESS-GROUP command. See "NO ACCESS-GROUP" on page 1665.

Use the no version of the NO SERVICE DHCP SNOOPING command to disable the DHCP snooping service on the switch. This command removes all of the DHCP snooping configuration from the running configuration except for any DHCP snooping maximum bindings settings (set with "IP DHCP SNOOPING MAX-BINDINGS" on page 683) and any DHCP snooping-based Access Control Lists (ACLs) which are retained when the service is disabled.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example enables DHCP snooping on a switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# service dhcp snooping
```

SHOW ARP SECURITY

Syntax

```
show arp security
```

Parameters

None

Mode

Privilege Exec mode

Description

Use this command to display the ARP security configuration for the specified ports or all ports.

Example

This example displays the ARP security configuration on the switch:

```
awplus> enable
awplus# show arp security
```

See Figure 129 for a sample display. See Table 71 on page 697 for an explanation of the parameters in this display.

```
awplus# show arp security

Arp Security Information:
   Total VLANs enabled..............2
   Total VLANs disabled.............10
   vlan1..............Disabled
   vlan2..............Disabled
   vlan3..............Disabled
   vlan4..............Disabled
   vlan5..............Disabled
   vlan100............Disabled
   vlan101............Disabled
   vlan102............Disabled
   vlan103............Disabled
   vlan104............Disabled
   vlan105............Enabled
   vlan1000...........Enabled
```

Figure 129. SHOW ARP SECURITY Command

Table 71. Parameters in SHOW ARP SECURITY Command

Parameter	Description
Total VLANs enabled	Specifies the number of VLANs that have ARP security enabled.
Total VLANs disabled	Specifies the number of VLANs that have ARP security disabled.

SHOW ARP SECURITY INTERFACE

Syntax

```
show arp security interface <port-list>
```

Parameters

interface
: Indicates the list of ports. If no ports are specified, information for all ports is displayed.

Mode

Privilege Exec mode

Description

Use this command to display ARP security configuration for the specified ports or all ports.

Example

This example displays ARP security configuration for ports 1 through 7:

```
awplus> enable
awplus# show arp security interface port1.0.1-port1.0.7
```

See Figure 130 for a sample display. See Table 72 on page 699 for an explanation of the parameters in this display.

```
awplus# show arp security interface port1.0.1-port1.0.5

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         LG TR --
port1.0.2         -- -- --
port1.0.3         LG TR LD
port1.0.4         LG -- --
port1.0.5         LG -- LD
```

Figure 130. SHOW ARP SECURITY INTERFACE Command

Table 72. Parameters in SHOW ARP SECURITY INTERFACE Command

Parameter	Description
Action	Indicates the action the switch takes when it detects an ARP security violation on the port.
Port	Specifies the port name.
LG, Log	Generates a log message.
TR, Trap	Generates an SNMP notification or trap.
LD, Link down	Shuts down the link.

SHOW ARP SECURITY STATISTICS

Syntax

```
show arp security statistics detail [interface <port-list>]
```

Parameters

detail
Displays detailed statistics.

interface
Indicates the list of ports.

Mode

Privilege Exec mode

Description

Use this command to display ARP security statistics for the specified ports or all ports.

Example

This example displays the brief statistics about ARP security:

```
awplus> enable
awplus# show arp security statistics
```

See Figure 131 for a sample display. See Table 73 on page 701 for an explanation of the parameters in this display.

```
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
```

Figure 131. SHOW ARP SECURITY STATISTICS Command

Table 73. Parameters in SHOW ARP SECURITY STATISTCS Command

Parameter	Description
Interface	Indicates a port name.
In Packets	Specifies the total number of incoming APR packets that are processed by DHCP Snooping ARP Security.
In Discards	Specifies the total number of ARP packets that are dropped by DHCP Snooping ARP Security.

Figure 132 displays sample output from the SHOW ARP SECURITY STATISTCS 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
```

Figure 132. SHOW ARP SECURITY STATISTICS DETAIL Command

SHOW IP DHCP SNOOPING

Syntax

```
show ip dhcp snooping
```

Parameters

None

Mode

Privilege Exec mode

Description

Use this command to display global DHCP snooping configuration on the switch.

Example

This example displays entries in the DHCP snooping database:

```
awplus> enable
awplus# show ip dhcp snooping
```

See Figure 133 on page 703 for a sample display.

```
awplus# show ip dhcp snooping

DHCP Snooping Information:
   DHCP Snooping service.................Enabled
   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
```

Figure 133. SHOW IP DHCP SNOOPING Command

SHOW IP DHCP SNOOPING BINDING

Syntax

```
show ip dhcp snooping binding
```

Parameters

None

Mode

Privilege Exec mode

Description

Use this command to display all dynamic and static entries in the DHCP snooping binding database.

Example

This example displays entries in the DHCP snooping database:

```
awplus> enable
awplus# show ip dhcp snooping binding
```

See Figure 134 for a sample display of this command. SeeTable 74 on page 705 for an explanation of the parameters in this display.

```
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

  Total number of bindings in database: 5
```

Figure 134. SHOW IP DHCP SNOOPING BINDING Command

Table 74. SHOW IP DHCP SNOOPING BINDING Command Parameters

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 is either: — Dyna: dynamically entered by snooping DHCP traffic configured with the IP DHCP SNOOPING BINDING command or loaded from the database backup file. — Stat: added statistically 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.

SHOW IP DHCP SNOOPING INTERFACE

Syntax

```
show ip dhcp snooping interface port-list
```

Parameters

port-list
: Indicates the list of ports. If no ports are specified, information for all ports is displayed.

Mode

Privileged Exec mode

Description

Use this command to display DHCP snooping configuration and leases for a port or a list of ports.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

This example displays DHCP snooping binding information for all of the ports:

```
awplus> enable
awplus# show ip dhcp snooping interface
```

This example displays DHCP snooping interface information for ports 1 through 6:

```
awplus> enable
awplus# # show ip dhcp snooping interface port1.0.1-
port1.0.6
```

See Figure 135 on page 707 for a sample of this display. See Table 75 on page 707 for an explanation of the parameters in this display.

```
awplus# show ip dhcp snooping interface port1.0.1-port1.0.6
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

DHCP Snooping Bindings:
                        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   Trusted   0         1        -- -- LD    Building 2 Level 1
  port1.0.6   Trusted   0         1        LG -- --
```

Figure 135. SHOW IP DHCP SNOOPING INTERFACE Command

Table 75. Parameters in SHOW IP DHCP SNOOPING INTERFACE Command

Parameter	Description
Port	Specifies the port interface name.
Status	Indicates the port status as either untrusted (default) or trusted.
Full Leases	Indicates the number of entries in the DHCP snooping database for the port.
Max Leases	Indicates the maximum number of entries that can be stored in the DHCP snooping database for the port.
Action	Specifies the DHCP snooping violation actions for the port.
Subscriber ID	Indicates the subscriber ID for the port. If the subscriber ID is longer than 34 characters, only the first 34 characters are displayed.

SHOW IP SOURCE BINDING

Syntax

```
show ip source binding
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display static entries in the DHCP snooping database. The static entries have been added with the IP SOURCE BINDING command. See “IP SOURCE BINDING” on page 692

Example

This example displays static entries in the DHCP snooping database:

```
awplus> enable
awplus# show ip source binding
```

See Figure 136 for a sample of this display. See Table 76 on page 709 for an explanation of the parameters in this display.

```
awplus# show ip dhcp source binding
IP Source Bindings:

  Client        MAC                                    Expires
  IP Address    Address           VLAN   Port          (sec)       Type
  ------------------------------------------------------------------------
  1.1.1.1       0000.1111.2222    1      port1.0.21    Infinite    Static
```

Figure 136. SHOW IP DHCP SOURCE BINDING Command

Table 76. SHOW IP DHCP SOURCE BINDING Command Parameters

Parameter	Description
Client IP Address	Specifies the IP address of the DHCP client.
MAC Address	Specifies the MAC address of the DHCP client.
VLAN	Indicates the VLAN ID the packet is received on.
Port	Specifies Layer 2 port name the packet is received on.
Expires (sec)	Indicates the time, in seconds, until the lease expires. The time is always infinite for static bindings, or when the leave time in the DHCP message is 0xffffffff (infinite).
Type	Indicates the DHCP snooping binding type is static.

Section V

Event Messages

This section contains the following chapters:

Chapter 47

Event Log

This chapter covers the following topics:

Overview

A managed switch is a complex piece of computer equipment that includes both hardware and software components. Multiple software features operate simultaneously, inter-operating with each other and processing large amounts of network traffic. It is often difficult to determine exactly what is happening when a switch appears not to be operating normally, or what happened when a problem occurred.

The operation of the switch can be monitored by viewing the event messages generated by the device. These events and the vital information about system activity that they provide can help you identify and solve system problems.

The event messages are stored or sent in or to the following types of outputs:

- The buffered log
- The permanent log
- Email addresses
- Consoles

The event messages include the following information:

- The time and date of the event
- The severity of the event
- The management module that generated the event
- An event description

The event messages can be filtered by:

- Severity level
- Management software modules
- Text-string within the message

Displaying the Event Log

There are two commands to display the messages stored in the event log. Both display the same messages and both are found in the Privileged Exec mode. The only difference is that one displays the messages from oldest to newest and the other from newest to oldest. The first command is the SHOW LOG command. If you are more interested in the older messages, this is the command to use. Here it is:

```
awplus# show log
```

The messages are displayed one screen at a time. To cancel the log, type 'q' for quit. Here is an example of the log.

```
<date> <time> <facility>.<severity> <program[<pid>]>: <message>
-------------------------------------------------------------------------
2010 Jan 15 14:39:04 user.information awplus stp: Set Configuration succeeded
2010 Jan 15 14:39:04 user.information awplus stp: Set Configuration succeeded
2010 Jan 15 14:39:04 user.information awplus stp: Disabled Spanning Tree
2010 Jan 15 14:39:04 user.information awplus stp: Active protocol changed to STP
```

Figure 137. SHOW LOG Command

The columns are described in Table 79 on page 732.

If you happen to be interested in the newer messages, use the SHOW LOG REVERSE command, instead. You will see the same messages, but the newest are displayed first.

Clearing the Event Log

To clear all the messages from the event log, use the CLEAR LOG BUFFERED command in the Privileged Exec mode. Here is the command:

```
awplus# clear log buffered
```

Chapter 48
Event Log Commands

The event log commands are summarized in Table 77 and described in detail within this chapter.

Table 77. Event Log Commands

Command	Mode	Description
“CLEAR LOG” on page 719	Privileged Exec	Deletes all entries in the buffered and permanent logs.
“CLEAR LOG BUFFERED” on page 720	Privileged Exec	Deletes all entries in the buffered log.
“CLEAR LOG PERMANENT” on page 721	Privileged Exec	Deletes all entries in the permanent log.
“LOG BUFFERED” on page 722	Global Configuration	Specifies the types of event messages to be stored in the buffered log.
“LOG CONSOLE” on page 724	Global Configuration	Specifies the types of event messages to be sent to the console.
“LOG PERMANENT” on page 726	Global Configuration	Specifies the types of event messages to be stored in the permanent log.
“NO LOG BUFFERED” on page 727	Global Configuration	Cancels the settings set by the LOG BUFFERED command.
“NO LOG CONSOLE” on page 729	Global Config ration	Cancels the settings set by the LOG CONSOLE command.
“NO LOG PERMANENT” on page 730	Global Configuration	Cancels the settings set by the LOG PERMANENT command.
“SHOW LOG” on page 732	Privileged Exec	Displays the event messages in the buffered log from oldest to newest.
“SHOW LOG CONFIG” on page 735	Privileged Exec	Displays the configuration of the event logs.
“SHOW LOG PERMANENT” on page 737	Privileged Exec	Displays the event messages in the permanent log.
“SHOW LOG PERMANENT TAIL” on page 738	Privileged Exec	Displays a limited number of the event messages in the permanent log.

Table 77. Event Log Commands

Command	Mode	Description
“SHOW LOG REVERSE” on page 739	Privileged Exec	Displays the event messages in the buffered log from newest to oldest.
“SHOW LOG TAIL” on page 740	Privileged Exec	Displays a limited number of the event messages in the buffered log.

CLEAR LOG

Syntax

```
clear log
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to delete the event messages in the buffered and permanent logs.

Confirmation Commands

"SHOW LOG" on page 732 and "SHOW LOG PERMANENT" on page 737

Example

The following example deletes the event messages in the buffered and permanent logs:

```
awplus> enable
awplus# clear log
```

CLEAR LOG BUFFERED

Syntax

```
clear log buffered
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to delete the event messages in the buffered log.

Confirmation Command

“SHOW LOG” on page 732

Example

The following example deletes the event messages in the buffered log:

```
awplus> enable
awplus# clear log buffered
```

CLEAR LOG PERMANENT

Syntax

```
clear log permanent
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to delete the event messages in the permanent log.

Confirmation Command

"SHOW LOG PERMANENT" on page 737

Example

The following example deletes the event messages in the permanent log:

```
awplus> enable
awplus# clear log permanent
```

LOG BUFFERED

Syntax

`log buffered [level` *`level`*`] [program` *`program`*`] [msgtext` *`msgtext`*`]]`

Parameters

level

Specifies the minimum severity level of the event messages to be stored in the buffered event log. The log stores the messages of the specified level and all higher levels. For example, if you specify level 4, the log stores the messages from levels 0 and 4. The severity levels are listed in Table 78. At the default level 6, the log stores messages that have a severity level of 0, 4, or 6.

program

Specifies the event messages of a particular management software module. The modules are listed in Table 80 on page 733. To specify more than one module, separate the modules with commas.

msgtext

Specifies a text string in the event messages. This string is case sensitive. The text may not contain spaces or special characters and must not be enclosed in quotation marks. To use this parameter, you have to include the LEVEL and PROGRAM parameters in the command and it has to be the last parameter in the command.

Mode

Global Configuration mode

Description

Use this command to specify the types of event messages the buffered log should store. You can specify the messages by severity level, management software module, a text string, or a combination of the parameters.

The available severity levels are listed in Table 78.

Table 78. Event Message Severity Levels

Severity	Description
0	Emergency message

Table 78. Event Message Severity Levels (Continued)

Severity	Description
4	Warning message
6	Informational message
7	Debug message

The management software modules are listed in Table 80 on page 733.

Confirmation Command

"SHOW LOG CONFIG" on page 735

Examples

This example configures the buffered log to save only those event messages that have a severity level of 0 or 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# log buffered level 4
```

This example configures the buffered log to save only those event messages that are generated by IGMP snooping (IGMPSNOOP), LACP and port configuration (PCFG):

```
awplus> enable
awplus# configure terminal
awplus(config)# log buffered program igmpsnooping,lacp,
pconfig
```

This example configures the buffered log to save those event messages that have a severity level of 0 or 4, that are generated by 802.1x port-based network access control (PACCESS) and 802.1q GARP, and that have the text "port" in the messages:

```
awplus> enable
awplus# configure terminal
awplus(config)# log buffered level 4 program paccess,garp
msgtext port
```

LOG CONSOLE

Syntax

`log console [level` *`level`*`]|[program` *`program`*`]|[msgtext` *`msgtext`*`]`

Parameters

level

Specifies the minimum severity level of the event messages. The levels are listed in Table 78 on page 722.

program

Specifies the event messages of a particular management software module. The modules are listed in Table 80 on page 733. To specify more than one module, separate the modules with commas.

msgtext

Specifies a text string with double quotations around to match the event messages. This string is case sensitive and must be the last text on the command line.

Mode

Global Configuration mode

Description

Use this command to specify the types of event messages to be sent to the console. You can filter the messages by specifying severity level, management software module, a text-string within the message or a combination of some or all of these.

The available severity levels are listed in Table 78 on page 722, and the management software modules is in Table 80 on page 733.

Confirmation Command

“SHOW LOG CONFIG” on page 735

Examples

This example configures the switch to send to the console only those event messages that have the minimum severity level 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# log console level 4
```

This example configures the switch to send to the console only those event messages that are generated by IGMP snooping (IGMPSNOOP) and LACP:

```
awplus> enable
awplus# configure terminal
awplus(config)# log console program igmpsnoop,lacp
```

This example configures the switch to send to the console only those event messages that have a minimum severity level of 4 and that are generated by 802.1x port-based network access control (PACCESS) and 802.1q GARP:

```
awplus> enable
awplus# configure terminal
awplus(config)# log console level 4 program paccess,garp
```

LOG PERMANENT

Syntax

```
log permanent [level level]|[program program]|
[msgtext msgtext]
```

Parameters

level

Specifies the minimum severity level of the event messages to be stored in the permanent log. The severity levels are listed in Table 78 on page 722.

program

Specifies the event messages of a particular management software module. The modules are listed in Table 80 on page 733. To specify more than one module, separate the modules with commas.

msgtext

Specifies a text string with double quotations around to match the event messages. This string is case sensitive and must be the last text on the command line.

Mode

Global Configuration mode

Description

Use this command to specify the types of event messages to be stored in the permanent log. You can specify the messages by severity level, management software module, a text-string within the message or a combination of some or all of these.

Confirmation Command

“SHOW LOG CONFIG” on page 735

NO LOG BUFFERED

Syntax

```
no log buffered [level level]|[program program]|
[msgtext msgtext]
```

Parameters

level
: Specifies the severity level setting.

program
: Specifies the management software module setting. To specify more than one module, separate the modules with commas.

msgtext
: Specifies a text string setting.

Mode

Global Configuration mode

Description

Use this command to cancel the settings set by the `log buffered` command. You can cancel a setting individually by specifying a parameter. If you do not specify any parameters, the command cancels all the settings and restores the default settings for the buffered log.

Confirmation Command

"SHOW LOG CONFIG" on page 735

Example

This example cancels the settings and restores the default settings for the buffered log:

```
awplus# no log buffered
```

This example cancels only the setting of MAC and keeps other settings so that the switch sends all messages that have a minimum severity level of 4 and that are generated by the IP program:

```
awplus# show log config
```

```
OUtputID  Type       Status    Details
-------------------------------------------------------------------------------------------------------------------
1         Temporary  Enabled   Wrap on Full. Filter: Level 4 program MAC, IP
```

```
awplus# configure terminal
awplus(config)# no log buffered Program mac
```

NO LOG CONSOLE

Syntax

```
no log console [level level]|[program program]|
[msgtext msgtext]
```

Parameters

level
: Specifies the severity level setting.

program
: Specifies the management software module setting. To specify more than one module, separate the modules with commas.

msgtext
: Specifies a text string setting.

Mode

Global Configuration mode

Description

Use this command to cancel the settings set by the LOG CONSOLE command. You can cancel a setting individually by specifying a parameter. If you do not specify any parameters, the command cancels all the settings and restores the default settings.

Confirmation Command

"SHOW LOG CONFIG" on page 735

Examples

This example cancels the settings and restores the default settings for the console:

```
awplus# no log console
```

This example cancels only the setting of MAC and keeps other settings:

```
awplus# configure terminal
awplus(config)# no log console Program mac
```

NO LOG PERMANENT

Syntax

```
no log permanent [level level]|[program program]|
[msgtext msgtext]
```

Parameters

level
: Specifies the severity level setting.

program
: Specifies the management software module setting. To specify more than one module, separate the modules with commas.

msgtext
: Specifies a text string setting.

Mode

Global Configuration mode

Description

Use this command to cancel the settings set by the LOG PERMANENT command. You can cancel a setting individually by specifying a parameter. If you do not specify any parameters, the command cancels all the settings and restores the default settings for the permanent log.

Confirmation Command

“SHOW LOG CONFIG” on page 735

Example

This example cancels the settings and restores the default settings for the permanent log:

```
awplus# no log permanent
```

This example cancels only the setting of MAC and keeps other settings so that the switch sends all messages that have a minimum severity level of 4 and that are generated by the IP program:

```
awplus# show log config
```

```
OUtputID  Type       Status    Details
-------------------------------------------------------------------------------------------------------------
1         Temporary  Enabled   Wrap on Full. Filter: Level 4 program MAC, IP
```

```
awplus# configure terminal
awplus(config)# no log permanent Program mac
```

SHOW LOG

Syntax

```
show log
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the messages in the buffered event log. The event messages are displayed from oldest to newest, one screen at a time. To cancel the display, type ‘q’ for quit. You cannot filter the log for specific types of messages. An example of the log is shown in Figure 138.

```
<date> <time> <facility>.<severity> <program[<pid>]>: <message>
-------------------------------------------------------------------------
2010 Jan 15 14:39:04 user.information awplus stp: Set Configuration succeeded
2010 Jan 15 14:39:04 user.information awplus stp: Set Configuration succeeded
2010 Jan 15 14:39:04 user.information awplus stp: Disabled Spanning Tree
2010 Jan 15 14:39:04 user.information awplus stp: Active protocol changed to STP
```

Figure 138. SHOW LOG Command

The columns in the log are described here:

Table 79. SHOW LOG Command

Parameter	Description
Date/Time	The date and time the message was entered in the event log.
Facility	This is always “user.”
Severity	The severity of the message. The severity levels are: ❒ Information: Useful information that can be ignored during normal operation. ❒ Error: Switch operation is severely impaired.

Table 79. SHOW LOG Command

Parameter	Description
Severity (continued)	❒ Warning: The issue reported by the message may require manager attention. ❒ Debug: Messages intended for technical support and software development.
Program	The module listed in Table 80 that generated the event message.
Message	The event message.

Table 80 lists the modules and their abbreviations.

Table 80. Management Software Modules

Module Name	Description
ALL	All management software modules
ACL	Port access control list
CFG	Switch configuration
CLASSIFIER	Classifiers used by ACL and QoS
CLI	Command line interface commands
ENCO	Encryption keys
ESTACK	Enhanced stacking
EVTLOG	Event log
FILE	File system
GARP	GARP GVRP
HTTP	Web server
IGMPSNOOP	IGMP snooping
IP	System IP configuration
LACP	Link Aggregation Control Protocol
MAC	MAC address table
PACCESS	802.1x port-based access control
PCFG	Port configuration

Table 80. Management Software Modules

Module Name	Description
PKI	Public Key Infrastructure
PMIRR	Port mirroring
PSEC	MAC address-based port security
PTRUNK	Static port trunking
QOS	Quality of Service
RADIUS	RADIUS authentication protocol
RTC	Real-time clock
SNMP	SNMP
SSH	Secure Shell protocol
SSL	Secure Sockets Layer protocol
STP	Spanning Tree and Rapid Spanning protocols
SYSTEM	Hardware status; manager and operator log in and log off events.
TACACS	TACACS+ authentication protocol
TELNET	Telnet
TFTP	TFTP
TIME	System time and SNTP
VLAN	Port-based, tagged and MAC address-based VLANs
WAT	Watchdog timer

Example

The following command displays the messages in the event log:

```
awplus# show log
```

SHOW LOG CONFIG

Syntax

```
show log config
```

Parameters

None

Modes

Privileged Exec mode

Description

Use this command to display the configuration of the event log.

awplus# show log config

```
Permanent log:
Status ............... Enable
   Filter:
   Level ............. Informational
   Program ........... All
   Message Text .......
Buffered log:
Status ............... Enable
   Filter:
   Level ............. Informational
   Program ........... All
   Message Text .......
```

Figure 139. SHOW LOG CONFIG Command

The fields in the display are described here:

Table 81. SHOW LOG CONFIG Command

Field	Description
Level	The severity levels of the messages to be stored in the log. The default is level 6, Informational, and higher. The levels are defined in Table 78 on page 722.

Table 81. SHOW LOG CONFIG Command

Field	Description
Program	The software module messages to be stored in the log. The modules are listed in Table 80 on page 733. The default is all modules.
Message Text	Text that identifies the messages to be stored in the log.

This command is also used to view the configuration of the syslog client. For information, refer to “SHOW LOG CONFIG” on page 753 in Chapter 50, “Syslog Client Commands” on page 749.

Example

The following command displays the configuration of the event log:

```
awplus# show log config
```

SHOW LOG PERMANENT

Syntax

```
show log permanent
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the messages in the permanent log. The event messages are displayed from oldest to newest, one screen at a time. To cancel the display, type 'q' for quit. An example of the log is shown in Figure 140.

```
<date> <time> <facility>.<severity> <program[<pid>]>: <message>
-------------------------------------------------------------------------
2010 Jan 15 14:39:04 user.information awplus stp: Set Configuration succeeded
2010 Jan 15 14:39:04 user.information awplus stp: Set Configuration succeeded
2010 Jan 15 14:39:04 user.information awplus stp: Disabled Spanning Tree
2010 Jan 15 14:39:04 user.information awplus stp: Active protocol changed to STP
```

Figure 140. SHOW LOG PERMANENT Command

Table 79 on page 732 describes the columns in the log and Table 80 on page 733 lists the modules and their abbreviations.

Example

The following example displays the messages in the permanent log:

```
awplus# show log permanent
```

SHOW LOG PERMANENT TAIL

Syntax

```
show log permanent tail [number]
```

Parameters

number
: Specifies the number of log entries to display. The range is 10 to 250 messages. The default is 10 messages.

Mode

Privileged Exec mode

Description

Use this command to display the most recent event messages in the permanent event log. The NUMBER parameter is used to specify the number of messages to display. The messages are displayed from oldest to newest. For an example and description of the log, refer to Figure 140 on page 737 and Table 79 on page 732.

Examples

This example displays the most recent 10 log messages in the permanent log:

```
awplus# show log permanent tail
```

This example displays the most recent 30 log messages in the permanent log:

```
awplus# show log permanent tail 30
```

SHOW LOG REVERSE

Syntax

```
show log reverse
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the event messages in the buffered log from newest to oldest. This command and the SHOW LOG command display the same messages, but in different order. The SHOW LOG command displays the messages from oldest to newest. To cancel the display, type 'q' for quit. You cannot filter the log for specific types of messages. For an example and description of the log, refer to Figure 138 on page 732 and Table 79 on page 732.

Example

This command displays the event messages in the buffered log from newest to oldest messages:

```
awplus# show log reverse
```

SHOW LOG TAIL

Syntax

```
show log tail [number]
```

Parameter

number
: Specifies the number of event messages to display. The range is 10 to 250 messages. The default is 10 messages.

Mode

Privileged Exec mode

Description

Use this command to display the most recent event messages in the buffered event log. The NUMBER parameter is used to specify the number of messages to display. The messages are displayed from oldest to newest. For an example and description of the log, refer to Figure 138 on page 732 and Table 79 on page 732.

Examples

This example displays the 10 most resent event messages in the buffered log. The messages are displayed from oldest to newest:

```
awplus# show log tail
```

This example displays the 30 most recent event messages:

```
awplus# show log tail 30
```

Chapter 49

Syslog Client

This chapter covers the following topics:

Overview

The switch has a syslog client. The client enables the switch to send its event messages to syslog servers on your network, for permanent storage.

To store the switch's event messages on a syslog server, you have to create a syslog server definition. The contents of a definition consist of an IP address of a syslog server and other information, such as the types of event messages the switch is to send.

Here are the guidelines to the syslog client:

- ❒ You can define up to 19 syslog server definitions.
- ❒ The switch must have a management IP address. For instructions, refer to "Adding a Management IP Address" on page 82 or Chapter 13, "IPv4 and IPv6 Management Addresses" on page 295.
- ❒ The syslog servers must be members of the same subnet as the management IP address of the switch, or must be able to access the subnet through routers or other Layer 3 devices.
- ❒ If the syslog servers are not members of the same subnet as the management IP address of the switch, the switch must have a default gateway that specifies the first hop to reaching the servers. For instructions on specifying the default gateway, refer to Chapter 13, "IPv4 and IPv6 Management Addresses" on page 295.
- ❒ The event messages are transmitted when they are generated. Any event messages that already exist in the event log are not transmitted when a new syslog server definition is created.
- ❒ The syslog client uses UDP port 514. You cannot change the UDP port.

Creating Syslog Server Definitions

To configure the switch to send event messages to a syslog server, create a syslog server definition with the LOG HOST command in the Global Configuration mode. Here is the format of the command:

`log host` *`ipaddress`* `[level` *`level`*`] [program` *`program`*`]`

This command creates just one definition at a time.

The IPADDRESS parameter is the IP address of a syslog server you want to receive event messages. You can specify just one address.

The LEVEL parameter specifies the minimal severity level of the events to transmit to the server. The switch supports the four severity levels in Table 82. Messages of the specified level and all levels below it are transmitted to the server. For example, specifying level 4 for a syslog server definition causes the switch to transmit levels 0 and 4 messages. If you omit this parameter, messages of all severity levels are sent.

Table 82. Event Message Severity Levels

Value	Severity Level	Description
0	Emergency	Switch operation is severely impaired.
4	Warning	An issue may require manager attention.
6	Informational	Useful information that can be ignored during normal operation.
7	Debug	Messages intended for technical support and software development.

The PROGRAM parameter is used to restrict the transmitted messages to just those that are generated by particular programs on the switch. You designate the programs by entering their abbreviations, listed in Table 83.

Table 83. Program Abbreviations

Abbreviation	Program
ALL	All features
ACL	Port access control list
CFG	Switch configuration
CLASSIFIER	Classifiers used by ACL and QoS
CLI	Command line interface commands

Table 83. Program Abbreviations

Abbreviation	Program
ENCO	Encryption keys
ESTACK	Enhanced stacking
EVTLOG	Event log
FILE	File system
GARP	GARP GVRP
HTTP	Web server
IGMPSNOOP	IGMP snooping
IP	System IP configuration
LACP	Link Aggregation Control Protocol
LLDP	LLDP and LLDP-MED
MAC	MAC address table
PACCESS	802.1x port-based access control
PCFG	Port configuration
PKI	Public Key Infrastructure
PMIRR	Port mirroring
PSEC	MAC address-based port security
PTRUNK	Static port trunking
QOS	Quality of Service
RADIUS	RADIUS authentication protocol
RRP	RRP snooping
RTC	Real time clock
SFLOW	sFlow client
SNMP	SNMP
SSH	Secure Shell protocol
SSL	Secure Sockets Layer protocol
STP	Spanning Tree, Rapid Spanning, and Multiple Spanning Tree protocols
SYSTEM	Hardware status; manager and operator log in and log off events.

Table 83. Program Abbreviations

Abbreviation	Program
TACACS	TACACS+ authentication protocol
TELNET	Telnet
TFTP	TFTP
TIME	System time and SNTP
VLAN	Port-based and tagged VLANs, and multiple VLAN modes
WATCHDOG	Watchdog timer

This example of the command creates a new syslog definition for a syslog server that has the IP address 149.24.111.23. The definition sends all event messages to the designated server.

```
awplus> enable
awplus# configure terminal
awplus(config)# log host 149.24.111.23
```

This example creates a syslog definition that sends all messages with severity levels 0, 4 to a syslog server that has the IP address 122.34.152.165:

```
awplus> enable
awplus# configure terminal
awplus(config)# log host 122.34.152.165 level 4
```

This example creates a syslog definition that sends messages from the RADIUS, spanning tree protocols, and static port trunks, to a syslog server that has the IP address 156.74.134.76:

```
awplus> enable
awplus# configure terminal
awplus(config)# log host 156.74.134.76 program radius,stp,
ptrunk
```

This example creates a syslog definition that sends messages with severity levels 0, 4, and 6 from access control lists and MAC address-based port security, to a syslog server that has the IP address 118.87.45.72:

```
awplus> enable
awplus# configure terminal
awplus(config)# log host 118.87.45.72 level 6 program acl,
psec
```

Deleting Syslog Server Definitions

To delete syslog server definitions from the switch, use the NO LOG HOST command in the Global Configuration mode. The format of the command is:

```
no log host ipaddress
```

To view the IP addresses of the syslog servers of the definitions, use the SHOW LOG CONFIG command. You can delete just one definition at a time with this command.

The switch stops sending event messages to a syslog server as soon as you delete a definition.

This example deletes a syslog server definition for the server IP address 124.145.112.61:

```
awplus> enable
awplus# configure terminal
awplus(config)# no log host 124.145.112.61
```

Displaying the Syslog Server Definitions

To view the IP addresses of the syslog servers use the SHOW LOG CONFIG command in the Privileged Exec mode:

```
awplus# show log config
```

Here is an example of the information.

```
Permanent log:
Status ..............  Enable
   Filter:
   Level ..............  Informational
   Program ............  All
   Message Text .......
Host 149.132.45.75:
   Filter:
   Level ..............  Informational
   Program ............  All
   Message Text .......
Host 149.132.101.128:
   Filter:
   Level ..............  Informational
   Program ............  All
   Message Text .......
Buffered log:
Status ..............  Enable
   Filter:
   Level ..............  Informational
   Program ............  All
   Message Text .......
```

Figure 141. SHOW LOG CONFIG Command with Syslog Server Entries

The syslog server entries are marked with "Host," followed by the server IP addresses. The example display has two syslog server entries that have the IP addresses 149.132.45.75 and 149.132.101.128.

Chapter 50

Syslog Client Commands

The syslog client commands are summarized in Table 84 and described in detail within the chapter.

Table 84. Syslog Client Commands

Command	Mode	Description
“LOG HOST” on page 750	Global Configuration	Creates syslog server definitions.
“NO LOG HOST” on page 752	Global Configuration	Deletes syslog server definitions.
“SHOW LOG CONFIG” on page 753	Privileged Exec	Displays the syslog server definitions.

LOG HOST

Syntax

`log host` *`ipaddress`* `[level` *`level`*`] [program` *`program`*`]`

Parameters

ipaddress
: Specifies the IP address of a syslog server. You can specify one address.

level
: Specifies the minimum severity level of the messages to be sent to the designated syslog server. The severity levels are listed in Table 82 on page 743. You can specify only one severity level. Omit this parameter to send messages of severity levels 0, 4, and 6.

program
: Specifies that only messages generated by particular management software modules are sent to the syslog server. The modules are listed in Table 80 on page 733. You can specify more than one feature. Separate multiple features with commas. Omit this parameter to send messages from all features.

Mode

Global Configuration mode

Description

Use this command to create syslog server definitions. The switch uses the definitions to send event messages to syslog servers on your network. There can be up to 19 syslog server definitions. You can create only one definition at a time with this command.

Confirmation Commands

“SHOW LOG CONFIG” on page 753

Examples

This example creates a new syslog definition that sends all event messages to a syslog server with the IP address 149.24.111.23:

```
awplus> enable
awplus# configure terminal
awplus(config)# log host 149.24.111.23
```

This example creates a new syslog definition for a syslog server that has the IP address 149.152.122.143. The definition sends only those messages that have a minimum severity level of 4 and that are generated by the RADIUS client (RADIUS) and static port trunks (PTRUNK):

```
awplus> enable
awplus# configure terminal
awplus(config)# log host 149.152.122.143 level 4 program
radius,ptrunk
```

NO LOG HOST

Syntax

```
no log host ipaddress
```

Parameters

ipaddress
Specifies an IP address of a syslog server.

Mode

Global Configuration mode

Description

Use this command to delete syslog server definitions from the switch.

Confirmation Command

“SHOW LOG CONFIG” on page 753

Example

This example deletes a syslog server definition with the server IP address 149.122.45.78:

```
awplus> enable
awplus# configure terminal
awplus(config)# no log host 149.122.45.78
```

SHOW LOG CONFIG

Syntax

```
show log config
```

Parameters

None

Modes

Privileged Exec mode

Description

Use this command to display the syslog server definitions on the switch. Here is an example of the information.

Figure 142 is an example of the information displayed.

```
Permanent log:
Status ................ Enable
   Filter:
   Level .............. Informational
   Program ............ All
   Message Text .......
Host 149.132.45.75:
   Filter:
   Level .............. Informational
   Program ............ All
   Message Text .......
Host 149.132.101.128:
   Filter:
   Level .............. Informational
   Program ............ All
   Message Text .......
Buffered log:
Status ................ Enable
   Filter:
   Level .............. Informational
   Program ............ All
   Message Text .......
```

Figure 142 SHOW LOG CONFIG Command with Syslog Server Entries

The syslog server entries are marked with "Host," followed by the server IP addresses. The example display has two syslog server entries that have the IP addresses 149.132.45.75 and 149.132.101.128.

Example

This example displays the configurations of the syslog server entries:

```
awplus# show log config
```

Section VI

Port Trunks

This section contains the following chapters:

Chapter 51

Static Port Trunks

This chapter covers the following topics:

Overview

Static port trunks are groups of two to eight ports that act as single virtual links between the switch and other network devices. Static port trunks are commonly used to improve network performance by increasing the available bandwidth between the switch and other network devices and to enhance the reliability of the connections between network devices.

Figure 143 is an example of a static port trunk of four links between two AT-FS970M Switches.

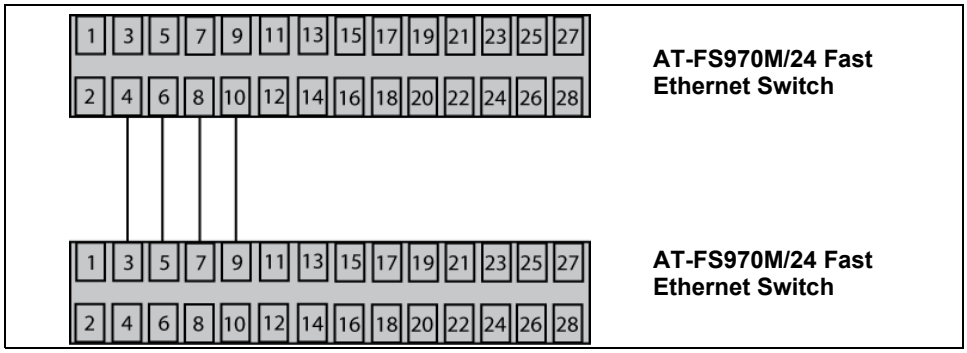

Figure 143. Static Port Trunk Example

When you create a new static port trunk, you can designate the manner in which the traffic is distributed across the physical links by the switch. This is explained in “Load Distribution Methods,” next.

Unlike LACP trunks, which are described in Chapter 53, “Link Aggregation Control Protocol (LACP)” on page 775, static port trunks do not permit standby ports. If a link is lost on a port in a static port trunk, the trunk’s total bandwidth is reduced. Although the traffic carried by a lost link is shifted to one of the remaining ports in the trunk, the bandwidth remains reduced until a lost link is reestablished or another port is manually added to the trunk.

Load Distribution Methods

This section discusses the load distribution methods for static port trunks and LACP trunks, described in Chapter 53, “Link Aggregation Control Protocol (LACP)” on page 775.

When you create a static port trunk or an LACP trunk, you have to specify the manner in which the switch should distribute the packets of the traffic load across the ports of a trunk. This is referred to as the load distribution method. The load distribution methods are listed here:

- Source MAC Address (Layer 2)
- Destination MAC Address (Layer 2)
- Source MAC Address / Destination MAC Address (Layer 2)

- Source IP Address (Layer 3)
- Destination IP Address (Layer 3)
- Source IP Address / Destination IP Address (Layer 3)

The load distribution methods examine the last three bits of a packet's MAC or IP address and compare the bits against mappings assigned to the ports in the trunk. The port mapped to the matching bits is selected as the transmission port for a packet.

In cases where you select a load distribution that employs either a source or destination address but not both, only the last three bits of the designated address are used in the selection process. If you select one of the two load distribution methods employing both source and destination addresses, port selection is achieved through an XOR operation of the last three bits of both addresses.

For example, assume you created a static port trunk or an LACP trunk of Ports 7 through 14 on the switch. The table below shows the mappings of the switch ports to the possible values of the last three bits of a MAC or IP address.

Last 3 Bits	000 (0)	001 (1)	010 (2)	011 (3)	100 (4)	101 (5)	110 (6)	111 (7)
Trunk Ports	7	8	9	10	11	12	13	14

Assume you selected source MAC address as the load distribution method and that the switch needed to transmit over the trunk a packet with a source MAC address that ended in 9. The binary equivalent of 9 is 1001, making the last three bits of the address 001. An examination of the table above indicates that the switch uses Port 8 to transmit the frame because that port is mapped to the matching bits.

A similar method is used for the two load distribution methods that employ both the source and destination addresses. Only here the last three bits of both addresses are combined by an XOR process to derive a single value which is then compared against the mappings of the bits to ports. The XOR rules are as follows:

0 XOR 0 = 0
0 XOR 1 = 1
1 XOR 0 = 1
1 XOR 1 = 0

For example, assume you selected source and destination MAC addresses for the load distribution method in our previous example, and that a packet for transmission over the trunk had a source MAC address that ended in 9 and a destination address that ended in 3. The binary values are:

9 = 1001
3 = 0011

Applying the XOR rules above on the last three bits result in 010, or 2. An examination of the table above shows that the packet is transmitted from port 9.

Port trunk mappings on the switch can consist of up to eight ports. This corresponds to the maximum number of ports allowed in a static trunk and the maximum number of active ports in an LACP trunk. Inactive ports in an LACP trunk are not applied to the mappings until they transition to the active status.

You can assign different load distribution methods to different static trunks on the same switch. The same is true for LACP aggregators. However, it should be noted that all aggregate trunks within an LACP aggregator must use the same load distribution method.

The load distribution methods assume that the final three bits of the source and/or destination addresses of the packets from the network nodes are varied enough to support efficient distribution of the packets over the trunk ports. A lack of variation can result in one or more ports in a trunk being used more than others, with the potential loss of a trunk's efficiency and performance.

Guidelines

Here are the guidelines to using static port trunks:

- A static trunk can have up to eight ports.
- The switch supports up to a total of 32 static port trunks and LACP trunks at a time. An LACP trunk is counted against the maximum number of trunks when it is active.
- The ports of a static port trunk can be either all twisted pair ports or all fiber optic ports. Static port trunks cannot have both types of ports.
- The ports of a trunk can be either consecutive (for example ports 5-9) or nonconsecutive (for example, ports 4, 8, 11, 20).
- The ports of static port trunks must be from the same switch.
- Static port trunks are compatible with spanning tree protocols because the switch views them as single virtual links.
- Before creating a port trunk, examine the speed, duplex mode, flow control, and back pressure settings of the lowest number port the trunk will contain. Verify that these port configuration settings

are compatible with the device to which the trunk will be connected. When you create a static port trunk, the management software copies the current settings of the lowest numbered port in the trunk to the other ports, so that all the ports have the same settings. For example, if you create a port trunk of ports 5 to 8, the parameter settings for port 5 are copied to ports 6, 7, and 8 so that all the ports of the trunk have the same settings.

- After creating a port trunk, do not change the speed, duplex mode, flow control, or back pressure of any port in the trunk without also changing the other ports.
- A port can belong to only one static trunk at a time.
- A port cannot be a member of a static trunk and an LACP trunk at the same time.
- The ports of a static trunk must be untagged members of the same VLAN. A trunk cannot consist of untagged ports from different VLANs.
- The switch selects the lowest-numbered port in the trunk to handle broadcast packets and packets of an unknown destination. For example, a trunk of ports 11 to 15 uses port 11 for broadcast packets.
- Because network equipment vendors tend to employ different techniques for static trunks, a static trunk on one device might not be compatible with the same feature on a device from a different manufacturer. For this reason, Allied Telesis recommends using this feature only between Allied Telesis network devices.

Creating New Static Port Trunks or Adding Ports To Existing Trunks

The command to create new static port trunks or to add ports to existing trunks is the STATIC-CHANNEL-GROUP command. Here is the format of the command:

```
static-channel-group id_number
```

You perform the command from the Port Interface mode of the ports the trunk is to contain. Here is an example that creates a new trunk of ports 22 to 23 and the ID number 1:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.22-port1.0.23
awplus(config-if)# static-channel-group 1
```

If a static port trunk of that ID number already exists, the commands add ports 22 and 23 to it.

Caution

To prevent the formation of loops in your network topology, do not connect the network cables to the member ports of a trunk until after you have created it. Network loops can result in broadcast storms that can adversely affect network performance.

For reference information, refer to “STATIC-CHANNEL-GROUP” on page 772.

Specifying the Load Distribution Method

The load distribution method defines how the switch distributes the traffic among the ports of a trunk. The command for this is the PORT-CHANNEL LOAD-BALANCE command, in the Static Port Trunk Interface mode. The command's format is shown here:

```
port-channel load-balance dst-ip|dst-mac|src-dst-ip|
src-dst-mac|src-ip|src-mac
```

The variables are defined here:

src-mac	Specifies source MAC address as the load distribution method.
dst-mac	Specifies destination MAC address.
src-dst-mac	Specifies source address/destination MAC address.
src-ip	Specifies source IP address.
dst-ip	Specifies destination IP address.
src-dst-ip	Specifies source address/destination IP address.

To enter the Static Port Trunk Interface mode, you use the INTERFACE TRUNK command. You enter the INTERFACE keyword followed by the name of the trunk. The name of the trunk consists of the prefix "sa" (for static trunk) and the trunk's ID number. (If you do not know the ID number of the trunk, refer to "Displaying Static Port Trunks" on page 765.)

This example sets the load distribution method to destination MAC address for a static port trunk that has the ID number 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface sa4
awplus(config-if)# port-channel load-balance dst-mac
```

For reference information, refer to "PORT-CHANNEL LOAD-BALANCE" on page 769.

Removing Ports from Static Port Trunks or Deleting Trunks

To remove ports from a static port trunk, enter the Port Interface mode of the ports to be removed and issue the NO STATIC-CHANNEL-GROUP command. This example removes ports 4 and 5 from their current static port trunk assignment:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4,port1.0.5
awplus(config-if)# no static-channel-group
```

To delete a static port trunk, remove all its member ports. This example deletes a trunk that consists of member ports 15 to 17 and 21:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15-port1.0.17,port1.0.21
awplus(config-if)# no static-channel-group
```

Caution

To prevent the formation of loops in your network topology, do not remove ports from a static port trunk without first disconnecting their network cable. Network loops can result in broadcast storms that can adversely affect network performance.

Displaying Static Port Trunks

To display the member ports of static port trunks, use the SHOW STATIC-CHANNEL-GROUP command in the User Exec mode or Privileged Exec mode:

```
awplus# show static-channel-group
```

Here is an example of the information.

```
% Static Aggregator: sa1
% Member:
   port1.0.5
   port1.0.6
   port1.0.7
% Static Aggregator: sa2
% Member:
   port1.0.19
   port1.0.20
   port1.0.21
   port1.0.22
```

Figure 144. SHOW STATIC-CHANNEL-GROUP Command

To view the load distribution methods of static port trunks, display the running configuration with "SHOW RUNNING-CONFIG" on page 168.

Chapter 52

Static Port Trunk Commands

The static port trunk commands are summarized in Table 85 and described in detail within the chapter.

Table 85. Static Port Trunk Commands

Command	Mode	Description
“NO STATIC-CHANNEL-GROUP” on page 768	Port Interface	Removes ports from existing static port trunks and deletes trunks from the switch.
“PORT-CHANNEL LOAD-BALANCE” on page 769	Static Port Trunk Interface	Sets the load distribution methods of static port trunks.
“SHOW STATIC-CHANNEL-GROUP” on page 771	User Exec and Privileged Exec	Displays the specifications of the static port trunks.
“STATIC-CHANNEL-GROUP” on page 772	Port Interface	Creates a new static port trunk and adds ports to an existing static port trunk.

NO STATIC-CHANNEL-GROUP

Syntax

```
no static-channel-group
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to remove ports from static port trunks and to delete trunks. To delete a trunk, remove all its ports.

Caution
To prevent the formation of loops in your network topology, do not remove ports from a static port trunk without first disconnecting their network cable. Network loops can result in broadcast storms that can adversely affect network performance.

Note
You cannot leave a trunk with just one port. There must be a minimum of two ports in a trunk.

Example

These commands remove ports 22 and 23 from a static port trunk. If these are the only ports in the trunk, the trunk is deleted from the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.22-port1.0.23
awplus(config-if)# no static-channel-group
```

PORT-CHANNEL LOAD-BALANCE

Syntax

```
port-channel load-balance src-mac|dst-mac|src-dst-mac|src-
ip|dst-ip|src-dst-ip
```

Parameters

src-mac
Specifies source MAC address as the load distribution method.

dst-mac
Specifies destination MAC address.

src-dst-mac
Specifies source address/destination MAC address.

src-ip
Specifies source IP address.

dst-ip
Specifies destination IP address.

src-dst-ip
Specifies source address/destination IP address.

Mode

Static Port Trunk Interface mode

Description

Use this command to specify the load distribution methods of static port trunks. The load distribution methods determine the manner in which the switch distributes packets among the ports of a trunk.

This command is found in the Static Port Trunk Interface mode. To enter the mode, use the INTERFACE TRUNK command. The format of the command is the keyword INTERFACE followed by name of a trunk you want to configure. The name of a static port truck consists of "sa" followed by a trunk's ID number. You can configure just one trunk at a time.

Example

This example sets the load distribution method to destination MAC address for a trunk with an ID number 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface sa4
awplus(config-if)# port-channel load-balance dst-mac
```

SHOW STATIC-CHANNEL-GROUP

Syntax

```
show static-channel-group
```

Parameters

None

Modes

User Exec mode and Privileged Exec mode

Description

Use this command to display the member ports of static port trunks on the switch. An example of the command is shown in Figure 145.

```
% Static Aggregator: sa1
% Member:
   port1.0.5
   port1.0.6
   port1.0.7
% Static Aggregator: sa2
% Member:
   port1.0.19
   port1.0.20
   port1.0.21
   port1.0.22
```

Figure 145. SHOW STATIC-CHANNEL-GROUP Command

To view the load distribution methods of static port trunks, display the running configuration with "SHOW RUNNING-CONFIG" on page 168.

Example

This example displays the member ports of a static port trunk:

```
awplus# show static-channel-group
```

STATIC-CHANNEL-GROUP

Syntax

```
static-channel-group id_number
```

Parameters

id_number
Specifies an ID number of a static port trunk. The range is 1 to 32. You can specify just one ID number.

Mode

Port Interface mode

Description

Use this command to create new static port trunks and to add ports to existing trunks. To create a new trunk, specify an unused ID number. To add ports to an existing trunk, specify an ID number of an existing trunk.

Caution
Do not connect the network cables to the ports of the static port trunk until after you have created it. A network loop may result if you connect the cables beforehand, possibly resulting in a broadcast storm and poor network performance.

To create a new static port trunk, you have to assign it an ID number, in the range of 1 to 32. This number is used by the switch to identify trunks and to assign trunk names. A name of a trunk consists of the prefix “sa” followed by an ID number. For instance, if you assign a new trunk the ID number 5, its name will be “sa5.”

You should review the following information before creating a new static port trunk:

- When you create a new trunk, the settings of the lowest numbered port are copied to the other ports so that all the ports have the same settings. Consequently, you should examine and verify that the speed, duplex mode, and flow control settings of the lowest numbered port are correct for the network device to which the trunk will be connected.
- The ports of a trunk must be members of the same VLAN.

- Ports can be members of just one static port trunk at a time. A port that is already a member of a trunk cannot be added to another trunk until it is first removed from its current trunk assignment. To remove ports from static port trunks, see "NO STATIC-CHANNEL-GROUP" on page 768.

You should review the following information if you are adding ports to an existing trunk:

- If the port you are adding will be the lowest numbered port in the trunk, its parameter settings will overwrite the settings of the existing ports in the trunk. Consequently, you check to see if its settings are appropriate prior to adding it to the trunk. If the port will not be the lowest numbered port, its settings are changed to match the settings of the existing ports in the trunk.
- If the port to be added to a trunk is already a member of another static trunk, you must first remove it from its current trunk assignment. To remove ports from a trunk, see "NO STATIC-CHANNEL-GROUP" on page 768.

Example

This example creates a new static port trunk of ports 11 and 12, with the ID number 2. If there is already a static port trunk with the same ID number the commands add the ports to it:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11-port1.0.12
awplus(config-if)# static-channel-group 2
```

Chapter 53

Link Aggregation Control Protocol (LACP)

This chapter covers the following topics:

Overview

The Link Aggregation Control Protocol (LACP) is used to increase the bandwidth between the switch and other LACP-compatible devices by grouping ports together to form single virtual links.

LACP trunks are similar in function to static port trunks, but they are more flexible. The implementations of static trunks tend to be vendor specific and so may not always be compatible. In contrast, the implementation of LACP in the switch is compliant with the IEEE 802.3ad standard. It is interoperable with equipment from other vendors that also comply with the standard. This makes it possible to create LACP trunks between the switch and network devices from other manufacturers.

The main component of an LACP trunk is an aggregator. An aggregator is a group of ports on the switch. The ports of an aggregator are further grouped into a trunk, referred to as an aggregate trunk. An aggregate trunk can consist of a maximum of 8 ports on the switch.

An aggregator can have only one trunk. You have to create a separate aggregator for each trunk on the switch. The switch up can support up to a total of 32 static and LACP aggregate trunks at a time

LACP System Priority

When two devices form an aggregate trunk, a conflict may occur if there is a difference in their LACP implementations. For example, the two devices might not support the same number of active ports in an aggregate trunk.

If a conflict does occur, the two devices must resolve the problem and decide whose LACP settings take precedence. This is accomplished with the system LACP priority value. A hexadecimal value of from 1 to FFFF, this parameter is used whenever the devices encounter a conflict creating a trunk. The lower the number, the higher the priority. The settings on the device with the higher priority take precedence over the settings on the other device. If both devices have the same system LACP priority value, the settings on whichever switch has the lowest MAC address takes precedence.

This parameter is useful if the switch and the other 802.3ad-compliant device have different LACP trunking capabilities. You should give the other device the higher priority if its LACP capability is less than the AT-FS970M Series switch capability. That way, the other device's settings are used by both devices to form the trunk.

For example, a conflict could occur in an aggregate trunk of six links if the other 802.3ad-compliant device supported just four active links at one time. The AT-FS970M Series switch would activate all six links, while the other device would activate only four ports. But by giving the other device the higher priority, the conflict is avoided because the AT-FS970M Series switch would use only four active links.

Base Port

The lowest numbered port in an aggregator is referred to as the base port. You cannot change the base port of an aggregator. You can neither delete it from an aggregator nor add any ports that are below it. For example, if an aggregator consists of ports 5 to 12, you cannot delete port 5 because it is the base port, and you are not allowed to add ports 1 to 4 to the aggregator. If you need to change the base port of an aggregator, you must delete and recreate the aggregator to which it belongs.

Load Distribution Methods

The load distribution method determines the manner in which the switch distributes the traffic across the active ports of an aggregate trunk. The method is assigned to an aggregator and applies to the aggregate trunk in it. For further information, refer to "Load Distribution Methods" on page 758.

Guidelines

Here are the LACP guidelines:

- LACP must be activated on both the switch and the other device.
- The other device must be 802.3ad-compliant.
- An aggregator can consist of any number of ports.
- The switch supports up to eight active ports in an aggregate trunk at a time.
- The switch can support up to a total of 32 static and LACP aggregate trunks at a time. An LACP trunk is countered against the maximum number of trunks only when it is active.
- The ports of an aggregate trunk must be the same medium type: all twisted pair ports or all fiber optic ports.
- The ports of a trunk can be consecutive (for example ports 5 to 9) or nonconsecutive (for example, ports 4, 8, 11, 20).
- A port can belong to only one aggregator at a time.
- A port cannot be a member of an aggregator and a static trunk at the same time.
- The ports of an aggregate trunk must be untagged members of the same VLAN.
- 10/100/1000Base-TX twisted pair ports must be set to Auto-Negotiation or 100 Mbps, full-duplex mode. LACP trunks are not supported in half-duplex mode.
- 100Base-FX fiber optic ports must be set to full-duplex mode.
- Only those ports that are members of an aggregator transmit LACPDU packets.
- The lowest numbered port in an aggregator is called the base port. You cannot add ports that are below the base port of an aggregator. For example, you cannot add ports 1 to 3 to an aggregator that consists of ports 4 to 8. You must delete and recreate an aggregator to change its base port.

- The load distribution method is applied at the aggregator level. For further information, refer to “Load Distribution Methods” on page 758.
- To function as a member of an aggregator, a port must receive LACPDU packets from a remote network device. A port that does not receive LACPDU packets while it is a member of an aggregate trunk functions as a regular Ethernet port, forwarding network traffic while also continuing to transmit LACPDU packets.
- The port with the highest priority in an aggregate trunk carries broadcast packets and packets with an unknown destination.
- Prior to creating an aggregate trunk between an Allied Telesis device and another vendor’s device, refer to the vendor’s documentation to determine the maximum number of active ports the device supports. If the number is less than eight, the maximum number for the AT-FS970M Series switch, you should assign the vendor’s device a higher system LACP priority than the switch. If it is more than eight, assign the AT-FS970M Series switch the higher priority. This will avoid a possible conflict between the devices if some ports are placed in the standby mode when the devices create the trunk. For background information, refer to “LACP System Priority” on page 776.
- LACPDU packets are transmitted as untagged packets.

Creating New Aggregators

To create a new aggregator, move to the Port Interface mode of the aggregator's member ports and issue the CHANNEL-GROUP command, which has this format:

```
channel-group id_number
```

The ID_NUMBER parameter has a range of 1 to 32. Each aggregator must be assigned a unique ID number.

If the ports of a new aggregator are already members of other aggregators, the switch automatically removes them from their current assignments before adding them to the new aggregator.

Caution

To avoid creating a loop in your network topology, do not connect the network cables to the ports until after you have created the aggregator with the CHANNEL-GROUP command.

These commands create a new aggregator of ports 11 and 12, with the ID number 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11-port1.0.12
awplus(config-if)# channel-group 4
```

Setting the Load Distribution Method

The load distribution method determines the manner in which the switch distributes the egress packets among the active ports of an aggregator. The packets can be distributed by source MAC or IP address, destination MAC or IP address, or by both source and destination addresses. The distribution methods are discussed in “Load Distribution Methods” on page 758.

The load distribution method of an aggregator is set with the PORT-CHANNEL LOAD-BALANCE command in the LACP Port Trunk Interface mode. To enter the mode, use the INTERFACE PO command from the Global Configuration mode, in this format:

```
interface po id_number
```

You specify the intended aggregator by adding its ID number as a suffix to PO.

Here is the format of the PORT-CHANNEL LOAD-BALANCE command:

```
port-channel load-balance src-mac|dst-mac|src-dst-mac|
src-ip|dst-ip|src-dst-ip
```

In this example, an aggregator with the ID number 5 is assigned the source MAC address distribution method:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface po5
awplus(config-if)# port-channel load-balance src-mac
```

This example assigns an aggregator with the ID number 17 the source destination MAC address distribution method:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface po17
awplus(config-if)# port-channel load-balance src-dst-mac
```

Adding Ports to Aggregators

The command to add ports to existing aggregators is the same command to create new aggregators, the CHANNEL-GROUP command in the Port Interface mode. To use the command, move to the Port Interface mode of the ports you want to add to an aggregator and issue the command.

Note
You cannot add to an aggregator any ports that are below the base port. For instance, you cannot add any ports below port 15 to an aggregator that has ports 15 to 22.

When you enter the command, specify the ID number of the existing aggregator to which the new ports are to be assigned. If you do not know the ID number, use the SHOW ETHERCHANNEL DETAIL command.

If the new ports of an aggregator are already members of other aggregators, you do not have to remove them from their current assignments before adding them to a different aggregator. The management software does that automatically.

Caution
To avoid creating a loop in your network topology, do not connect the network cables to the aggregator ports until you have performed the CHANNEL-GROUP command.

These commands add ports 18 and 23 to the aggregator with ID number 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.18,port1.0.23
awplus(config-if)# channel-group 5
```

Removing Ports from Aggregators

To remove ports from an aggregator, use the NO CHANNEL-GROUP command, in the Port Interface mode. Move to the Port Interface mode for those ports you want to remove from an aggregator and enter the command. You can remove ports from only one aggregator at a time.

Caution

Do not remove a port from an aggregator without first disconnecting the network cable. Leaving the network cable connected may result in a network loop, which can cause a broadcast storm.

Note

You cannot remove the base port of an aggregator. The base port is the lowest-numbered port of an aggregator. For example, you cannot delete port 7 from an aggregator consisting of ports 7 to 12. Removing the base port requires deleting and recreating the aggregator to which the base port belongs.

These commands delete ports 11 and 12 from an aggregator:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11-port1.0.12
awplus(config-if)# no channel-group
```

Deleting Aggregators

To delete an aggregator, remove all its ports with the NO CHANNEL-GROUP command, in the Port Interface mode.

Caution

Do not delete an aggregator without first disconnecting the network cables from its ports. Leaving the network cables connected may result in a network loop, which can cause a broadcast storm.

These commands delete an aggregator consisting of ports 17, 22 and 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17,port1.0.22,port1.0.23
awplus(config-if)# no channel-group
```

Displaying Aggregators

There are five SHOW commands for LACP. Two of them are mentioned here. For descriptions of all the commands, refer to Chapter 54, “LACP Commands” on page 787.

The first command is the SHOW ETHERCHANNEL DETAIL command in the Privileged Exec mode. It displays configuration information and operation status about the aggregators on the switch. Included are the ports of the individual aggregators, their link states, and the load distribution methods of the aggregators. Here is the command:

```
awplus# show etherchannel detail
```

Here is an example of the information.

```
Aggregator # 1 ..... po1

Mac address: (00-15-77-d8-43-60,0000)
Admin Key: 0xff01 - Oper Key: 0x0101
Receive link count: 4 - Transmit link count: 4
Individual: 0 - Ready: 0
Distribution Mode .. MACBoth
Partner LAG: (0080,00-a0-d2-00-94-24,F601)
   Link: Port 1.0.1   sync
   Link: Port 1.0.2   sync
   Link: Port 1.0.3   sync
   Link: Port 1.0.4   sync

Aggregator # 22..... po22

Mac address: (00-15-77-d8-43-60,0000)
Admin Key: 0xff16 - Oper Key: 0x1616
Receive link count: 0 - Transmit link count: 0
Individual: 0 - Ready: 0
Distribution Mode .. MACDest
Partner LAG: (0000,00-00-00-00-00-00,0000)
   Link: Port 1.0.22  disabled
   Link: Port 1.0.23  disabled
   Link: Port 1.0.24  disabled
```

Figure 146. SHOW ETHERCHANNEL DETAIL

The only information the SHOW ETHERCHANNEL DETAIL command does not include is the LACP system priority value. That value can been seen with the SHOW LACP SYS-ID command, also in the Privileged Exec mode. Here is the command:

```
awplus# show lacp sys-id
```

Here is an example of the information.

```
System Priority: 0x0080 (32768)
Mac Address: EC-CD-6D-1E-52-28
```

Figure 147. SHOW LACP SYS-ID Command

It should be mentioned that while the system priority value is set as an integer with the LACP SYSTEM-PRIORITY command, this command displays it in hexadecimal format.

Chapter 54
LACP Commands

The LACP port trunk commands are summarized in Table 86 and described in detail within the chapter.

Table 86. LACP Port Trunk Commands

Command	Mode	Description
“CHANNEL-GROUP” on page 788	Port Interface	Creates new aggregators and adds ports to existing aggregators.
“LACP SYSTEM-PRIORITY” on page 790	Global Configuration	Sets the LACP system priority value for the switch.
“NO CHANNEL-GROUP” on page 791	Port Interface	Removes ports from aggregators and deletes aggregators.
“PORT-CHANNEL LOAD-BALANCE” on page 792	LACP Port Trunk Interface	Sets the load distribution method.
“SHOW ETHERCHANNEL” on page 794	Privileged Exec	Displays the ports of the aggregators on the switch.
“SHOW ETHERCHANNEL DETAIL” on page 795	Privileged Exec	Displays the states of the ports of the aggregators.
“SHOW ETHERCHANNEL SUMMARY” on page 797	Privileged Exec	Displays detailed information about the aggregators.
“SHOW LACP SYS-ID” on page 798	Privileged Exec	Displays the LACP priority value and MAC address of the switch.
“SHOW PORT ETHERCHANNEL” on page 799	Privileged Exec	Displays the LACP port information.

CHANNEL-GROUP

Syntax

```
channel-group id_number
```

Parameters

id_number
Specifies the ID number of a new or an existing aggregator. The range is 1 to 32.

Mode

Port Interface mode

Description

Use this command to create new aggregators or to add ports to existing aggregators.

The lowest numbered port in an aggregator is called the base port. When adding ports to an existing aggregator, you cannot add ports that are below the base port. For example, you cannot add ports 1 to 6 to an existing aggregator that consists of ports 7 to 12. You have to delete and recreate an aggregator to change its base port.

To review the guidelines to creating or modifying aggregators, refer to “Guidelines” on page 777.

Caution
To prevent creating a loop in your network topology, do not connect the network cables to the ports until after you have created the aggregator. Network loops can cause broadcast storms that can lead to poor network performance.

Confirmation Command

“SHOW ETHERCHANNEL” on page 794

Examples

These commands create a new aggregator consisting of ports 11 to 16. The ID number of the aggregator is 2.

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11-port1.0.16
awplus(config-if)# channel-group 2
```

This example adds port 15 to an existing aggregator that has the ID number 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# channel-group 4
```

LACP SYSTEM-PRIORITY

Syntax

```
lacp system-priority priority
```

Parameters

priority
: Specifies the LACP system priority value for the switch. The range is 1 to 65535.

Mode

Global Configuration mode

Description

Use this command to set the LACP priority of the switch. The switch uses the LACP priority to resolve conflicts with other network devices when it creates aggregate trunks.

Confirmation Command

"SHOW LACP SYS-ID" on page 798

Note
The value is set as an integer with this command and displayed in hexadecimal format by the SHOW LACP SYS-ID command.

Example

This example assigns the system priority 200 to the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# lacp system-priority 200
```

NO CHANNEL-GROUP

Syntax

```
no channel-group
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to remove ports from aggregators and to delete aggregators. To delete an aggregator, remove all its ports.

You cannot remove the base port of the aggregator. Changing the base port requires deleting and recreating the aggregator.

Caution
To prevent creating a loop in your network topology, you should not remove ports from an aggregator without first disconnecting their network cables. Network loops can cause broadcast storms that can lead to poor network performance.

Confirmation Command

"SHOW ETHERCHANNEL" on page 794

Example

These commands delete ports 11 and 12 from an aggregator. The aggregator is deleted if these are its only ports:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11-port1.0.12
awplus(config-if)# no channel-group
```

PORT-CHANNEL LOAD-BALANCE

Syntax

```
port-channel load-balance src-mac|dst-mac|src-dst-mac|
src-ip|dst-ip|src-dst-ip
```

Parameters

src-mac
Specifies source MAC address as the load distribution method.

dst-mac
Specifies destination MAC address.

src-dst-mac
Specifies source address/destination MAC address.

src-ip
Specifies source IP address.

dst-ip
Specifies destination IP address.

src-dst-ip
Specifies source address/destination IP address.

Mode

LACP Port Trunk Interface mode

Description

Use this command to set the load distribution methods of aggregators. An aggregator can have only one load distribution method. The load distribution methods are the same as those for static port trunks described in “Load Distribution Methods” on page 758.

To enter the LACP Port Trunk Interface mode, from the Global Configuration mode, enter the INTERFACE PO command and the ID number of the aggregator. For example, to enter the mode for the aggregator that has the ID number 2, you enter:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface po2
```

Confirmation Command

"SHOW ETHERCHANNEL DETAIL" on page 795

Example

This example sets the load distribution method to source MAC address for the LACP trunk that has the ID number 22:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface po22
awplus(config-if)# port-channel load-balance src-mac
```

SHOW ETHERCHANNEL

Syntax

```
show etherchannel id_number
```

Parameters

id_number
Specifies the ID number of the aggregator.

Mode

Privileged Exec mode

Description

Use this command to display the ports of specific aggregators on the switch. Figure 148 illustrates the information.

```
Aggregator #2 .... po2

Admin Key: 0xff01 - Oper Key: 0x0101
    Link: Port1.0.2      sync
    Link: Port1.0.3      sync
    Link: Port1.0.4      sync
    Link: Port1.0.5      sync
    Link: Port1.0.6      sync
```

Figure 148. SHOW ETHERCHANNEL Command

Example

This example displays the ports of the aggregator with the ID number 22:

```
awplus# show etherchannel 22
```

SHOW ETHERCHANNEL DETAIL

Syntax

```
show etherchannel detail
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display detailed information about the aggregators on the switch. Figure 149 illustrates the information.

```
Aggregator # 1 ..... po1

Mac address: (00-15-77-d8-43-60,0000)
Admin Key: 0xff01 - Oper Key: 0x0101
Receive link count: 4 - Transmit link count: 4
Individual: 0 - Ready: 0
Distribution Mode .. MACBoth
Partner LAG: (0080,00-a0-d2-00-94-24,F601)
Link: Port 1.0.1     sync
Link: Port 1.0.2     sync
Link: Port 1.0.3     sync
Link: Port 1.0.4     sync

Aggregator # 22..... po22

Mac address: (00-15-77-d8-43-60,0000)
Admin Key: 0xff16 - Oper Key: 0x1616
Receive link count: 0 - Transmit link count: 0
Individual: 0 - Ready: 0
Distribution Mode .. MACDest
Partner LAG: (0000,00-00-00-00-00-00,0000)
Link: Port 1.0.22    disabled
Link: Port 1.0.23    disabled
Link: Port 1.0.24    disabled
```

Figure 149. SHOW ETHERCHANNEL DETAIL Command

Example

This example displays detailed information about aggregators:

```
awplus# show etherchannel detail
```

SHOW ETHERCHANNEL SUMMARY

Syntax

```
show etherchannel summary
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the states of the member ports of the aggregators. Figure 150 illustrates the information.

```
Aggregator #2 .... po2

Admin Key: 0xff01 - Oper Key: 0x0101
    Link: Port1.0.2      sync
    Link: Port1.0.3      sync
    Link: Port1.0.4      sync
    Link: Port1.0.5      sync
    Link: Port1.0.6      sync

Aggregator #21 .... po21

Admin Key: 0xff16 - Oper Key: 0x1616
    Link: Port1.0.21     disabled
    Link: Port1.0.22     disabled
    Link: Port1.0.23     disabled
    Link: Port1.0.24     disabled
    Link: Port1.0.25     disabled
```

Figure 150. SHOW ETHERCHANNEL SUMMARY Command

Example

This example displays the states of the aggregator's member ports:

```
awplus# show etherchannel summary
```

SHOW LACP SYS-ID

Syntax

```
show lacp sys-id
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the LACP priority value and MAC address of the switch. Figure 151 provides an example of the display.

```
System Priority: 0x0080 (32768)
Mac Address: EC-CD-6D-1E-52-28
```

Figure 151. SHOW LACP SYS-ID Command

Note
The LACP priority value is set as an integer with “LACP SYSTEM-PRIORITY” on page 790 and displayed in hexadecimal format by this command.

Example

This example displays the LACP priority value and MAC address:

```
awplus# show lacp sys-id
```

SHOW PORT ETHERCHANNEL

Syntax

```
show port etherchannel [interface port]
```

Parameters

port

Specifies the port of an aggregator. You can display more than one port at a time.

Mode

Privileged Exec mode

Description

Use this command to display the LACP port information. Figure 152 illustrates the information. Refer to the IEEE 802.3ad standard for definitions of the fields.

```
Link: port: 1.0.5
Aggregator # 2
Receive machine state: Defaulted
Periodic Transmission machine state: Slow periodic
Mux machine state: Detached
ACTOR                                  PARTNER
=========================================================================
Actor Port ............. 05           Partner Port ......... 00
Selected ............... UNSELECTED   Partner System ....... 00-00-00-00-00-00
Oper Key ............... 0x0001       Oper Key  ............. 0x0000
Oper Port Priority  .... 0x0005       Oper Port Priority ... 0x0000
Individual ............. NO           Individual ........... YES
Synchronized............ NO           Synchronized.......... NO
Collecting  ............ NO           Collecting ........... NO
Distributing ........... NO           Distributing ......... NO
Defaulted .............. YES          Defaulted ............ NO
Expired ................ NO           Expired .............. NO
Actor Churn   .......... NO           Partner Churn ........ NO
```

Figure 152. SHOW PORT ETHERCHANNEL Command

Example

This example displays the LACP port information for port 5:

```
awplus# show port etherchannel port1.0.5
```

Section VII

Spanning Tree Protocols

This section contains the following chapters:

Chapter 55

STP, RSTP and MSTP Protocols

This chapter covers the following topics:

Overview

The Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP) and Multiple Spanning Tree Protocol (MSTP) guard against the formation of loops in an Ethernet network topology. A topology has a loop when two or more nodes can transmit packets to each other over more than one data path. The problem that data loops pose is that packets can become caught in repeating cycles, referred to as broadcast storms, that needlessly consume network bandwidth and that can significantly reduce network performance.

Spanning tree prevents loops from forming by ensuring that only one path exists between the end nodes in your network. Where multiple paths exist, these protocols place the extra paths in a standby or blocking mode.

Spanning tree can also activate redundant paths if primary paths go down. So not only do these protocols guard against multiple links between segments and the risk of broadcast storms, but they can also maintain network connectivity by activating backup redundant paths.

One of the primary differences between the two protocols is in the time each takes to complete the process referred to as convergence. When a change is made to the network topology, such as the addition of a new bridge, a spanning tree protocol must determine whether there are redundant paths that must be blocked to prevent data loops, or activated to maintain communications between the various network segments. This is the process of convergence.

With STP, convergence can take up to a minute to complete in a large network. This can result in the loss of communication between various parts of the network during the convergence process, and the subsequent lost of data packets.

RSTP is much faster and is the default spanning tree mode. It can complete a convergence in seconds to greatly diminish the possible impact the process can have on your network.

MSTP is similar to RSTP in its efficiency of convergence. It also allows more than one instance of spanning tree to be active at a time. See “Multiple Spanning Tree Protocol (MSTP)” on page 881 for more information about how MSTP operates in an environment of multiple spanning tree instances.

The STP implementation on the switch complies with the IEEE 802.1d standard. The RSTP implementation complies with the IEEE 802.1w standard. The MSTP feature complies with the IEEE 802.1s standard. The following subsections provide an overview the basic features of STP, RSTP and MSTP, and define the different parameters that you can adjust.

Bridge Priority and the Root Bridge

The first task that bridges perform when a spanning tree protocol is activated on a network is the selection of a *root bridge*. A root bridge distributes network topology information to the other network bridges and is used by the other bridges to determine if there are redundant paths in the network.

A root bridge is selected by the *bridge priority* number, also referred to as the bridge identifier. The bridge with the lowest bridge priority number in the network is selected as the root bridge. If two or more bridges have the same bridge priority number, of those bridges, the one with the lowest MAC address is designated as the root bridge.

You can change the bridge priority number on the switch. You can designate which switch on your network you want as the root bridge by giving it the lowest bridge priority number. You might also consider which bridge should function as the backup root bridge in the event you need to take the primary root bridge offline, and assign that bridge the second lowest bridge identifier number.

The bridge priority has a range 0 to 61,440 in increments of 4,096. A lower priority number indicates a greater likelihood of the switch becoming the root bridge. The priority values can be set only in increments of 4,096. The default value is 32,768.

Path Costs and Port Costs

After the root bridge has been selected, the bridges determine if the network contains redundant paths and, if one is found, select a preferred path while placing the redundant paths in a backup or blocking state.

A bridge that has only one path between itself and the root bridge is referred to as the *designated bridge*. And the port through which it is communicating with the root bridge is referred to as the *root port*.

If redundant paths exist, the bridges that are a part of the paths must determine which path will be the primary, active path, and which path(s) will be placed in the standby, blocking mode. This is accomplished by a determination of *path costs*. The path offering the lowest cost to the root bridge becomes the primary path, and the redundant paths are placed in the blocking state.

Path cost is determined by evaluating *port costs*. Every port on a bridge participating in STP and RSTP has a cost associated with it. The cost of a port on a bridge is typically based on port speed. The faster the port, the lower the port cost. The exception to this is the ports on the root bridge, where all ports have a port cost of 0.

Path cost is simply the sum of the port costs between a bridge and the root bridge.

The path cost of a port is adjustable on the switch. The range is 1 to 200000000.

Port Priority

If two paths have the same port cost, the bridges must select a preferred path. In some instances this can involve the use of the *port priority* parameter. This parameter is used as a tie breaker when two paths have the same cost.

The port priority has a range from 0 to 240 in increments of 16. The priority values can be set only in increments of 16. The default value is 128, which is increment 8.

Forwarding Delay and Topology Changes

If there is a change in the network topology due to a failure, removal, or addition of any active components, the active topology also changes. This may trigger a change in the state of some blocked ports. However, a change in a port state is not activated immediately.

It might take time for the root bridge to notify all bridges that a topology change has occurred, especially if it is a large network. If a topology change is made before all the bridges have been notified, a temporary data loop could occur, and that could adversely impact network performance.

To forestall the formation of temporary data loops during topology changes, a port designated to change from blocking to forwarding passes through two additional states—listening and learning—before beginning to forward frames. The amount of time a port spends in these states is set by the forwarding delay value. This value states the amount of time that a port spends in the listening and learning states prior to changing to the forwarding state.

The forwarding delay value is adjustable on the switch. The appropriate value for this parameter depends on a number of variables, with the size of your network being a primary factor. For large networks, you should specify a value large enough to allow the root bridge sufficient time to propagate a topology change throughout the entire network. For small networks, you should not specify a value so large that a topology change is needlessly delayed, which could result in the delay or loss of some data packets.

Note
The forwarding delay parameter applies only to ports on the switch that are operating STP-compatible mode.

Hello Time and Bridge Protocol Data Units (BPDU)

The bridges that are part of a spanning tree domain communicate with each other using a bridge broadcast frame that contains a special section devoted to carrying STP or RSTP information. This portion of the frame is referred to as the bridge protocol data unit (BPDU). When a bridge is brought online, it issues a BPDU in order to determine whether a root bridge has already been selected in the network, and if not, whether it has the lowest bridge priority number of all the bridges and should therefore become the root bridge.

The root bridge periodically transmits a BPDU to determine whether there have been any changes to the network topology and to inform other bridges of topology changes. The frequency with which the root bridge sends out a BPDU is called the hello time. This is a value that you can set on the switch. The interval is measured in seconds and has a default setting of two seconds. Consequently, if the switch is selected as the root bridge of a spanning tree domain, it transmits a BPDU every two seconds.

Point-to-Point and Edge Ports

Part of the task of configuring RSTP or MSTP is defining the port types on the switch. This relates to the devices connected to the ports. With the port types defined, RSTP or MSTP can reconfigure a network much quicker than STP when a change in network topology is detected.

> **Note**
> This section applies only to RSTP and MSTP.

There are two possible selections:

- Point-to-point port
- Edge port

A port that is operating in full-duplex mode is functioning as a point-to-point port. Figure 153 illustrates two switches that are connected with one data link. With the link operating in full-duplex, the ports are point-to-point ports.

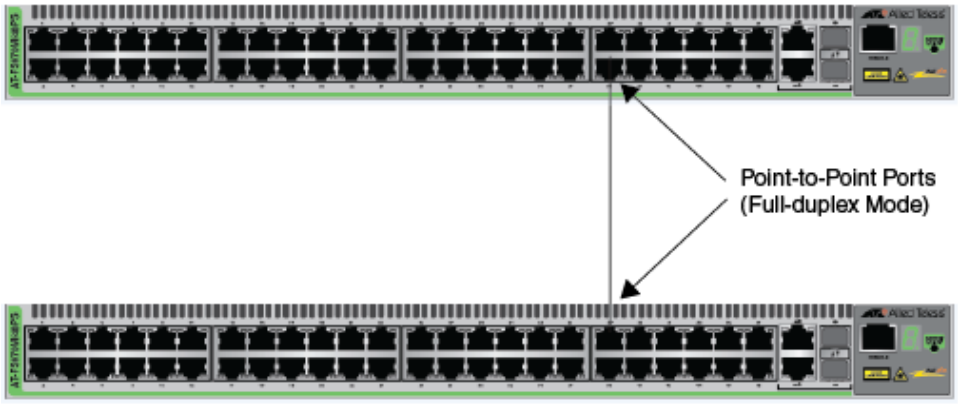

Figure 153. Point-to-Point Ports

If a port is operating in half-duplex mode and is not connected to any further bridges that are participating in spanning tree, then the port is an edge port. Figure 154 on page 811 illustrates an edge port on the switch. The port is connected to an Ethernet hub, which in turn is connected to a series of Ethernet workstations. This is an edge port because it is connected to a device that has no participating RSTP or MSTP devices.

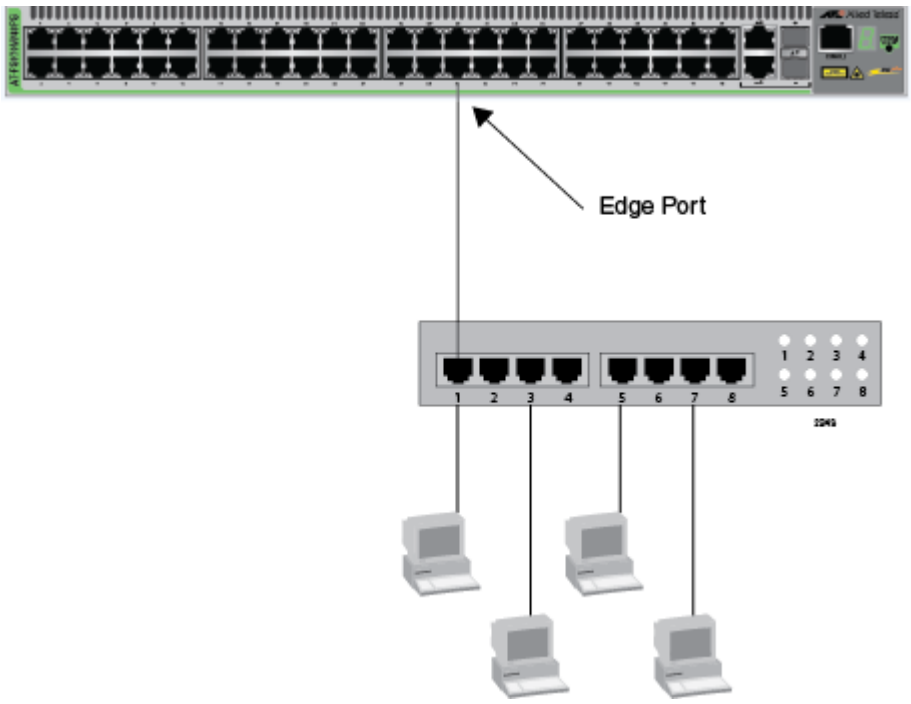

Figure 154. Edge Port

A port can be both a point-to-point and an edge port at the same time. It operates in full-duplex and has no spanning tree devices connected to it. Figure 155 illustrates a port functioning as both a point-to-point and edge port.

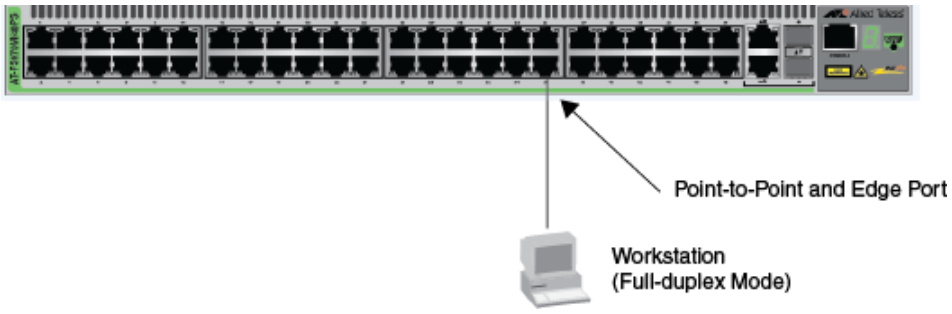

Figure 155. Point-to-Point and Edge Port

Determining whether a bridge port is point-to-point, edge, or both, can be a bit confusing. For that reason, do not change the default values for this RSTP feature unless you have a good grasp of the concept. In most cases, the default values work well.

Mixed STP and RSTP Networks

RSTP IEEE 802.1w is fully compliant with STP IEEE 802.1d. A network can have both protocols. If both RSTP and STP are present in a network, they operate together to create a single spanning tree domain. Given this, if you decide to activate spanning tree on the switch, there is no reason not to use RSTP, even if the other switches are running STP. The switch combines its RSTP with the STP on the other switches by monitoring the traffic on the ports for BPDU packets. Ports that receive RSTP BPDU packets operate in RSTP mode while ports receiving STP BPDU packets operate in STP mode.

Spanning Tree and VLANs

STP and RSTP support a single-instance spanning tree that encompasses all the ports on the switch. If the ports are divided into different VLANs, the spanning tree protocol crosses the VLAN boundaries. This point can pose a problem in networks that contain multiple VLANs that span different switches and that are connected with untagged ports. In this situation, STP and RSTP might block a data link if they detect a data loop, causing fragmentation of your VLANs.

This issue is illustrated in Figure 156. Two VLANs, Sales and Production, span two switches. Two links consisting of untagged ports connect the separate parts of each VLAN. If STP or RSTP is activated on the switches, one of the links is disabled because the links form a loop. In the example, the port on the top switch that links the two parts of the Production VLAN is changed to the block state. This leaves the two parts of the Production VLAN unable to communicate with each other.

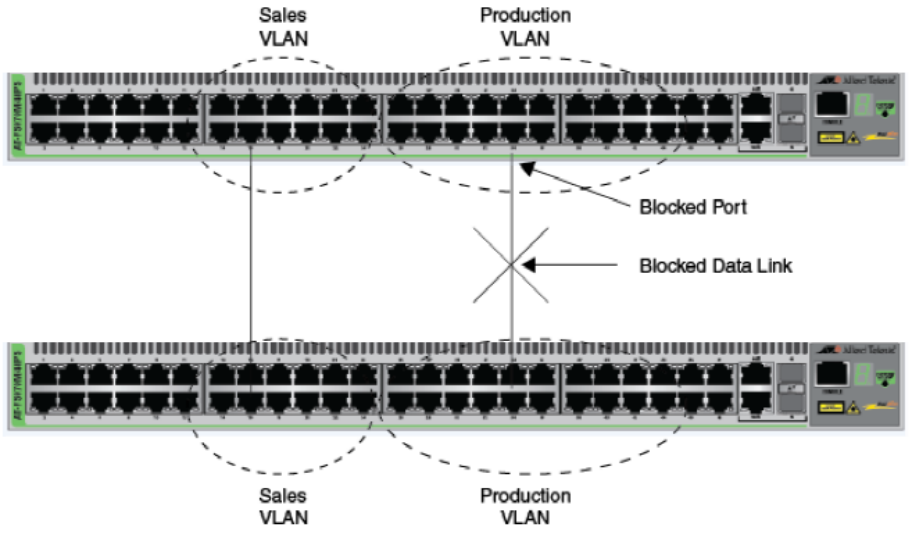

Figure 156. VLAN Fragmentation

You can avoid this problem by not activating spanning tree or by connecting VLANs using tagged instead of untagged ports. (For information about tagged and untagged ports, refer to Chapter 62, "Port-based and Tagged VLANs" on page 927.)

RSTP and MSTP BPDU Guard

This feature monitors the RSTP or MSTP edge ports on the switch for BPDU packets. Edge ports that receive BPDU packets are disabled by the switch. The benefit of this feature is that it prevents the use of edge ports by RSTP or MSTP devices. This reduces the possibility of unwanted changes to a network topology.

Note
This section applies only to RSTP and MSTP.

When RSTP or MSTP detects a loop in a network topology, it performs a process called convergence in which the spanning tree devices identify the ports to be blocked to prevent the loop. The length of time the process requires depends on a number of factors, including the number of devices and ports in the domain. Long convergence processes can affect network performance because areas of a network may be isolated while the devices check for loops and enable or disable ports.

You can decrease the amount of time of the convergence process by designating edge ports on the switches. These ports are connected to devices that are at the edge of a network, such as workstations and printers. The advantages of edge ports are that they typically do not participate in the convergence process and that they immediately transition to the forwarding state, skipping the intermediate listening and learning states.

Edge ports, however, can leave a spanning tree domain vulnerable to unwanted topology changes. This can happen if someone connects an RSTP or MSTP device to an edge port, causing the other devices in the domain to perform the convergence process to integrate the new device into the spanning tree domain. If the new device assumes the role of root bridge, the new topology might be undesirable. In the worst case scenario, someone could use an edge port to introduce false BPDUs into a network to deliberately initiate a change.

The BPDU guard feature lets you protect your network from unnecessary convergences by preventing the use of edge ports by RSTP or MSTP devices. When this feature is active on the switch, any edge port that receives BPDU packets is automatically disabled, preventing the initiation of the convergence process. You are notified of the event with an SNMP trap. An edge port remains disabled until you enable it again with the management software, such as with the ENABLE SWITCH PORT command in the command line.

Here are the guidelines to this feature:

- BPDU guard is configured for each port and has only two possible settings: enabled or disabled. The default setting is disabled.
- This feature is supported on the base ports of the switch and any fiber optic transceivers installed in the unit.

Note
A port disabled by the BPDU guard feature remains in that state until you enable it with the management software. If a port is still receiving BPDUs, you should disconnect the network cable before enabling it to prevent the feature from disabling the port again.

STP, RSTP, MSTP Loop Guard

Although spanning tree is designed to detect and prevent the formation of loops in a network topology, it is possible in certain circumstances for the protocol to inadvertently create loops. This can happen in the unlikely situation where a link between two spanning tree devices remains active when there is an cessation of BPDUs because of a hardware or software problem. The loop guard feature is designed to prevent the formation of loops in this situation.

Note
The Loop Guard feature is supported in STP, RSTP, and MSTP.

Network devices running spanning tree regularly transmit BPDUs to discover the topology of a network and to the search for loops. These packets are used by the devices to identify redundant physical paths to the root bridge and, where loops exist, to determine the ports to be blocked.

The proper operation of spanning tree relies on the flow of these packets. If there is a hardware or software failure that interrupts their transmission or reception, it is possible the protocol might mistakenly unblock one or more ports in the spanning tree domain, causing a network loop.

The loop guard feature protects against this type of failure by monitoring the ports on the switch for BPDUs from the other RSTP devices. If a port stops receiving BPDUs without a change to its link state (that is the link on a port stays up), the switch assumes that there is a problem with RSTP on the other device and takes action depending on a port's role in the spanning tree domain. If the event happens on an alternate port in the blocking state, the port is kept in that state. If this occurs on a root or designated port in the forwarding state, the port's state is changed to the blocking state.

The switch activates loop guard only when there is a cessation in the flow of BPDUs on a port whose link state has not changed. A port that never receives BPDUs will not be affected by this feature.

A port that loop guard has placed in the blocking state remains in that state until it begins to receive BPDUs again or you reset the switch. Disconnecting the port, disabling or enabling a port with the management software, or even disabling loop guard does not change a port's blocking state.

If a loop guard event occurs during a local or remote management session, you will see this message displayed on the screen:

```
Loop Guard is triggered
```

If you configured the SNMP community strings on the switch, an SNMP trap is sent to your management workstations to notify you of the event. However, this event does not generate an entry in the switch's log.

This feature is supported on the base ports of the switch as well as on any fiber optic transceivers installed in the unit.

The following figures illustrate this feature. The first figure shows spanning tree under normal operations in a network of three switches that have been connected to form a loop. To block the loop, switch 3 designates port 14 as an alternate port and places it in the blocking or discarding state.

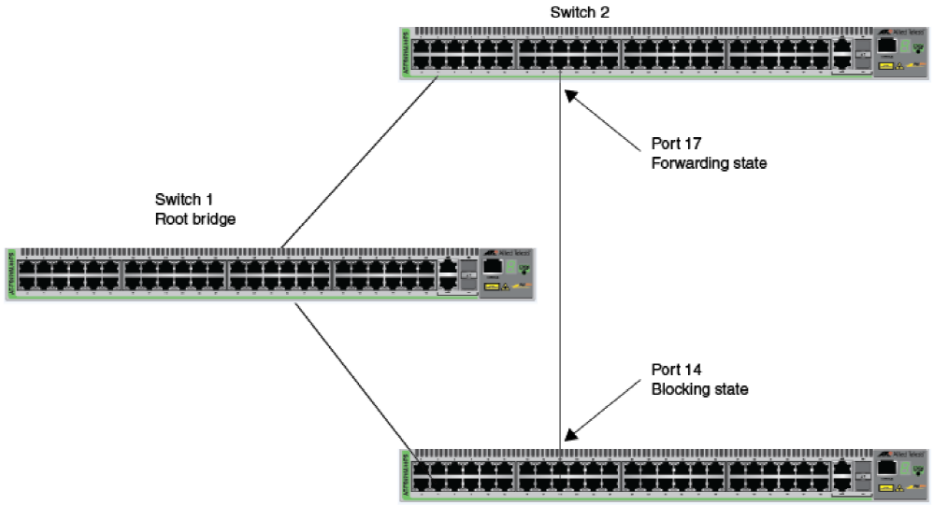

Figure 157. Loop Guard Example 1

If port 17 on switch 2 stops transmitting BPDUs, port 14 on switch 3 transitions from the blocking state to the forwarding state because the switch assumes that the device connected to the port is no longer an RSTP device. The result is a network loop, as illustrated in Figure 158 on page 818.

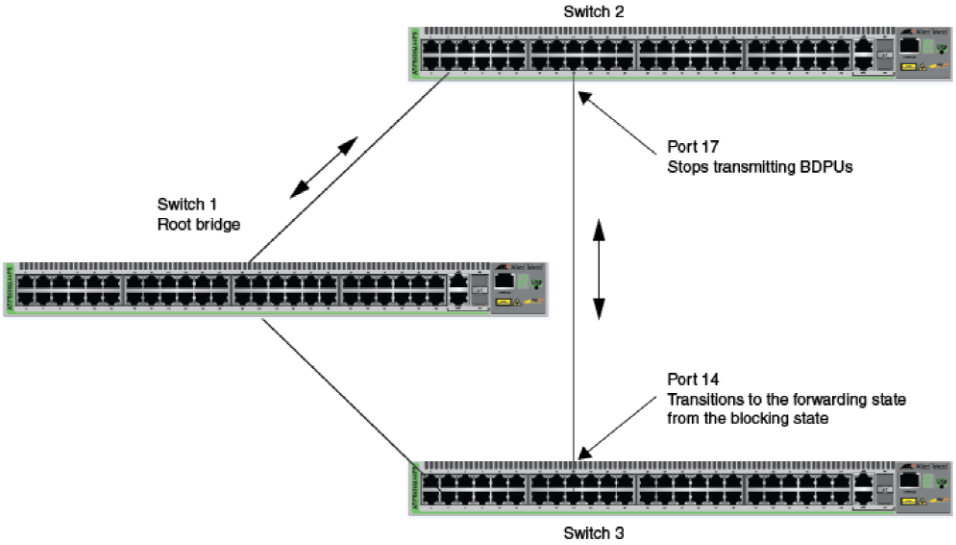

Figure 158. Loop Guard Example 2

But if loop guard is enabled on port 14 on switch 3, the port, instead of changing to the forwarding state, stays in the blocking state, preventing the formation of the loop.

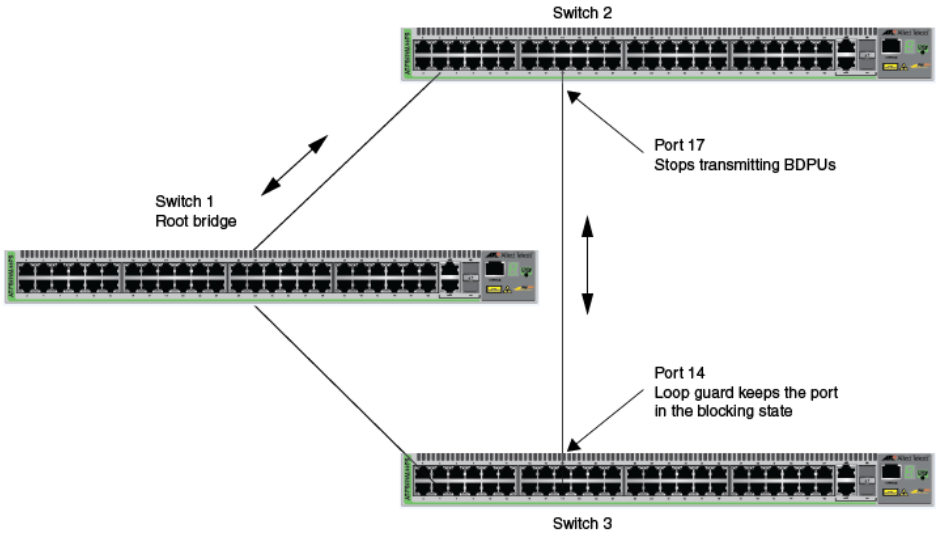

Figure 159. Loop Guard Example 3

The previous example illustrates how loop guard works to maintain a loop-free topology by keeping alternate ports in the blocking state when they stop receiving BPDUs. Loop guard can also work on root and designated ports that are in the forwarding state. This is illustrated in the next two examples.

In the first example, the root bridge stops transmitting BPDUs. If switch 3

is not using loop guard, it continues to forward traffic on port 4. But since no BPDUs are received on the port, it assumes that the device connected to the port is not an RSTP device. Since switch 2 becomes the new root bridge, port 14 on switch 3 transitions to the forwarding state from the blocking state to become the new root port for the switch. The result is a network loop.

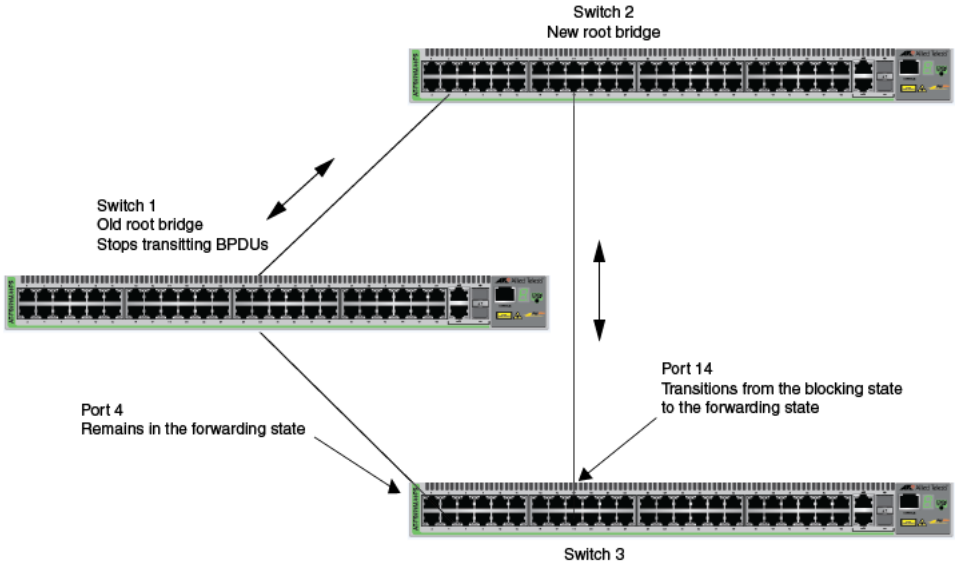

Figure 160. Loop Guard Example 4

But if loop guard is active on port 4 on switch 3, the port is placed in the blocking state since the reception of BPDUs is interrupted. This blocks the loop. The port remains in the blocking state until it again receives BPDUs or the switch is reset.

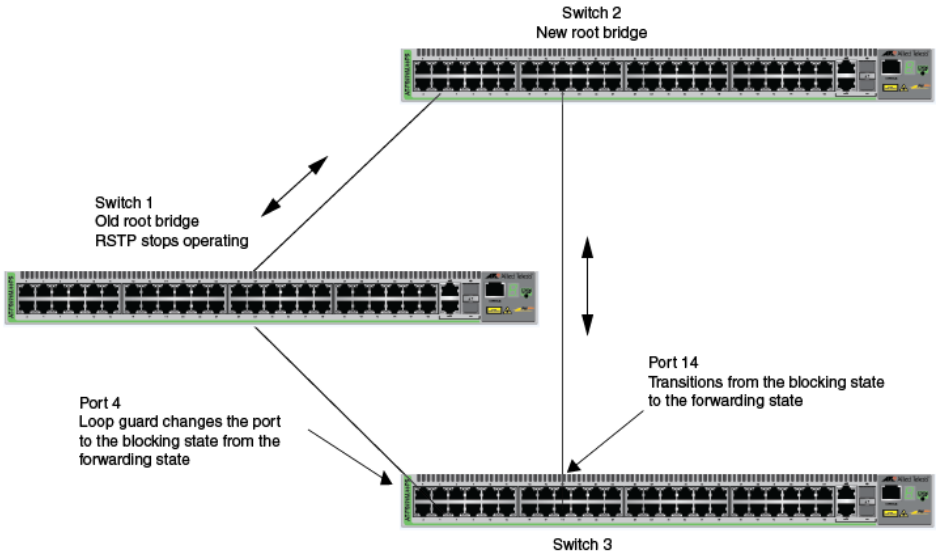

Figure 161. Loop Guard Example 5

STP and RSTP Root Guard

The Root Guard feature enforces the root bridge placement in a network. It ensures the port that you have configured with the Root Guard feature is a designated port. Normally, root bridge ports are all designated ports, unless two or more ports of the root bridge are connected.

If the bridge receives a superior BPDU on a root-designated port, the Root Guard feature changes the state of the port to a “root inconsistent” STP state. This state varies depending on the spanning tree designation. For STP, this is a listening state. For RSTP (and MSTP), this is a discarding state. For more information about this command, see “SPANNING-TREE GUARD ROOT” on page 869 in the RSTP Commands chapter.

Note
This feature is also supported in MSTP. See “MSTP Root Guard” on page 900 for more information.

Chapter 56

Spanning Tree Protocol (STP) Procedures

This chapter provides the following procedures:

Designating STP as the Active Spanning Tree Protocol

Before you can configure the STP parameters or enable the protocol on the switch, you have to designate STP as the active spanning tree protocol. The switch supports other spanning tree protocols in addition to STP, but only one of them can be active at a time on the device.

To designate STP as the active spanning tree protocol on the switch, use the SPANNING-TREE MODE STP command in the Global Configuration mode. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree mode stp
```

After you enter the command, you can configure the STP parameters and enable the protocol so that the switch begins to use the protocol.

Enabling the Spanning Tree Protocol

To enable STP on the switch, use the SPANNING-TREE STP ENABLE command in the Global Configuration mode. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree stp enable
```

The switch immediately begins to send BPDUs from its ports to participate in the spanning tree domain.

Setting the Switch Parameters

This table lists the STP functions that are controlled at the switch level. These commands are located in the Global Configuration mode and apply to the entire switch.

Table 87. STP Switch Parameter Commands

To	Use This Command	Range
Specify how long the ports remain in the listening and learning states before entering the forwarding state.	SPANNING-TREE FORWARD-TIME *forwardtime*	4 to 30 seconds
Configure how frequently the switch sends spanning tree configuration information when it is functioning as the root bridge or trying to become the root bridge.	SPANNING-TREE HELLO-TIME *hellotime*	1 to 10 seconds
Configure how long the switch stores bridge protocol data units (BPDUs) before deleting them.	SPANNING-TREE MAX-AGE *maxage*	6 to 40 seconds
Assign the switch a priority number, which is used to determine the root bridge in the spanning tree domain.	SPANNING-TREE PRIORITY *priority*	0 to 61,440, in increments of 4,096

Unless you are familiar with their functions, you should not change the forward time, hello time, and max-age parameters from their default values on the switch. These parameters have to be set in accordance with the following formulas, as specified in IEEE Standard 802.1d:

max-age <= 2 x (forward time - 1.0 second)
max-age => 2 x (hello time + 1.0 second)

This example changes the forward time to 24 seconds, the hello time to 5 seconds and the max-age to 20:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree forward-time 24
awplus(config)# spanning-tree hello-time 5
awplus(config)# spanning-tree max-age 20
```

If you want the switch to be the root bridge of the spanning tree domain, assign it a low priority number with the SPANNING-TREE PRIORITY command. The bridge priority has a range 0 to 61,440 in increments of 4.096. The default value is 32,768.

This example of the command sets the switch's priority value to 8,192:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree priority 8192
```

Setting the Port Parameters

This table lists the STP functions that are controlled at the port level. You set these parameters in the Port Interface mode of the individual ports.

Table 88. STP Port Parameter Commands

To	Use This Command	Range
Specify the cost of a port to the root bridge.	SPANNING-TREE PATH-COST *path-cost*	1 to 200000000
Assign a priority value, which is used as a tie breaker when two or more ports have equal costs to the root bridge.	SPANNING-TREE PRIORITY *priority*	0 to 240 in increments of 16

This example of the SPANNING-TREE PATH-COST command assigns a path cost of 40 to ports 4 and 18:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4,port1.0.18
awplus(config-if)# spanning-tree path-cost 40
```

This example of the SPANNING-TREE PRIORITY command assigns a priority value of 32:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# spanning-tree priority 32
```

Disabling the Spanning Tree Protocol

To disable STP on the switch, use the NO SPANNING-TREE STP ENABLE command in the Global Configuration mode. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# no spanning-tree stp enable
```

Note
Before disabling the spanning tree protocol on the switch, display the STP states of the ports and disconnect the network cables from any ports that are in the discarding state. Ports that are in the discarding state begin to forward traffic again when STP is disabled. Leaving the cables connected may result in broadcast storms from network loops. To view the states of the ports, refer to "Displaying STP Settings" on page 828.

Displaying STP Settings

To view the STP settings on the switch, use the SHOW SPANNING-TREE in the Privileged Exec mode. The command has this format:

```
show spanning-tree [interface port]
```

Use the INTERFACE parameter to view the settings of the specified ports. Otherwise, omit the parameter to view all the ports. Here is an example of the information the command displays:

```
% Default: Spanning Tree up - Enabled
% Default: Priority 32768
% Default: Forward Delay 15 - Hello Time 2 - Max Age 20- Root port 0
% Default: Root Id 8000:00153355ede1
% Default: Bridge Id 8000:00153355ede1
% Default: portfast bpdu-guard disabled
% Default: portfast bpdu-filter disabled
% Default: portfast errdisable timeout disabled
% Default: portfast errdisable timeout interval 300 sec
%   port1.0.1: Port Id 8001 - Role Disabled - State Disabled
%   port1.0.1: Designated Path Cost 0
%   port1.0.1: Configured Path Cost 2000000  - Add type Explicit ref count 1
%   port1.0.1: Designated Port Id 8001 - Priority 128  -
%   port1.0.1: Root 8000:000000000000
%   port1.0.1: Designated Bridge 8000:000000000000
%   port1.0.1: Max Age 20
%   port1.0.1: Hello Time 2 - Forward Delay 15
%   port1.0.1: Version Spanning Tree Protocol
%   port1.0.1: Current portfast off
%   port1.0.1: Current loop-guard off
%   port1.0.1: Current portfast bpdu-guard off
%   port1.0.1: Current portfast bpdu-filter off
%   port1.0.1: Current root-guard off
%   port1.0.1: Configured Link Type auto
```

Figure 162. SHOW SPANNING-TREE Command for STP

Chapter 57
STP Commands

The STP commands are summarized in Table 89 and described in detail within the chapter.

Table 89. Spanning Tree Protocol Commands

Command	Mode	Description
“NO SPANNING-TREE STP ENABLE” on page 831	Global Configuration	Disables STP on the switch.
“SHOW SPANNING-TREE” on page 832	User Exec and Privileged Exec	Displays the STP settings.
“SPANNING-TREE FORWARD-TIME” on page 834	Global Configuration	Sets the forward time, which specifies how long the ports remain in the listening and learning states before they transition to the forwarding state.
“SPANNING-TREE GUARD ROOT” on page 835	Port Interface	Enables the Root Guard feature on a port.
“SPANNING-TREE HELLO-TIME” on page 836	Global Configuration	Sets the hello time, which defines how frequently the switch sends spanning tree configuration information when it is the root bridge or is trying to become the root bridge.
“SPANNING-TREE MAX-AGE” on page 837	Global Configuration	Sets the maximum age parameter, which defines how long bridge protocol data units (BPDUs) are stored by the switch before they are deleted.
“SPANNING-TREE MODE STP” on page 838	Global Configuration	Designates STP as the active spanning tree protocol on the switch.
“SPANNING-TREE PATH-COST” on page 839	Port Interface	Specifies the cost of a port to the root bridge.
“SPANNING-TREE PORTFAST” on page 840	Port Interface	Designates edge ports on the specified port.

Table 89. Spanning Tree Protocol Commands (Continued)

Command	Mode	Description
“SPANNING-TREE PORTFAST BPDU-GUARD” on page 841	Port Interface	Enables the BPDU guard feature on a port so that the switch monitors edge ports and disables them if they receive BPDUs.
“SPANNING-TREE PRIORITY (Bridge Priority)” on page 842	Global Configuration	Assigns the switch a priority number.
“SPANNING-TREE Priority (Port Priority)” on page 843	Port Interface	Assigns a priority value to a port.
“SPANNING-TREE STP ENABLE” on page 844	Global Configuration	Enables STP on the switch.

NO SPANNING-TREE STP ENABLE

Syntax

```
no spanning-tree stp enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable STP on the switch. To view the current status of STP, refer to "SHOW SPANNING-TREE" on page 832. The default setting is disabled.

> **Note**
> Before disabling the spanning tree protocol on the switch, display the STP states of the ports and disconnect the network cables from any ports that are in the discarding state. Ports that are in the discarding state begin to forward traffic again when STP is disabled. Leaving the cables connected may result in broadcast storms from network loops. To view the states of the ports, refer to "SHOW SPANNING-TREE" on page 832.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168 or "SHOW SPANNING-TREE" on page 832

Example

This example disables STP on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no spanning-tree stp enable
```

SHOW SPANNING-TREE

Syntax

```
show spanning-tree [interface port]
```

Parameters

port

Specifies a port. You can specify more than one port at a time in the command. The switch displays the STP settings for all the ports if you omit this parameter.

Modes

Privileged Exec mode

Description

Use this command to display the STP settings on the switch. An example of the display is shown in Figure 163.

```
% Default: Spanning Tree up - Enabled
% Default: Priority 32768
% Default: Forward Delay 15 - Hello Time 2 - Max Age 20- Root port 0
% Default: Root Id 8000:00153355ede1
% Default: Bridge Id 8000:00153355ede1
% Default: portfast bpdu-guard disabled
% Default: portfast bpdu-filter disabled
% Default: portfast errdisable timeout disabled
% Default: portfast errdisable timeout interval 300 sec
%   port1.0.1: Port Id 8001 - Role Disabled - State Disabled
%   port1.0.1: Designated Path Cost 0
%   port1.0.1: Configured Path Cost 2000000  - Add type Explicit ref count 1
%   port1.0.1: Designated Port Id 8001 - Priority 128  -
%   port1.0.1: Root 8000:000000000000
%   port1.0.1: Designated Bridge 8000:000000000000
%   port1.0.1: Max Age 20
%   port1.0.1: Hello Time 2 - Forward Delay 15
%   port1.0.1: Version Spanning Tree Protocol
%   port1.0.1: Current portfast off
%   port1.0.1: Current loop-guard off
%   port1.0.1: Current portfast bpdu-guard off
%   port1.0.1: Current portfast bpdu-filter off
%   port1.0.1: Current root-guard off
%   port1.0.1: Configured Link Type auto
```

Figure 163. SHOW SPANNING-TREE Command for STP

Examples

This command displays the STP settings for all the ports:

```
awplus# show spanning-tree
```

This command displays the STP settings for ports 1 and 4:

```
awplus# show spanning-tree interface port1.0.1,port1.0.4
```

SPANNING-TREE FORWARD-TIME

Syntax

```
spanning-tree forward-time forwardtime
```

Parameters

forwardtime
: Specifies the forward time. The range is 4 to 30 seconds. The default is 15 seconds.

Mode

Global Configuration mode

Description

Use this command to set the forward time parameter on the switch. This parameter specifies how long the ports remain in the listening and learning states before they transition to the forwarding state.

This parameter is active only if the switch is acting as the root bridge of the spanning tree domain. Switches that are not acting as the root bridge use a dynamic value supplied by the root bridge.

The forward time, max-age and hello time parameters should be set according to the following formulas, as specified in IEEE Standard 802.1d:

max-age <= 2 x (forward time - 1.0 second)
max-age >= 2 x (hello time + 1.0 second)

Use the no version of this command, NO SPANNING-TREE FORWARD-TIME, to set the command to its default value of 15 seconds.

Confirmation Command

“SHOW SPANNING-TREE” on page 832

Example

This example sets the forward time on the switch to 25 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree forward-time 25
```

SPANNING-TREE GUARD ROOT

Syntax

```
spanning-tree guard root
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to enable the Root Guard feature on the specified port. The Root Guard feature ensures that the port on which it is enabled is a designated port. If a Root-Guard-enabled port receives a superior BPDU that may cause it to become a root port, then the port traffic is placed in a "root inconsistent" state. For STP, this state is a listening state.

Use the no version of this command, NO SPANNING-TREE GUARD ROOT, to disable the Root Guard feature on the specified port.

To display the current setting for this parameter, refer to "SHOW SPANNING-TREE" on page 832.

Confirmation Command

"SHOW SPANNING-TREE" on page 832

Examples

This example enables the Root Guard feature on port 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.7
awplus(config-if)# spanning-tree guard root
```

This example disables the Root Guard feature on port 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12
awplus(config-if)# no spanning-tree guard root
```

SPANNING-TREE HELLO-TIME

Syntax

```
spanning-tree hello-time hellotime
```

Parameters

hellotime
: Specifies the hello time. The range is 1 to 10 seconds. The default is 2 seconds.

Mode

Global Configuration mode

Description

Use this command to set the hello time parameter on the switch. This parameter controls how frequently the switch sends spanning tree configuration information when it is the root bridge or is trying to become the root bridge.

The forward time, max-age and hello time parameters should be set according to the following formulas, as specified in IEEE Standard 802.1d:

max-age <= 2 x (forward time - 1.0 second)
max-age >= 2 x (hello time + 1.0 second)

To view the current setting for this parameter, refer to “SHOW SPANNING-TREE” on page 832.

Use the no version of this command, NO SPANNING-TREE HELLO-TIME, to set the command to its default value of 2 seconds.

Confirmation Command

“SHOW SPANNING-TREE” on page 832

Example

This example sets the hello time parameter on the switch to 7 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree hello-time 7
```

SPANNING-TREE MAX-AGE

Syntax

```
spanning-tree max-age maxage
```

Parameters

maxage
: Specifies the max-age parameter. The range is 6 to 40 seconds. The default is 20 seconds.

Mode

Global Configuration mode

Description

Use this command to set the maximum age parameter. This parameter determines how long bridge protocol data units (BPDUs) are stored by the switch before they are deleted.

The forward time, max-age and hello time parameters should be set according to the following formulas, as specified in IEEE Standard 802.1d:

max-age <= 2 x (forward time - 1.0 second)
max-age => 2 x (hello time + 1.0 second)

Use the no form of this command, NO SPANNING-TREE MAX-AGE, to set the command to its default value of 20 seconds.

Confirmation Command

"SHOW SPANNING-TREE" on page 832

Example

This example sets the maximum age parameter to 35 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree max-age 35
```

SPANNING-TREE MODE STP

Syntax

```
spanning-tree mode stp
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to designate STP as the active spanning tree protocol on the switch. You must select STP as the active spanning tree protocol before you can enable it or configure its parameters.

Only one spanning tree protocol can be active on the switch at a time.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example designates STP as the active spanning tree protocol on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree mode stp
```

SPANNING-TREE PATH-COST

Syntax

```
spanning-tree path-cost path-cost
```

Parameters

path-cost
Specifies the cost of a port to the root bridge. The range is 1 to 200000000.

Mode

Port Interface mode

Description

Use this command to specify the cost of a port to the root bridge. This cost is combined with the costs of the other ports in the path to the root bridge, to determine the total path cost. The lower the numeric value, the higher the priority of the path. The range is 1 to 200000000.

Confirmation Command

"SHOW SPANNING-TREE" on page 832

Example

This example assigns port 2 a port cost of 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree path-cost 15
```

SPANNING-TREE PORTFAST

Syntax

```
spanning-tree portfast
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to designate an edge port on the switch. Edge ports are not connected to spanning tree devices or to LANs that have spanning tree devices. As a consequence, edge ports do not receive BPDUs. If an edge port starts to receive BPDUs, it is no longer considered to be an edge port.

This command is used in conjunction with the SPANNING-TREE PORTFAST BPDU-GUARD command.

Confirmation Command

“SHOW SPANNING-TREE” on page 832

Example

This example configures port 17 as an edge port:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17
awplus(config-if)# spanning-tree portfast
```

SPANNING-TREE PORTFAST BPDU-GUARD

Syntax

```
spanning-tree portfast bpdu-guard
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to enable the BPDU guard feature so that the switch monitors edge ports and disables them if they receive BPDU packets.

To disable an edge port that was disabled by the BPDU guard feature, use the NO SPANNING-TREE PORTFAST BPDU-GUARD command. See "NO SPANNING-TREE PORTFAST BPDU-GUARD" on page 862.

Confirmation Command

"SHOW SPANNING-TREE" on page 832

Example

This example enables the BPDU guard feature on port 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# spanning-tree portfast bpdu-guard
```

SPANNING-TREE PRIORITY (Bridge Priority)

Syntax

```
spanning-tree priority priority
```

Parameters

priority
Specifies a priority number for the switch.

Mode

Global Configuration mode

Description

Use this command to assign the switch a priority number. The device that has the lowest priority number in the spanning tree domain becomes the root bridge. If two or more devices have the same priority value, the device with the numerically lowest MAC address becomes the root bridge.

The range is 0 to 61,440, in increments of 4,096. The priority values can be set only in increments of 4,096. The default value is 32,768.

Use the no form of this command, NO SPANNING-TREE PRIORITY, to reset the command to its default value of 32,768.

Confirmation Command

“SHOW SPANNING-TREE” on page 832

Example

This example sets the priority value of the switch to 8,192:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree priority 8192
```

SPANNING-TREE Priority (Port Priority)

Syntax

```
spanning-tree priority priority
```

Parameters

priority
: Specifies the priority value for a port. The range is 0 to 240, in increments of 16.

Mode

Port Interface mode

Description

Use this command to set the priority value of a port. This parameter is used as a tie breaker when two or more ports have equal costs to the root bridge. The range is 0 to 240 in increments of 16. The priority values can be set only in increments of 16. The default is 128.

Use the no form of this command, NO SPANNING-TREE PRIORITY, to reset the command to its default value of 128.

Confirmation Command

"SHOW SPANNING-TREE" on page 832

Example

This example assigns ports 16 and 17 a port priority value of 192:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16,port1.0.17
awplus(config-if)# spanning-tree priority 192
```

SPANNING-TREE STP ENABLE

Syntax

```
spanning-tree stp enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enable STP on the switch. You must designate STP as the active spanning tree protocol on the switch before you can enable it or configure its parameters. For instructions, refer to “SPANNING-TREE MODE STP” on page 838.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168 or “SHOW SPANNING-TREE” on page 832

Example

This example enables STP on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree stp enable
```

Chapter 58

Rapid Spanning Tree Protocol (RSTP) Procedures

This chapter provides the following procedures:

Designating RSTP as the Active Spanning Tree Protocol

The first step to using RSTP on the switch is to designate it as the active spanning tree protocol. This is accomplished with the SPANNING-TREE MODE RSTP command in the Global Configuration mode. Afterwards, you can configure its settings and enable the protocol. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree mode rstp
```

Because RSTP is the default active spanning tree protocol on the switch, you only need to use this command if you activated STP and now want to change the switch back to RSTP.

Enabling the Rapid Spanning Tree Protocol

To enable RSTP on the switch, use the SPANNING-TREE RSTP ENABLE command in the Global Configuration mode. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree rstp enable
```

After you enter the command, the switch immediately begins to participate in the spanning tree domain. It sends BPDUs from its ports and disables ports if it determines, along with the other STP and RSTP devices, that there are loops in the network topology.

Configuring the Switch Parameters

This table lists the RSTP parameters that are set in the Global Configuration mode and apply to all the ports on the switch.

Table 90. RSTP Switch Parameters

To	Use This Command	Range
Specify how long the ports remain in the listening and learning states before they transition to the forwarding state.	SPANNING-TREE FORWARD-TIME *forwardtime*	4 to 30 seconds
Configure how frequently the switch sends spanning tree configuration information if it is the root bridge or is trying to become the root bridge.	SPANNING-TREE HELLO-TIME *hellotime*	1 to 10 seconds
Configure how long the switch stores bridge protocol data units (BPDUs) before deleting them.	SPANNING-TREE MAX-AGE *maxage*	6 to 40 seconds
Assign the switch a priority number, which is used to determine the root bridge in the spanning tree domain.	SPANNING-TREE PRIORITY *priority*	0 to 61,440, in increments of 4,096
Enable BPDU guard so that the switch disables edge ports if they receive BPDU packets.	SPANNING-TREE PORTFAST BPDU-GUARD	-
Disable BPDU guard on the switch.	NO SPANNING-TREE PORTFAST BPDU-GUARD	-

Setting the Forward Time, Hello Time, and Max Age

You should not change the forward time, hello time, and max-age parameters from their default values unless you are familiar with their functions. These parameters have to be set in accordance with the following formulas, as specified in IEEE Standard 802.1d:

max-age <= 2 x (forward time - 1.0 second)
max-age >= 2 x (hello time + 1.0 second)

This example reduces the max-age parameter to discard BPDUs after 10 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree max-age 10
```

This example increases the forward time to 25 seconds and the hello time to 8 seconds. The forward time controls the amount of time the ports remain in the listening and learning states, and the hello time controls how frequently the switch sends spanning tree configuration information:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree forward-time 25
awplus(config)# spanning-tree hello-time 8
```

For reference information, refer to "SPANNING-TREE FORWARD-TIME" on page 868, "SPANNING-TREE HELLO-TIME" on page 870 and "SPANNING-TREE MAX-AGE" on page 873.

Setting the Bridge Priority

The bridges of a spanning tree domain use their priority values to determine the root bridge. The lower the value, the higher the priority. The bridge with the highest priority becomes the root bridge. The range of the parameter is 0 to 61,440, in increments of 4,096. The priority values can be set only in increments of 4,096.

This example assigns the switch the low priority number 4,096 to increase the likelihood of it becoming the root bridge of the spanning tree domain:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree priority 4096
```

For reference information, refer to "SPANNING-TREE PRIORITY (Bridge Priority)" on page 878.

Enabling or Disabling BPDU Guard

The BPDU guard feature disables edge ports if they receive BPDU packets. For background information, refer to "RSTP and MSTP BPDU Guard" on page 814. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree portfast bpdu-guard
```

After you enter the command, the switch disables any edge ports that receive BPDU packets.

Note
To enable an edge port that was disabled by the BPDU guard feature, use the NO SHUTDOWN command. For instructions, refer to "NO SHUTDOWN" on page 221. If a port is still receiving BPDUs, the switch will disable it again unless you disconnect the network cable.

To disable the BPDU guard feature on the switch, use the NO SPANNING-TREE BPDU-GUARD command in the Global Configuration mode. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# no spanning-tree portfast bpdu-guard
```

Configuring the Port Parameters

This table lists the RSTP port parameters. These parameters are set on the individual ports in the Port Interface mode.

Table 91. RSTP Port Parameters

To	Use This Command	Range
Specify port costs.	SPANNING-TREE PATH-COST *path-cost*	1 to 200000000
Assign a priority value to be used as a tie breaker when two or more paths have equal costs to the root bridge.	SPANNING-TREE PRIORITY *priority*	0 to 240 in increments of 16
Designate edge ports.	SPANNING-TREE PORTFAST	-
Remove the edge port designation from ports.	NO SPANNING-TREE	-
Designate ports as point-to-point or shared links.	SPANNING-TREE LINK-TYPE POINT-TO-POINT|SHARED	-
Enable the loop-guard feature.	SPANNING-TREE LOOP-GUARD	-
Disable the loop-guard feature.	NO SPANNING-TREE LOOP-GUARD	-
Activate the BPDU guard feature.	SPANNING-TREE PORTFAST BPDU-GUARD	-
Activate the BPDU guard timer.	SPANNING-TREE ERRDISABLE-TIMEOUT ENABLE	-
Specify the time interval.	SPANNING-TREE ERRDISABLE-TIMEOUT INTERVAL	10 to 1000000 seconds
Deactivate the BPDU guard timer.	NO SPANNING-TREE ERRDISABLE-TIMEOUT ENABLE	-

Configuring Port Costs

The command to change the costs of the ports is the SPANNING-TREE PATH-COST command. The lower the port cost, the greater the likelihood a port will be selected as part of the active path to the root bridge if there is a physical loop in the topology.

This example assigns a port cost of 12 to port 2:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree path-cost 12
```

Configuring Port Priorities

If RSTP discovers a loop in the topology, but the two paths that constitute the loop have the same path cost, the spanning tree protocol uses port priorities to determine which path to make active and which to place in the blocking state. The lower the priority value, the higher the priority and the greater the likelihood of a port being the active, designated port in the event of duplicate paths.

The range is 0 to 240, in increments of 16. The priority values can be set only in increments of 16. The default value is 128.

This example assigns ports 20 and 21 a port priority value of 192:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.20,port1.0.21
awplus(config-if)# spanning-tree priority 192
```

Designating Point-to-point and Shared Ports

This example designates ports 11 to 23 as point-to-point ports:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11-port1.0.23
awplus(config-if)# spanning-tree link-type point-to-point
```

This example designates ports 26 and 27 as shared ports:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.26,port1.0.27
awplus(config-if)# spanning-tree link-type shared
```

Designating Edge Ports

If a port on the switch is not connected to a device or a network that is running the spanning tree protocol, you can designate it as an edge port to reduce the time of the spanning tree convergence process. Edge ports are not taken into account in the convergence process. If a port that has been designated as an edge port begins to receive RSTP BPDUs, the switch automatically considers it as a non-edge port.

To designate ports as edge ports, use the SPANNING-TREE PORTFAST command. This example configures port 16 as an edge port:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16
awplus(config-if)# spanning-tree portfast
```

This example uses the NO SPANNING-TREE command to remove port 21 as an edge port:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.21
awplus(config-if)# no spanning-tree portfast
```

Enabling or Disabling RSTP Loop-guard

The RSTP loop guard feature disables ports if they stop receiving spanning tree BPDUs from their link partners when there is no change to the link state. For background information, refer to "STP, RSTP, MSTP Loop Guard" on page 816. In this example, the feature is activated on ports 20 and 21:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.20,port1.0.21
awplus(config-if)# spanning-tree loop-guard
```

A port disabled by this feature remains disabled until it starts to receive BPDU packets again or the switch is reset.

To disable the loop-guard feature, use the NO SPANNING-TREE LOOP-GUARD command. This example disables the feature on port 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# no spanning-tree loop-guard
```

Note
Ports disabled by the loop-guard feature do not forward traffic again when you disable the feature. They only forward traffic if they receive BPDUs again or you reset the switch.

Enabling or Disabling BPDU Guard

The BPDU guard feature disables edge ports that receive BPDU packets. For background information, refer to "RSTP and MSTP BPDU Guard" on page 814. This example activates the feature on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree portfast bpdu-guard
```

Edge ports that are disabled by the feature remain disabled until you manually enable them again with the NO SHUTDOWN command. As an alternative, you can activate the BPDU guard timer so that the switch automatically reactivates disabled ports after the specified period of time. This example activates the timer and sets it to 1000 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree errdisable-timeout enable
awplus(config)# spanning-tree errdisable-timeout interval
1000
```

To disable BPDU guard on the switch, use the NO SPANNING-TREE PORTFAST BPDU-GUARD command, shown in this example:

```
awplus> enable
awplus# configure terminal
awplus(config)# no spanning-tree portfast bpdu guard
```

Disabling the Rapid Spanning Tree Protocol

To disable RSTP on the switch, use the NO SPANNING-TREE RSTP ENABLE command in the Global Configuration mode. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# no spanning-tree rstp enable
```

To view the current status of RSTP, refer to "Displaying RSTP Settings" on page 856.

Note
Before disabling the spanning tree protocol on the switch, display the RSTP states of the ports and disconnect the network cables from any ports that are in the discarding state. Ports that are in the discarding state begin to forward traffic again when RSTP is disabled. Leaving the cables connected may result in broadcast storms from network loops. To view the states of the ports, refer to "Displaying RSTP Settings" on page 856.

Displaying RSTP Settings

To view the RSTP settings on the switch, use the SHOW SPANNING-TREE in the Privileged Exec mode. The command has this format:

```
show spanning-tree [interface port]
```

Use the INTERFACE parameter to view the settings of the specified ports. Otherwise, omit the parameter to view all the ports. Here is an example of the information the command displays:

```
% Default: Bridge up - Spanning Tree Disabled
% Default: Bridge Priority 32768
% Default: Forward Delay 15 - Hello Time 2 - Max Age 20
% Default: Root Id 8000:eccd6d4d5bf9
% Default: Bridge Id 8000:eccd6d4d5bf9
% Default: portfast bpdu-guard disabled
% Default: portfast bpdu-filter disabled
% Default: portfast errdisable timeout disabled
% Default: portfast errdisable timeout interval 300 sec
%   port1.0.1: Port Id 8101 - Role Disabled - State Forwarding
%   port1.0.1: Designated Path Cost 0
%   port1.0.1: Configured Path Cost 2000000  - Add type Explicit ref count 1
%   port1.0.1: Designated Port Id 8101 - Priority 128  -
%   port1.0.1: Root 8000:000000000000
%   port1.0.1: Designated Bridge 8000:000000000000
%   port1.0.1: Max Age 20
%   port1.0.1: Hello Time 2 - Forward Delay 15
%   port1.0.1: Version Rapid Spanning Tree Protocol
%   port1.0.1: Current portfast off
%   port1.0.1: Current loop-guard off
%   port1.0.1: Current portfast bpdu-guard off
%   port1.0.1: Current portfast bpdu-filter off
%   port1.0.1: Current root-guard off
%   port1.0.1: Configured Link Type auto
```

Figure 164. SHOW SPANNING-TREE Command for RSTP

Chapter 59
RSTP Commands

The RSTP commands are summarized in Table 92 and described in detail within the chapter.

Table 92. Rapid Spanning Tree Protocol Commands

Command	Mode	Description
“NO SPANNING-TREE PORTFAST” on page 859	Port Interface	Removes ports as edge ports on the switch.
“NO SPANNING-TREE ERRDISABLE-TIMEOUT ENABLE” on page 860	Global Configuration	Deactivates the RSTP BPDU guard timer.
“NO SPANNING-TREE LOOP-GUARD” on page 861	Port Interface	Disables the BPDU loop-guard feature on the ports.
“NO SPANNING-TREE PORTFAST BPDU-GUARD” on page 862	Port Interface	Disables the BPDU guard feature on a port.
“NO SPANNING-TREE RSTP ENABLE” on page 863	Global Configuration	Disables RSTP on the switch.
“SHOW SPANNING-TREE” on page 864	User Exec and Privileged Exec	Displays the RSTP settings on the switch.
“SPANNING-TREE ERRDISABLE-TIMEOUT ENABLE” on page 866	Global Configuration	Activates the RSTP BPDU guard timer.
“SPANNING-TREE ERRDISABLE-TIMEOUT INTERVAL” on page 867	Global Configuration	Specifies the duration the RSTP BPDU guard timer.
“SPANNING-TREE FORWARD-TIME” on page 868	Global Configuration	Sets the forward time, which specifies how long ports remain in the listening and learning states before they transition to the forwarding state.
“SPANNING-TREE GUARD ROOT” on page 869	Port Interface	Enables the Root Guard feature on a port.
“SPANNING-TREE HELLO-TIME” on page 870	Global Configuration	Sets the hello time, which defines how frequently the switch sends spanning tree configuration information when it is the root bridge or is trying to become the root bridge.

Table 92. Rapid Spanning Tree Protocol Commands (Continued)

Command	Mode	Description
“SPANNING-TREE LINK-TYPE” on page 871	Port Interface	Designates point-to-point ports and shared ports.
“SPANNING-TREE LOOP-GUARD” on page 872	Port Interface	Enables the BPDU loop-guard feature on the ports.
“SPANNING-TREE MAX-AGE” on page 873	Global Configuration	Sets the maximum age parameter, which defines how long bridge protocol data units (BPDUs) are stored by the switch before they are deleted.
“SPANNING-TREE MODE RSTP” on page 874	Global Configuration	Designates RSTP as the active spanning tree protocol on the switch.
“SPANNING-TREE PATH-COST” on page 875	Port Interface	Specifies the costs of the ports to the root bridge.
“SPANNING-TREE PORTFAST” on page 876	Port Interface	Designates the ports as edge ports.
“SPANNING-TREE PORTFAST BPDU-GUARD” on page 877	Port Interface	Enables the BPDU guard feature on a port.
“SPANNING-TREE PRIORITY (Bridge Priority)” on page 878	Global Configuration	Assigns the switch a priority number.
“SPANNING-TREE PRIORITY (Port Priority)” on page 879	Port Interface	Assigns priority values to the ports.
“SPANNING-TREE RSTP ENABLE” on page 880	Global Configuration	Enables RSTP on the switch.

NO SPANNING-TREE PORTFAST

Syntax

```
no spanning-tree portfast
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to remove ports as edge ports on the switch.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example removes port 21 as an edge port:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.21
awplus(config-if)# no spanning-tree portfast
```

NO SPANNING-TREE ERRDISABLE-TIMEOUT ENABLE

Syntax

```
no spanning-tree errdisable-timeout enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to deactivate the timer for the RSTP BPDU guard feature. When the timer is deactivated, ports that the feature disables because they receive BPDU packets remain disabled until you manually activate them again with the NO SHUTDOWN command.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example deactivates the time for the RSTP BPDU guard feature:

```
awplus> enable
awplus# configure terminal
awplus(config)# no spanning-tree errdisable-timeout enable
```

NO SPANNING-TREE LOOP-GUARD

Syntax

```
no spanning-tree loop-guard
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to disable the BPDU loop-guard feature on the ports. The default setting is disabled.

> **Note**
> Ports that are disabled by the loop-guard feature do not forward traffic again when you disable the feature. They only forward traffic if they start to receive BPDUs again or you reset the switch.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example disables the BPDU loop-guard feature on port 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# no spanning-tree loop-guard
```

NO SPANNING-TREE PORTFAST BPDU-GUARD

Syntax

```
no spanning-tree portfast bpdu-guard
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to disable the BPDU guard feature on a port.

> **Note**
> Edge ports disabled by the BPDU guard feature remain disabled until you enable them with the management software. For instructions, refer to “NO SHUTDOWN” on page 221.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example disables the guard feature on port 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# no spanning-tree portfast bpdu-guard
```

NO SPANNING-TREE RSTP ENABLE

Syntax

```
no spanning-tree rstp enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable RSTP on the switch.

Note
Before disabling the spanning tree protocol on the switch, display the RSTP states of the ports and disconnect the network cables from any ports that are in the discarding state. Ports that are in the discarding state begin to forward traffic again when RSTP is disabled. Leaving the cables connected may result in broadcast storms from network loops. To view the states of the ports, refer to "SHOW SPANNING-TREE" on page 864.

Confirmation Command

"SHOW SPANNING-TREE" on page 864

Example

This example disables RSTP on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no spanning-tree rstp enable
```

SHOW SPANNING-TREE

Syntax

```
show spanning-tree
```

Parameters

None

Modes

Privileged Exec mode

Description

Use this command to display the RSTP settings on the switch. An example of the display is shown in Figure 165.

```
% Default: Bridge up - Spanning Tree Disabled
% Default: Bridge Priority 32768
% Default: Forward Delay 15 - Hello Time 2 - Max Age 20
% Default: Root Id 8000:eccd6d4d5bf9
% Default: Bridge Id 8000:eccd6d4d5bf9
% Default: portfast bpdu-guard disabled
% Default: portfast bpdu-filter disabled
% Default: portfast errdisable timeout disabled
% Default: portfast errdisable timeout interval 300 sec
%   port1.0.1: Port Id 8101 - Role Disabled - State Forwarding
%   port1.0.1: Designated Path Cost 0
%   port1.0.1: Configured Path Cost 2000000  - Add type Explicit ref count 1
%   port1.0.1: Designated Port Id 8101 - Priority 128  -
%   port1.0.1: Root 8000:000000000000
%   port1.0.1: Designated Bridge 8000:000000000000
%   port1.0.1: Max Age 20
%   port1.0.1: Hello Time 2 - Forward Delay 15
%   port1.0.1: Version Rapid Spanning Tree Protocol
%   port1.0.1: Current portfast off
%   port1.0.1: Current loop-guard off
%   port1.0.1: Current portfast bpdu-guard off
%   port1.0.1: Current portfast bpdu-filter off
%   port1.0.1: Current root-guard off
%   port1.0.1: Configured Link Type auto
```

Figure 165. SHOW SPANNING-TREE Command for RSTP

Example

This example displays the RSTP settings on the switch:

```
awplus# show spanning-tree
```

SPANNING-TREE ERRDISABLE-TIMEOUT ENABLE

Syntax

```
spanning-tree errdisable-timeout enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate the timer for the RSTP BPDU guard feature. The BPDU guard feature prevents unnecessary RSTP domain convergences by disabling edge ports if they receive BPDUs. When the timer is activated, the switch will automatically reactivate disabled ports. The time interval that ports remain disabled is set with “SPANNING-TREE ERRDISABLE-TIMEOUT INTERVAL” on page 867.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example activates the timer for the RSTP BPDU guard feature:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree errdisable-timeout enable
```

SPANNING-TREE ERRDISABLE-TIMEOUT INTERVAL

Syntax

```
spanning-tree errdisable-timeout interval interval
```

Parameters

interval

Specifies the number of seconds that ports remain disabled by the RSTP BPDU guard feature. The range is 10 to 1000000 seconds. The default is 300 seconds.

Mode

Global Configuration mode

Description

Use this command to specify the number of seconds that must elapse before the switch automatically enables ports that are disabled by the RSTP BPDU guard feature. To activate the timer, refer to "SPANNING-TREE ERRDISABLE-TIMEOUT ENABLE" on page 866.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example sets the time interval to 200 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree errdisable-timeout interval
200
```

SPANNING-TREE FORWARD-TIME

Syntax

```
spanning-tree forward-time forwardtime
```

Parameters

forwardtime
: Specifies the forward time. The range is 4 to 30 seconds. The default is 15 seconds.

Mode

Global Configuration mode

Description

Use this command to set the forward time parameter to control how fast the ports change their spanning tree states when moving towards the forwarding state. For RSTP, this parameter specifies the maximum time taken by the ports to transition from the discarding state to the learning state and from the learning state to the forwarding state.

This parameter is active only if the switch is acting as the root bridge. Switches that are not acting as the root bridge use a dynamic value supplied by the root bridge.

The forward time, max-age and hello time parameters should be set according to the following formulas, as specified in IEEE Standard 802.1d:

max-age <= 2 x (forward time - 1.0 second)
max-age >= 2 x (hello time + 1.0 second)

Use the no version of this command, NO SPANNING-TREE FORWARD-TIME, to set the command to its default value of 15 seconds.

Confirmation Command

“SHOW SPANNING-TREE” on page 864

Example

This example sets the forward time for the switch to 5 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree forward-time 5
```

SPANNING-TREE GUARD ROOT

Syntax

```
spanning-tree guard root
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to enable the Root Guard feature on the specified port. The Root Guard feature ensures that the port on which it is enabled is a designated port. If a Root-Guard-enabled port receives a superior BPDU that may cause it to become a root port, then the port traffic is placed in a "root inconsistent" state. For RSTP, this state is a discarding state.

Use the no version of this command, NO SPANNING-TREE GUARD ROOT, to disable the Root Guard feature on the specified port.

To view the current setting for this parameter, refer to "SHOW SPANNING-TREE" on page 864.

Confirmation Command

"SHOW SPANNING-TREE" on page 864

Examples

This example enables the Root Guard feature on port 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.7
awplus(config-if)# spanning-tree guard root
```

This example disables the Root Guard feature on port 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12
awplus(config-if)# no spanning-tree guard root
```

SPANNING-TREE HELLO-TIME

Syntax

```
spanning-tree hello-time hellotime
```

Parameters

hellotime
: Specifies the hello time. The range is 1 to 10 seconds. The default is 2 seconds.

Mode

Global Configuration mode

Description

Use this command to set the hello time parameter on the switch. This parameter controls how frequently the switch sends spanning tree configuration information when it is the root bridge or is trying to become the root bridge.

The forward time, max-age and hello time parameters should be set according to the following formulas, as specified in IEEE Standard 802.1d:

max-age <= 2 x (forward time - 1.0 second)
max-age >= 2 x (hello time + 1.0 second)

Use the no version of this command, NO SPANNING-TREE HELLO-TIME, to set the command to its default value of 2 seconds.

Confirmation Command

“SHOW SPANNING-TREE” on page 864

Example

This example sets the hello time parameter on the switch to 4 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree hello-time 4
```

SPANNING-TREE LINK-TYPE

Syntax

```
spanning-tree link-type point-to-point|shared
```

Parameters

point-to-point
: Allows for rapid transition of a port to the forwarding state during the convergence process of the spanning tree domain.

shared
: Disables rapid transition of a port. You may want to set link type to shared if a port is connected to a hub with multiple switches connected to it.

Mode

Port Interface mode

Description

Use this command to designate point-to-point ports and shared ports.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

This example designates ports 11 to 23 as point-to-point ports:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11-port1.0.23
awplus(config-if)# spanning-tree link-type point-to-point
```

This example designates the links on ports 26 and 27 as shared links:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.26,port1.0.27
awplus(config-if)# spanning-tree link-type shared
```

SPANNING-TREE LOOP-GUARD

Syntax

```
spanning-tree loop-guard
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to enable the BPDU loop-guard feature on the ports. If a port that has this feature activated stops receiving BPDU packets, the switch automatically disables it. A port that has been disabled by the feature remains in that state until it begins to receive BPDU packets again or the switch is reset. The default setting for BPDU loop-guard on the ports is disabled.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example activates the BPDU loop-guard feature on ports 5 and 11:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5,port1.0.11
awplus(config-if)# spanning-tree loop-guard
```

SPANNING-TREE MAX-AGE

Syntax

```
spanning-tree max-age maxage
```

Parameters

maxage
: Specifies the maximum age parameter. The range is 6 to 40 seconds. The default is 20 seconds.

Mode

Global Configuration mode

Description

Use this command to set the maximum age parameter on the switch. This parameter determines how long the switch retains bridge protocol data units (BPDUs) before it deletes them.

The forward time, maximum age and hello time parameters should be set according to the following formulas, as specified in IEEE Standard 802.1d:

max-age <= 2 x (forward time - 1.0 second)
max-age >= 2 x (hello time + 1.0 second)

Use the no form of this command, NO SPANNING-TREE MAX-AGE, to set the command to its default value of 20 seconds.

Confirmation Command

"SHOW SPANNING-TREE" on page 864

Example

This example sets the maximum age parameter to 10 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree max-age 10
```

SPANNING-TREE MODE RSTP

Syntax

```
spanning-tree mode rstp
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to designate RSTP as the active spanning tree protocol on the switch. After activating the protocol, you can enable or disable the spanning tree protocol and set the switch or port parameters. RSTP is active on the switch only after you have designated it as the active spanning tree with this command and enabled it with “SPANNING-TREE RSTP ENABLE” on page 880.

Only one spanning tree protocol— STP or RSTP— can be active on the switch at a time.

Confirmation Command

“SHOW SPANNING-TREE” on page 864

Example

This example designates RSTP as the active spanning tree protocol on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree mode rstp
```

SPANNING-TREE PATH-COST

Syntax

```
spanning-tree path-cost path-cost
```

Parameters

path-cost
Specifies the cost of a port to the root bridge. The range is 1 to 200000000.

Mode

Port Interface mode

Description

Use this command to specify the cost of a port to the root bridge. This cost is combined with the costs of the other ports in the path to the root bridge, to determine the total path cost. The lower the numeric value, the higher the priority of a path. The range is 1 to 200000000.

Confirmation Command

"SHOW SPANNING-TREE" on page 864

Example

This example assigns a port cost of 22 to port 2:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree path-cost 22
```

SPANNING-TREE PORTFAST

Syntax

```
spanning-tree portfast
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to designate edge ports on the switch. Edge ports are not connected to spanning tree devices or to LANs that have spanning tree devices. As a consequence, edge ports do not receive BPDUs. If an edge port starts to receive BPDUs, it is no longer considered an edge port by the switch.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example configures port 17 as an edge port:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17
awplus(config-if)# spanning-tree portfast
```

SPANNING-TREE PORTFAST BPDU-GUARD

Syntax

```
spanning-tree portfast bpdu-guard
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to enable the BPDU guard feature so that the switch monitors edge ports and disables them if they receive BPDU packets.

To disable an edge port that was disabled by the BPDU guard feature, use the NO SPANNING-TREE PORTFAST BPDU-GUARD command.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example enables the BPDU guard feature on port 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# spanning-tree portfast bpdu-guard
```

SPANNING-TREE PRIORITY (Bridge Priority)

Syntax

```
spanning-tree priority priority
```

Parameters

priority
: Specifies a priority number for the switch. The range is 0 to 61440, in increments of 4096.

Mode

Global Configuration mode

Description

Use this command to assign the switch a priority number. The device that has the lowest priority number in the spanning tree domain becomes the root bridge. If two or more devices have the same priority value, the device with the numerically lowest MAC address becomes the root bridge.

The range is 0 to 61,440, in increments of 4,096. The priority value can be set only in increments of 4,096. The default value is 32,768.

Use the no form of this command, NO SPANNING-TREE PRIORITY, to reset the command to its default value of 32,768.

Confirmation Command

“SHOW SPANNING-TREE” on page 864

Example

This example sets the priority value of the switch to 8,192:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree priority 8192
```

SPANNING-TREE PRIORITY (Port Priority)

Syntax

```
spanning-tree priority priority
```

Parameters

priority
: Specifies the priority value for a port. The range is 0 to 240, in increments of 16.

Mode

Port Interface mode

Description

Use this command to set the priority value of a port. This parameter is used as a tie breaker when two or more ports have equal costs to the root bridge. The range is 0 to 240 in increments of 16. The priority values can be set only in increments of 16. The default is 128.

Use the no form of this command, NO SPANNING-TREE PRIORITY, to reset the command to its default value of 128.

Confirmation Command

"SHOW SPANNING-TREE" on page 864

Example

This example assigns ports 20 and 21 a port priority value of 192:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.20,port1.0.21
awplus(config-if)# spanning-tree priority 192
```

SPANNING-TREE RSTP ENABLE

Syntax

```
spanning-tree rstp enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enable the Rapid Spanning Tree Protocol on the switch. You cannot enable RSTP until you have activated it with “SPANNING-TREE MODE RSTP” on page 874.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168 or “SHOW SPANNING-TREE” on page 864

Example

This example enables RSTP on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree rstp enable
```

Chapter 60

Multiple Spanning Tree Protocol (MSTP)

This chapter provides background information about the Multiple Spanning Tree Protocol (MSTP). It covers the following topics:

Overview

As mentioned in Chapter 55, “STP, RSTP and MSTP Protocols” on page 803, STP and RSTP are referred to as single-instance spanning trees that search for physical loops across all VLANs in a bridged network. When loops are detected, the protocols stop the loops by placing one or more bridge ports in a blocking state.

As explained in “Spanning Tree and VLANs” on page 813, STP and RSTP can result in VLAN fragmentation where VLANs that span multiple bridges are connected together with untagged ports. The untagged ports creating the links can represent a physical loop in the network, which are blocked by spanning tree. This can result in a loss of communication between different parts of the same VLAN.

One way to resolve this, other than by not activating spanning tree on your network, is to link the switches using tagged ports, which can handle traffic from multiple VLANs simultaneously. The drawback to this approach is that the link formed by the tagged ports can create a bottleneck to your Ethernet traffic, resulting in reduced network performance.

Another approach is to use the Multiple Spanning Tree Protocol (MSTP). This spanning tree shares many of the same characteristics as RSTP. It features rapid convergence and has many of the same parameters. But the main difference is that while RSTP, just like STP, supports only a single-instance spanning tree, MSTP supports multiple spanning trees within a network.

The following sections describe some of the terms and concepts relating to MSTP. If you are not familiar with spanning tree or RSTP, review “Overview” on page 804.

Note
Do not activate MSTP on an AT-FS970M Allied Telesis Switch without first familiarizing yourself with the following concepts and guidelines. Unlike STP and RSTP, you cannot activate this spanning tree protocol on a switch without first configuring the protocol parameters.

Note
The AlliedWare Plus MSTP implementation complies fully with the new IEEE 802.1s standard and should be interoperable with any other vendor’s fully compliant 802.1s implementation.

Multiple Spanning Tree Instance (MSTI)

The individual spanning trees in MSTP are referred to as Multiple Spanning Tree Instances (MSTIs). An MSTI can span any number of AT-FS970M Switches. The switch can support up to 15 MSTIs at a time.

To create an MSTI, you first assign it a number, referred to as the MSTI ID. The range is 1 to 15. (The switch is shipped with a default MSTI with an MSTI ID of 0. This default spanning tree instance is discussed later in "Common and Internal Spanning Tree (CIST)" on page 892.)

After you have selected an MSTI ID, you need to define the scope of the MSTI by assigning one or more VLANs to it. An instance can contain any number of VLANs, but a VLAN can belong to only one MSTI at a time.

Following are several examples. Figure 166 illustrates two AT-FS970M Switches, each containing the two VLANs Sales and Production. The two parts of each VLAN are connected with a direct link using untagged ports on both switches. If the switches were running STP or RSTP, one of the links would be blocked because the links constitute a physical loop. Which link would be blocked depends on the STP or RSTP bridge settings. In Figure 166, the link between the two parts of the Production VLAN is blocked, resulting in a loss of communications between the two parts of the Production VLAN.

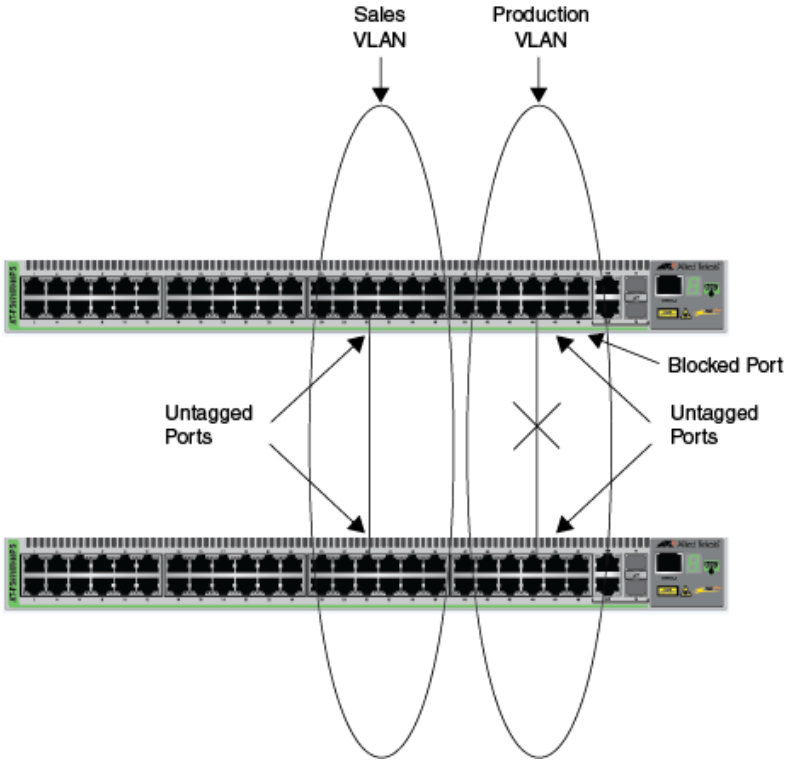

Figure 166. VLAN Fragmentation with STP or RSTP

Figure 167 illustrates the same two AT-FS970M Switches and the same two virtual LANs. But in this example, the two switches are running MSTP, and the two VLANs have been assigned different spanning tree instances. Now that they reside in different MSTIs, both links remain active, enabling the VLANs to forward traffic over their respective direct link.

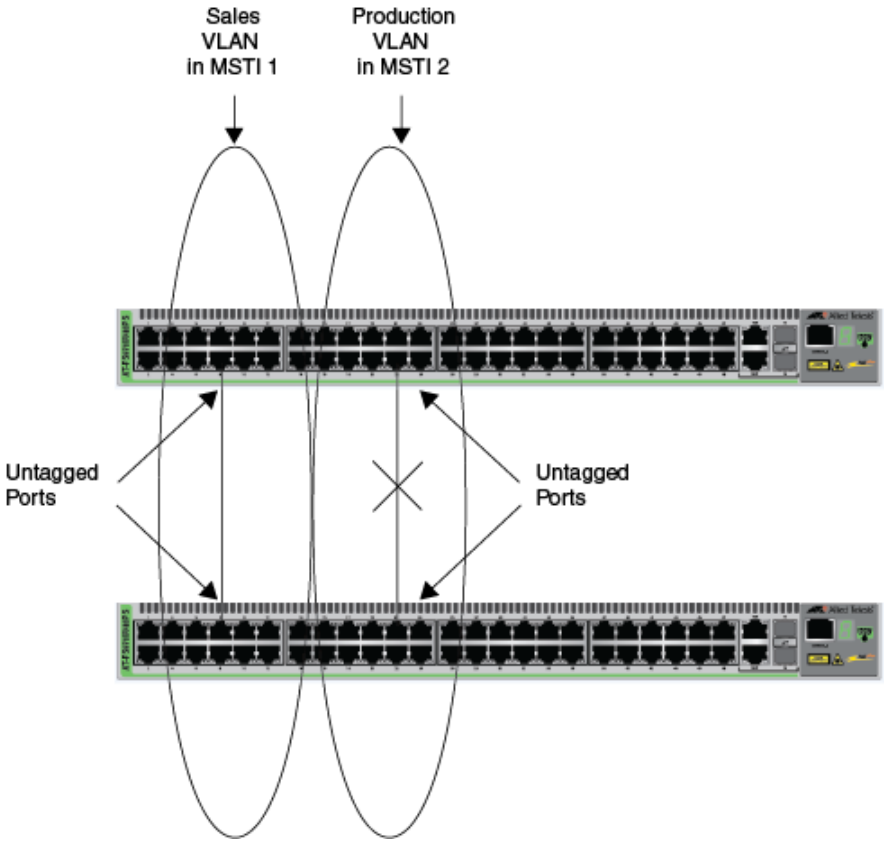

Figure 167. MSTP Example of Two Spanning Tree Instances

An MSTI can contain more than one VLAN. This is illustrated in Figure 168 on page 885 where there are two AT-FS970M Switches with four VLANs. There are two MSTIs, each containing two VLANs. MSTI 1 contains the Sales and Presales VLANs and MSTI 2 contains the Design and Engineering VLANs.

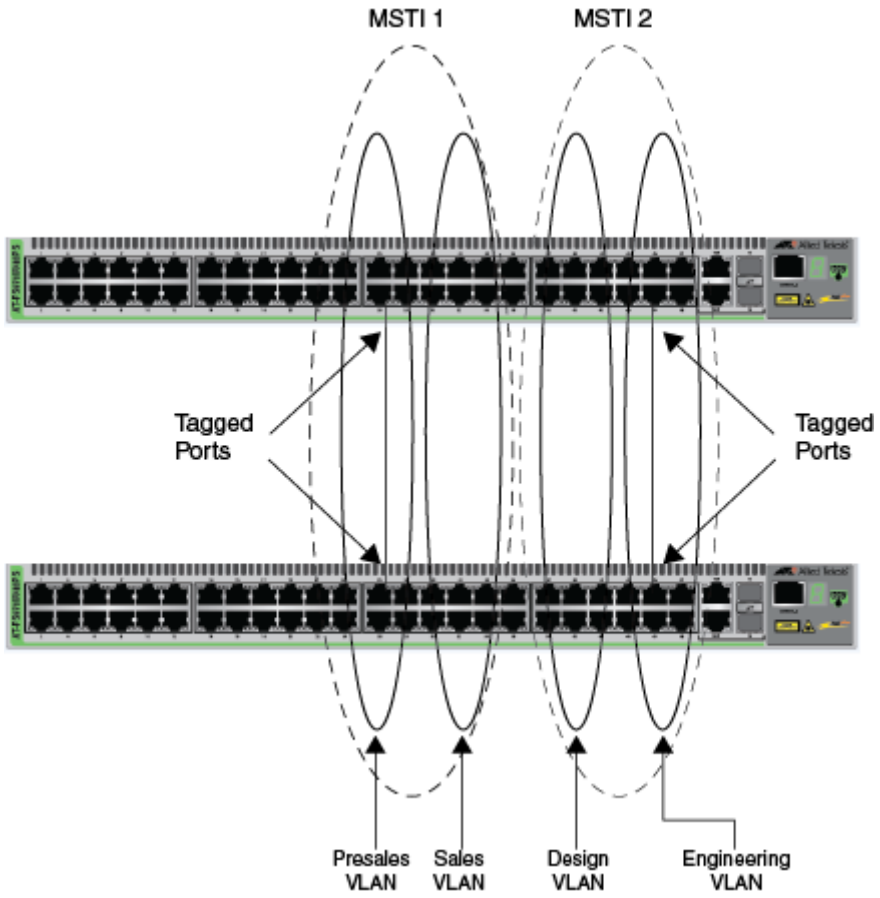

Figure 168. Multiple VLANs in an MSTI

In this example, because an MSTI contains more than one VLAN, the links between the VLAN parts are made with tagged, not untagged, ports so that they can carry traffic from more than one virtual LAN. Referring again to Figure 168, the tagged link in MSTI 1 is carrying traffic for both the Presales and Sales VLANs while the tagged link in MSTI 2 is carrying traffic for the Design and Engineering VLANs.

MSTI Guidelines

Following are several guidelines to keep in mind about MSTIs:

- The AT-FS970M Switch can support up to 15 spanning tree instances, including the Common and Internal Spanning Tree (CIST).
- An MSTI can contain any number of VLANs.
- A VLAN can belong to only one MSTI at a time.
- A switch port can belong to more than one spanning tree instance at a time by being an untagged and tagged member of VLANs belonging to different MSTIs. This is possible because a port can be in different MSTP states for different MSTIs simultaneously. For example, a port can be in the MSTP blocking state for one MSTI and the forwarding state for another spanning tree instance. For further information, refer to “Ports in Multiple MSTIs” on page 888.
- A router or Layer 3 network device is required to forward traffic between different VLANs.

VLAN and MSTI Associations

Part of the task to configuring MSTP involves assigning VLANs to spanning tree instances. The mapping of VLANs to MSTIs is called *associations*. A VLAN, either port-based or tagged, can belong to only one instance at a time, but an instance can contain any number of VLANs.

Ports in Multiple MSTIs

A port can be a member of more than one MSTI at a time if it is a tagged member of one or more VLANs assigned to different MSTIs. In this circumstance, a port might be have to operate in different spanning tree states simultaneously, depending on the requirements of the MSTIs. For example, a port that belongs to two different VLANs in two different MSTIs might operate in the forwarding state in one MSTI and the blocking state in the other.

A port's MSTI parameter settings are divided into two groups. The first group is referred to as generic parameters. These are set just once on a port and apply to all the MSTIs where the port is a member. One of these parameters is the external path cost, which sets the operating cost of a port connected to a device outside its region. A port, even if it belongs to multiple MSTIs, can have only one external path cost. Other generic parameters designate the port as an edge port or a point-to-point port.

The second group of port parameters can be set differently for each MSTI where a port is a member. One parameter, the internal path cost, specifies the operating cost of a port when it is connected to a bridge in the same MSTP region. The other parameter in this group sets the port priority, which acts as a tie breaker when two or more ports have equal costs to a regional root bridge.

Multiple Spanning Tree Regions

Another important concept of MSTP is *regions*. An MSTP region is defined as a group of bridges that share exactly the same MSTI characteristics. These characteristics are:

- Configuration name
- Revision number
- VLANs
- VLAN to MSTI ID associations

A *configuration name* is a name assigned to a region to identify it. You must assign each bridge in a region exactly the same name, even the same upper and lowercase lettering. Identifying the regions in your network is easier if you choose names that are characteristic of the functions of the nodes and bridges of the region. Examples are Sales Region and Engineering Region.

The *revision number* is an arbitrary number assigned to a region. This number can be used to keep track of the revision level of a region's configuration. For example, you might use this value to maintain the number of times you revise a particular MSTP region. It is not important that you maintain this number, only that each bridge in a region has the same number.

The bridges of a particular region must also have the same VLANs. The names of the VLANs and the VIDs must be the same on all bridges of a region.

Finally, the VLANs in the bridges must be associated to the same MSTIs.

If any of the above information is different on two bridges, MSTP does consider the bridges as residing in different regions.

Table 93 illustrates the concept of regions. It shows one MSTP region consisting of two AT-FS970M Switches. Each switch in the region has the same configuration name and revision level. The switches also have the same five VLANs, and the VLANs are associated with the same MSTIs.

Table 93. MSTP Region

Configuration Name: Marketing Region, Revision Level 1	
Switch 1	**Switch 2**
MSTI ID 1: VLAN: Sales (VID 2) VLAN: Presales (VID 3)	MSTI ID 1: VLAN: Sales (VID 2) VLAN: Presales (VID 3)
MSTI ID 2: VLAN: Accounting (VID 4)	MSTI ID 2: VLAN: Accounting (VID 4)

The AT-FS970M Switch determines regional boundaries by examining the MSTP BPDUs received on the ports. A port that receives an MSTP BPDU from another bridge with regional information different from its own is considered to be a boundary port and the bridge connected to the port as belonging to another region.

The same is true for any ports connected to bridges running the single-instance spanning tree STP or RSTP. Those ports are also considered as part of another region.

Each MSTI functions as an independent spanning tree within a region. Consequently, each MSTI must have a root bridge to locate physical loops within the spanning tree instance. An MSTI's root bridge is called a *regional root*. The MSTIs within a region may share the same regional root or they can have different regional roots.

A regional root for an MSTI must be within the region where the MSTI is located. An MSTI cannot have a regional root that is outside its region.

A regional root is selected by a combination of the *MSTI priority* value and the bridge's MAC address. The MSTI priority is analogous to the RSTP bridge priority value. Where they differ is that while the RSTP bridge priority is used to determine the root bridge for an entire bridged network, MSTI priority is used only to determine the regional root for a particular MSTI.

The range for this parameter is the same as the RSTP bridge priority, from 0 to 61,440 in sixteen increments of 4,096. To set the parameter, you specify the increment that represents the desired MSTI priority value. Table 96 on page 903 lists the increments.

Region Guidelines

Following are several points to remember about regions.

- A network can contain any number of regions, and a region can contain any number of AT-FS970M Switches.
- The AT-FS970M Switch can belong to only one region at a time.
- A region can contain any number of VLANs.
- All of the bridges in a region must have the same configuration name, revision level, VLANs, and VLAN to MSTI associations.
- An MSTI cannot span multiple regions.
- Each MSTI must have a regional root for locating loops in the instance. MSTIs can share the same regional root or have different roots. A regional root is determined by the MSTI priority value and a bridge's MAC address.
- The regional root of an MSTI must be in the same region as the MSTI.

Common and Internal Spanning Tree (CIST)

MSTP has a default spanning tree instance called the Common and Internal Spanning Tree (CIST). This instance has an MSTI ID of 0.

This instance has unique features and functions that make it different from the MSTIs that you create yourself. Firstly, you cannot delete this instance, and you cannot change its MSTI ID.

Secondly, when you create a new port-based or tagged VLAN, it is by default associated with the CIST and is automatically given an MSTI ID of 0. The Default_VLAN is also associated by default with CIST.

Another critical difference is that when you assign a VLAN to another MSTI, it still partially remains a member of CIST. This is because CIST is used by MSTP to communicate with other MSTP regions and with any RSTP and STP single-instance spanning trees in the network. MSTP uses CIST to participate in the creation of a spanning tree between different regions and between regions and single-instance spanning tree, to form one spanning tree for the entire bridged network.

MSTP uses CIST to form the spanning tree of an entire bridged network because CIST can cross regional boundaries, while an MSTI cannot. If a port is a boundary port, that is, if it is connected to another region, that port automatically belongs solely to CIST, even if it was assigned to an MSTI, because only CIST is active outside of a region.

As mentioned earlier, every MSTI must have a root bridge, referred to as a regional root, in order to locate loops that might exist within the instance. CIST must also have a regional root. However, the CIST regional root communicates with the other MSTP regions and single-instance spanning trees in the bridged network.

The CIST regional root is set with the *CIST Priority* parameter. This parameter, which functions similar to the RSTP bridge priority value, selects the root bridge for the entire bridged network. If the AT-FS970M switch has the lowest CIST Priority value among all the spanning tree bridges, it functions as the root bridge for all the MSTP regions and STP and RSTP single-instance spanning trees in the network.

MSTP with STP and RSTP

MSTP is fully compatible with STP and RSTP. If a port on the AT-FS970M switch running MSTP receives STP BPDUs, the port sends only STP BPDU packets. If a port receives RSTP BPDUs, the port sends MSTP BPDUs because RSTP can process MSTP BPDUs.

A port connected to a bridge running STP or RSTP is considered to be a boundary port of the MSTP region and the bridge as belonging to a different region.

An MSTP region can be considered as a virtual bridge. The implication is that other MSTP regions and STP and RSTP single-instance spanning trees cannot discern the topology or constitution of an MSTP region. The only bridge they are aware of is the regional root of the CIST instance.

Summary of Guidelines

Careful planning is essential for the successful implementation of MSTP. This section reviews all the rules and guidelines mentioned in earlier sections, and contains a few new ones:

- The AT-FS970M Switch can support up to 15 spanning tree instances, including the CIST.
- An MSTI can contain any number of VLANs.
- A VLAN can belong to only one MSTI at a time.
- The range of an MSTI ID is from 1 to 15.
- The CIST ID is 0. You cannot change this value.
- A switch port can belong to more than one spanning tree instance at a time. This allows you to assign a port as an untagged and tagged member of VLANs that belong to different MSTIs. What makes this possible is a port's ability to be in different MSTP states for different MSTIs simultaneously. For example, a port can be in the MSTP blocking state for one MSTI and the forwarding state for another spanning tree instance.
- A router or Layer 3 network device is required to forward traffic between VLANs.
- A network can contain any number of regions, and a region can contain any number of AT-FS970M Switches.
- The AT-FS970M Switch can belong to only one region at a time.
- A region can contain any number of VLANs.
- All of the bridges in a region must have the same configuration name, revision level, VLANs, and VLAN to MSTI associations.
- An MSTI cannot span multiple regions.
- Each MSTI must have a regional root for locating loops in the instance. MSTIs can share the same regional root or have different roots. A regional root is determined by the MSTI priority value and a bridge's MAC address.
- The regional root of an MSTI must be in the same region as the MSTI.
- The CIST must have a regional root for communicating with other regions and single-instance spanning trees.
- MSTP is compatible with STP and RSTP.
- A port transmits CIST information even when it is associated with another MSTI ID. However, in determining network loops, MSTI takes precedence over CIST. (This is explained in more detail in "Associating VLANs to MSTIs" on page 896.)

Note
The AlliedWare Plus MSTP implementation complies fully with the new IEEE 802.1s standard. Any other vendor's fully compliant 802.1s implementation is interoperable with the AlliedWare Plus implementation.

Associating VLANs to MSTIs

Allied Telesis recommends that you assign all VLANs on a switch to an MSTI. You should not leave a VLAN assigned to just the CIST, including the Default_VLAN. This is to prevent the blocking of a port that should be in the forwarding state. The reason for this guideline is explained below.

An MSTP BPDU contains the instance to which the port transmitting the packet belongs. By default, all ports belong to the CIST instance. So CIST is included in the BPDU. If the port is a member of a VLAN that has been assigned to another MSTI, that information is also included in the BPDU.

This is illustrated in Figure 169. Port 8 in switch A is a member of a VLAN assigned to MSTI ID 7 while port 1 is a member of a VLAN assigned to MSTI ID 10. The BPDUs transmitted by port 8 to switch B would indicate that the port is a member of both CIST and MSTI 7, while the BPDUs from port 1 would indicate the port is a member of the CIST and MSTI 10.

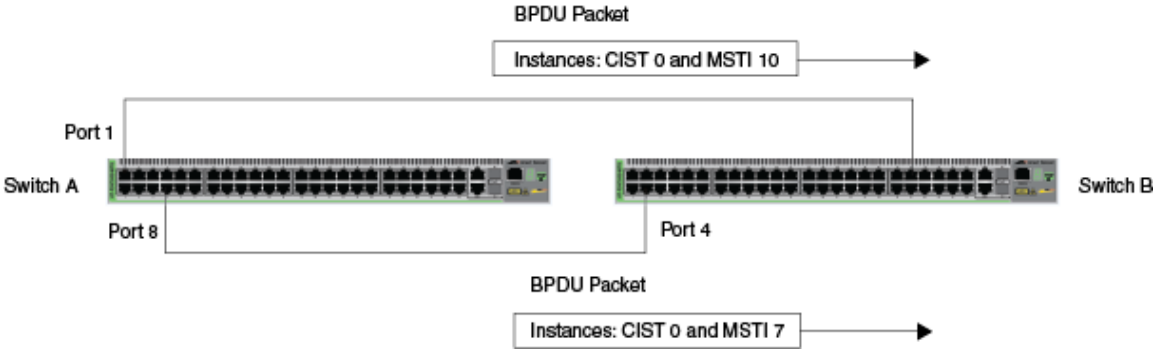

Figure 169. CIST and VLAN Guideline - Example 1

At first glance, it might appear that because both ports belong to CIST, a loop exists between the switches and that MSTP blocks a port to stop the loop. However, within a region, MSTI takes precedence over CIST. When switch B receives a packet from switch A, it uses MSTI, not CIST, to determine whether a loop exists. Because both ports on switch A belong to different MSTIs, switch B determines that no loop exists.

A problem can arise if you assign some VLANs to MSTIs while leaving others just to CIST. The problem is illustrated in Figure 170 on page 897. The network is the same as the previous example. The only difference is that the VLAN containing port 8 on Switch A is not assigned to an MSTI, and belongs only to CIST with its MSTI ID of 0.

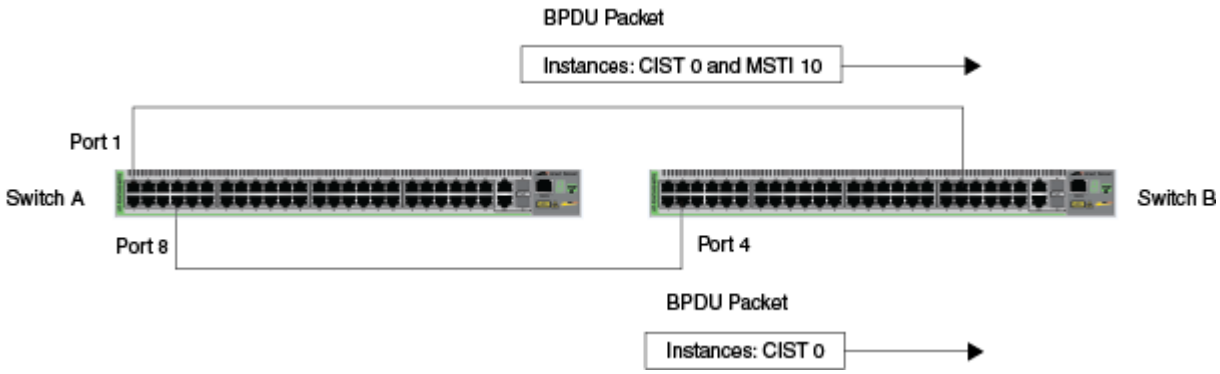

Figure 170. CIST and VLAN Guideline - Example 2

When port 4 on switch B receives a BPDU, the switch notes the port sending the packet belongs only to CIST. Therefore, switch B uses CIST in determining whether a loop exists. The result would be that the switch detects a loop because the other port is also receiving BPDU packets from CIST 0. Switch B would block a port to cancel the loop.

To avoid this issue, always assign all VLANs on a switch, including the Default_VLAN, to an MSTI. This guarantees that all ports on the switch have an MSTI ID and that helps to ensure that loop detection is based on MSTI, not CIST.

Connecting VLANs Across Different Regions

Special consideration needs to be taken into account when you connect different MSTP regions or an MSTP region and a single-instance STP or RSTP region. Unless planned properly, VLAN fragmentation can occur between the VLANS of your network.

As mentioned previously, only the CIST can span regions. An MSTI cannot. Consequently, you may run into a problem if you use more than one physical data link to connect together various parts of VLANs that reside in bridges in different regions. The result can be a physical loop, which spanning tree disables by blocking ports.

This is illustrated in Figure 171. The example show two switches, each residing in a different region. Port 5 in switch A is a boundary port. It is an untagged member of the Accounting VLAN, which has been associated with MSTI 4. Port 16 is a tagged and untagged member of three different VLANs, all associated with MSTI 12.

If both switches were a part of the same region, there would be no problem because the ports reside in different spanning tree instances. However, the switches are part of different regions, and MSTIs do not cross regions. Consequently, the result is that spanning tree would determine that a loop exists between the regions, and Switch B would block a port.

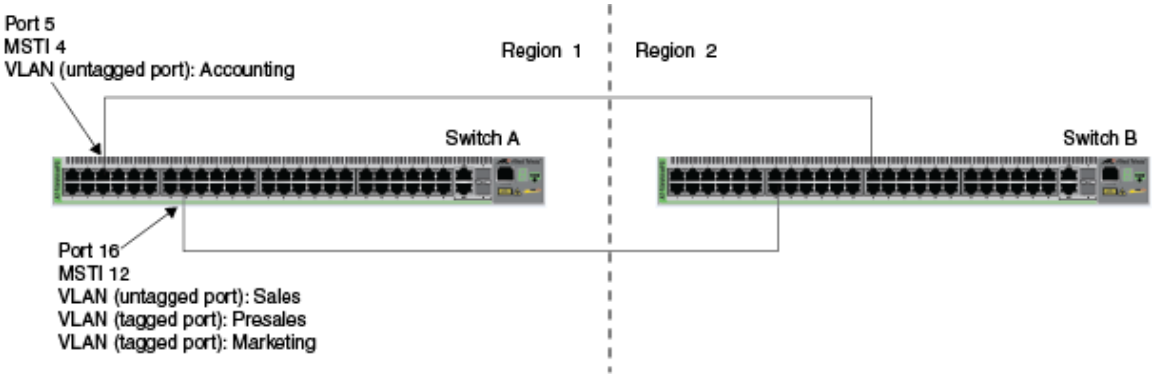

Figure 171. Spanning Regions - Example 1

There are several ways to address this issue. The first is to have only *one* MSTP region for each subnet in your network.

Another approach is to group those VLANs that need to span regions into the same MSTI. In this case, VLANs that do not span regions can be assigned to other MSTIs.

Here is an example. Assume that you have two regions that contain the following VLANS:

Table 94. Two Region Examples

Region 1 VLANs	Region 2 VLANs
Sales	Hardware Engineering
Presales	Software Engineering
Marketing	Technical Support
Advertising	Product Management
Technical Support	CAD Development
Product Management	Accounting
Project Management	
Accounting	

The two regions share three VLANs: Technical Support, Product Management, and Accounting. You can group these three VLANs into the same MSTI in each region. For instance, for Region 1 you might group the three VLANs in MSTI 11 and in Region 2 you could group them into MSTI 6. After they are grouped, you can connect the VLANs across the regions using a link of untagged/tagged ports. See Figure 172.

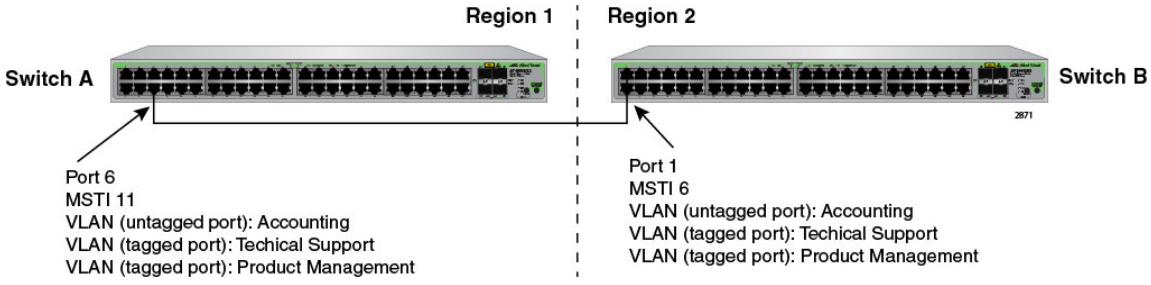

Figure 172. Spanning Regions without Blocking

MSTP Root Guard

The Root Guard feature enforces the root bridge placement in a network. It ensures the port that you have configured with the Root Guard feature is a designated port. Normally, root bridge ports are all designated ports, unless two or more ports of the root bridge are connected.

If the bridge receives a superior BPDU on a root-designated port, the Root Guard feature changes the state of the port to a “root inconsistent” STP state. This state varies depending on the spanning tree designation. For MSTP, this is a discarding state. For more information about this command, see “SPANNING-TREE GUARD ROOT” on page 915.

Note
This feature is also supported in STP and RSTP.

Chapter 61
MSTP Commands

The MSTP commands are summarized in Table 95 and described in detail within the chapter.

Table 95. Multiple Spanning Tree Protocol Commands

Command	Mode	Description
“INSTANCE MSTI-ID PRIORITY” on page 903	Interface Configuration	Sets the port priority for an MST instance (MSTI).
“INSTANCE MSTI-ID VLAN” on page 905	MST Configuration	Create an MSTI instance and associate a VLAN with it.
“NO SPANNING-TREE ERRDISABLE-TIMEOUT ENABLE” on page 906	Global Configuration	Deactivates the BPDU guard timer.
“NO SPANNING-TREE PORTFAST” on page 907	Port Interface	Removes ports as edge ports on the switch.
“NO SPANNING-TREE MSTP ENABLE” on page 908	Global Configuration	Disables MSTP on the switch.
“SHOW SPANNING-TREE” on page 909	User Exec and Privileged Exec	Displays the MSTP settings on the switch.
“SHOW SPANNING-TREE MST CONFIG” on page 910	Privileged Executive	Displays the MSPT Configuration information for a bridge.
“SHOW SPANNING-TREE MST” on page 911	Privileged Executive	Displays the MST to VLAN port mapping.
“SHOW SPANNING-TREE MST INSTANCE” on page 912	Privileged Executive	Displays detailed information for a particular instance.
“SPANNING-TREE ERRDISABLE-TIMEOUT ENABLE” on page 913	Global Configuration	Activates the timer for the BPDU guard feature.
“SPANNING-TREE ERRDISABLE-TIMEOUT INTERVAL” on page 914	Global Configuration	Specifies the duration of the BPDU guard timer.
“SPANNING-TREE GUARD ROOT” on page 915	Port Interface	Enables the Root Guard feature on a port.
“SPANNING-TREE MODE MSTP” on page 916	Global Configuration	Sets MSTP as the spanning tree protocol.

Table 95. Multiple Spanning Tree Protocol Commands (Continued)

Command	Mode	Description
“SPANNING-TREE MSTP ENABLE” on page 917	Global Configuration	Designates the MSTP mode on the switch.
“SPANNING-TREE MST CONFIGURATION” on page 918	Global Configuration	Enters the MST Configuration mode.
“SPANNING-TREE MST INSTANCE” on page 919	Interface Configuration	Associates an MSTI with a port.
“SPANNING-TREE PATH-COST” on page 920	Port Interface	Specifies the cost of a port to the root bridge.
“SPANNING-TREE PORTFAST” on page 921	Port Interface	Designates the ports as edge ports.
“SPANNING-TREE PORTFAST BPDU-GUARD” on page 922	Interface Configuration	Enables the Root Guard feature.
“REGION” on page 923	MST Configuration	Assigns a name to an MST region.
“REVISION” on page 924	MST Configuration	Assigns an MST revision number.

INSTANCE MSTI-ID PRIORITY

Syntax

```
instance msti-id priority priority
```

Parameters

priority

Specifies a port priority. The range is 0 to 61440, in increments of 4096.

Mode

Interface Configuration mode

Description

Use this command to set the port priority for an MST instance (MSTI).

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 is chosen as the root port over a port— equivalent in all other aspects— but with a higher priority value. The default value is 32768. For information about MSTI, see "MSTI Guidelines" on page 886.

The range is 0 to 61,440, in increments of 4,096. The range is divided into the sixteen increments listed in Table 96. You specify the increment that represents the bridge priority value you want to assign the switch. The default value is 32,768 (increment 8).

Table 96. MSTP Bridge Priority Value Increments

Increment	Bridge Priority	Increment	Bridge Priority
0	0	8	32768
1	4096	9	36864
2	8192	10	40960
3	12288	11	45056
4	16384	12	49152
5	20480	13	53248
6	24576	14	57344

Table 96. MSTP Bridge Priority Value Increments (Continued)

Increment	Bridge Priority	Increment	Bridge Priority
7	28672	15	61440

Use the no command, NO INSTANCE MSTI-ID PRIORITY, to restore the default priority value of 32768.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example assigns MSTI ID 3 a priority of 4096 to port 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree mode mstp
awplus(config)# spanning-tree mstp enable
awplus(config)# spanning-tree spanning-tree mst
configuration
awplus(config-mst)# interface port 1.0.4
awplus(config-mst)# instance 3 priority 4096
```

INSTANCE MSTI-ID VLAN

Syntax

```
instance msti-id vlan vid|vidlist
```

Parameters

vid
Specifies a VLAN ID.

vidlist
Specifies a list of VLAN IDs.

Mode

Port Interface mode

Description

Use this command to permit MSTP to create an instance and associate an instance with one or more VLANs. The switch supports up to 15 MSTIs. An instance can contain any number of VLANs, but a VLAN can belong to only one MSTI at a time. For information about MSTI, see "MSTI Guidelines" on page 886.

After you use the INSTANCE MSTI-ID VLAN command to create an instance and associate it with a VLAN, use the SPANNING-TREE MST INSTANCE command to associate ports with each instance. See "SPANNING-TREE MST INSTANCE" on page 919.

Use the no command, NO INSTANCE MSTI-ID VLAN, to delete an instance and its associated VLAN ID.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example assigns an MSTI ID 3 to VLAN 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree mode mstp
awplus(config)# spanning-tree mstp enable
awplus(config)# spanning-tree mst configuration
awplus(config-mst)# instance 3 vlan 7
```

NO SPANNING-TREE ERRDISABLE-TIMEOUT ENABLE

Syntax

```
spanning-tree errdisable-timeout enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to deactivate the timer for the MSTP BPDU guard feature. When the timer is deactivated, ports that the feature disables because they receive BPDU packets remain disabled until you manually activate them again with the NO SHUTDOWN command.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example deactivates the timer for the MSTP BPDU guard feature:

```
awplus> enable
awplus# configure terminal
awplus(config)# no spanning-tree errdisable-timeout enable
```

NO SPANNING-TREE PORTFAST

Syntax

```
no spanning-tree portfast
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to remove ports as edge ports on the switch. This command is equivalent to "NO SPANNING-TREE PORTFAST" on page 859.

Example

This example removes port 21 as an edge port:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.21
awplus(config-if)# no spanning-tree portfast
```

NO SPANNING-TREE MSTP ENABLE

Syntax

```
no spanning-tree mstp enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable MSTP on the switch.

> **Note**
> Before disabling the spanning tree protocol on the switch, display the MSTP states of the ports and disconnect the network cables from any ports that are in the discarding state. Ports that are in the discarding state begin to forward traffic again when MSTP is disabled. Leaving the cables connected may result in broadcast storms from network loops. To view the states of the ports, refer to “SHOW SPANNING-TREE” on page 909.

Confirmation Command

“SHOW SPANNING-TREE” on page 909

Example

This example disables MSTP on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no spanning-tree mstp enable
```

SHOW SPANNING-TREE

Syntax

```
show spanning-tree
```

Parameters

None

Modes

Privileged Exec mode

Description

Use this command to display the MSTP settings on the switch. An example of the display is shown in Figure 173.

```
% Default: Bridge up - Spanning Tree Enabled
% Default: CIST Root Path Cost 0 - CIST Root Port 0 -  CIST Bridge Priority 32768
% Default: Forward Delay 15 - Hello Time 2 - Max Age 20 - Max-hops 20
% Default: CIST Root Id 8000:eccd6d1e5228
% Default: CIST Reg Root Id 8000:eccd6d1e5228
% Default: CIST Bridge Id 8000:eccd6d1e5228
% Default: portfast bpdu-filter disabled
% Default: portfast bpdu-guard disabled
% Default: portfast errdisable timeout disabled
% Default: portfast errdisable timeout interval 300 sec
%  Instance      VLAN
%  0           1
```

Figure 173. SHOW SPANNING-TREE Command for MSTP

Example

This example displays MSTP settings on the switch:

```
awplus# show spanning-tree
```

SHOW SPANNING-TREE MST CONFIG

Syntax

```
show spanning-tree mst config
```

Parameters

None

Mode

Privileged Executive Mode

Description

Use this command to display the MSTP configuration information for a bridge. Use the display to check that the digest is the same on this device as for all other devices in the same region.

Example

This example displays the MSTP configuration information for a bridge:

```
awplus> enable
awplus# show spanning-tree mst config
```

An example of the display is shown in Figure 174.

```
%
% MSTP Configuration Information for bridge 0:
% ----------------------------------------------------------------
%  Format Id: 0
%  Name:
%  Revision Level: 0
%  Digest: 0xAC36177F50283CD4B83821D8AB26DE62
%  ----------------------------------------------------------------
```

Figure 174. SHOW SPANNING-TREE MST CONFIG Command

SHOW SPANNING-TREE MST

Syntax

```
show spanning-tree mst
```

Parameters

None

Mode

Privileged Executive Mode

Description

Use this command to display the MST to VLAN port mapping.

Example

This example displays the MST to VLAN port mappings:

```
awplus> enable
awplus# show spanning-tree mst
```

An example of the display is shown in Figure 175.

```
% Default: Bridge up - Spanning Tree Enabled
% Default: CIST Root Path Cost 200000 - CIST Root Port 33033 - CIST
Bridge Priority 327 68
%  Default: Forward Delay 15 - Hello Time 2 - Max Age 20 - Max-hops 0
%  Default: CIST Root Id 00:30:84:fd:7a:55
%  Default: CIST Reg Root ID 02:10:18:47:04:10
%  Default: CIST Bridge ID 02:10:18:47:04:10
%  Default: CIST 4 topology change(s) - last topology change Sat Jan 1
00:01:35:2000


%  Instance VLAN
%  0: 1,4095
```

Figure 175. SHOW SPANNING-TREE MST Command

SHOW SPANNING-TREE MST INSTANCE

Syntax

```
show spanning-tree mst instance <msti-id>
```

Parameters

instance
: Specifies an instance ID. The range is from 1 to 15.

Mode

Privileged Executive Mode

Description

Use this command to display detailed information for a particular instance and all switch ports associated with that instance.

Example

This example displays detailed information for instance 4 and all the ports associated with that instance:

```
awplus> enable
awplus# show spanning-tree mst instance 4
```

SPANNING-TREE ERRDISABLE-TIMEOUT ENABLE

Syntax

```
spanning-tree errdisable-timeout enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate the timer for the BPDU guard feature. The BPDU guard feature prevents unnecessary domain convergences by disabling edge ports if they receive BPDUs. When the timer is activated, the switch will automatically reactivate disabled ports. The time interval that ports remain disabled is set with "SPANNING-TREE ERRDISABLE-TIMEOUT INTERVAL" on page 914.

To disable the timer for the BPDU guard feature, use the NO SPANNING-TREE ERRDISABLE TIMEOUT INTERVAL command.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

The following example activates the timer for the BPDU guard feature:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree errdisable-timeout enable
```

SPANNING-TREE ERRDISABLE-TIMEOUT INTERVAL

Syntax

```
spanning-tree errdisable-timeout interval interval
```

Parameters

interval

Specifies the number of seconds that ports remain disabled by the BPDU guard feature. The range is 10 to 1000000 seconds. The default is 300 seconds.

Mode

Global Configuration mode

Description

Use this command to specify the number of seconds that must elapse before the switch automatically enables ports that are disabled by the BPDU guard feature. To activate the timer, refer to “SPANNING-TREE ERRDISABLE-TIMEOUT ENABLE” on page 913.

To reset the timer to its default value of 300 seconds, use the NO SPANNING-TREE ERRDISABLE-TIMEOUT INTERVAL command.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example sets the time interval to 200 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree errdisable-timeout interval
200
```

SPANNING-TREE GUARD ROOT

Syntax

```
spanning-tree guard root
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to enable the Root Guard feature on the specified port. The Root Guard feature ensures that the port on which it is enabled is a designated port. If a Root-Guard-enabled port receives a superior BPDU, that may cause it to become a root port, then the port traffic is placed in a "root inconsistent" state. For MSTP, this state is a discarding state.

Use the no version of this command, NO SPANNING-TREE GUARD ROOT, to disable the Root Guard feature on the specified port.

To view the current setting for this parameter, refer to "SHOW SPANNING-TREE" on page 909.

Confirmation Command

"SHOW SPANNING-TREE" on page 909

Examples

This example enables the Root Guard feature on port 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.7
awplus(config-if)# spanning-tree guard root
```

This example disables the Root Guard feature on port 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12
awplus(config-if)# no spanning-tree guard root
```

SPANNING-TREE MODE MSTP

Syntax

```
spanning-tree mode mstp
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to set MSTP as the spanning tree protocol mode.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example sets MSTP as the spanning tree protocol mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree mode mstp
```

SPANNING-TREE MSTP ENABLE

Syntax

```
spanning-tree mstp enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to designate MSTP as the active spanning tree protocol on the switch. After activating the protocol, you can enable or disable the spanning tree protocol and set the switch or port parameters.

MSTP is active on the switch only after you have designated it as the active spanning tree with this command and enabled it with "SPANNING-TREE MST CONFIGURATION" on page 918.

Only one spanning tree protocol, STP, RSTP, or MSTP can be active on the switch.

Confirmation Command

"SHOW SPANNING-TREE" on page 909

Example

This example enables MSTP on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree mstp enable
```

SPANNING-TREE MST CONFIGURATION

Syntax

```
spanning-tree mst configuration
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enter the MST mode.

> **Note**
> Only one spanning tree protocol, STP, RSTP, or MSTP, can be active on the switch.

Confirmation Command

“SHOW SPANNING-TREE” on page 909

Example

This example enters the MST mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree mstp mode
awplus(config)# spanning-tree mst configuration
```

SPANNING-TREE MST INSTANCE

Syntax

```
spanning-tree mst instance <1-15>
```

Parameters

instance
Specifies an instance ID. The range is from 1 to 15.

Mode

Interface Configuration mode

Description

Use this command to associate a Multiple Spanning Tree instance (MSTI) with a port. Before you assign an instance ID to a port, you must create an instance. To create an instance, use the INSTANCE MSTI-ID VLAN command. See "INSTANCE MSTI-ID VLAN" on page 905.

Ports are automatically configured to send and receive spanning-tree information for the associated MSTI when you assign a VLAN to the MSTI using the INSTANCE MST-ID VLAN command. For information about this command, see "INSTANCE MSTI-ID VLAN" on page 905.

To remove the association between an MST instance and a port, use the NO SPANNING-TREE MST INSTANCE command. In addition, to disable the automatic configuration of member ports of a VLAN to an associated MSTI, use the NO SPANNING-TREE MST INSTANCE command to remove the member port from the MSTI.

Confirmation Command

"SHOW SPANNING-TREE" on page 909

Example

In the following example, port 2 is associated with instance 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree mst instance 12
```

SPANNING-TREE PATH-COST

Syntax

```
spanning-tree path-cost path-cost
```

Parameters

path-cost
: Specifies the cost of a port to the root bridge. The range is 1 to 200000000.

Mode

Port Interface mode

Description

Use this command to specify the cost of a port to the root bridge. This cost is combined with the costs of the other ports in the path to the root bridge, to determine the total path cost. For MSTP, this command only applies to the path cost for CIST. The lower the numeric value, the higher the priority of a path. The range is 1 to 200000000. The default depends on the port speed.

To return a port to the default value, use the no version of this command, NO SPANNING-TREE PATH-COST.

Confirmation Command

“SHOW SPANNING-TREE” on page 909

Example

This example assigns port 2 a port cost of 22:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# spanning-tree path-cost 22
```

SPANNING-TREE PORTFAST

Syntax

```
spanning-tree portfast
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to designate edge ports on the switch. Edge ports are not connected to spanning tree devices or to LANs that have spanning tree devices. As a consequence, edge ports do not receive BPDUs. If an edge port starts to receive BPDUs, it is no longer considered an edge port by the switch.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example configures port 17 as an edge port:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17
awplus(config-if)# spanning-tree portfast
```

SPANNING-TREE PORTFAST BPDU-GUARD

Syntax

```
spanning-tree portfast bpdu-guard
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enable the Root Guard feature on the switch which protects the switch from receiving superior BPDUs.

Use the no version of this command, NO SPANNING-TREE PORTFAST BPDU-GUARD, to disable the root guard feature on a switch.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example enables the root guard feature on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree portfast bpdu-guard
```

REGION

Syntax

```
region <region-name>
```

Parameters

region-name
Specifies the name of an MST region. Up to 32 characters.

Mode

MSTP Configuration mode

Description

Use this command to name the MSTP Region.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168 or "SHOW SPANNING-TREE" on page 909

Example

This example names the MSTP region "santa clara county:"

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree mst enable
awplus(config)# spanning-tree mst configuration
awplus (config-mst)# region santa_clara_county
```

REVISION

Syntax

```
revision <revision-number>
```

Parameters

revision-number
Specifies the revision number. The range is 0 to 255.

Mode

MST Configuration mode

Description

Use this command to specify the revision number of the current MST configuration. This value is an arbitrary value that you assign to an MST region. Use the revision number to track the number of times an MST configuration has been updated on the network.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

“SHOW SPANNING-TREE” on page 909

Example

This example specifies the MST revision number as 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# spanning-tree mst enable
awplus(config)# spanning-tree mst configuration
awplus (config-mst)# revision 4
```

Section VIII

Virtual LANs

This section contains the following chapters:

Chapter 62

Port-based and Tagged VLANs

This chapter covers the following topics:

Overview

A VLAN is a group of ports that form a logical Ethernet segment on an Ethernet switch. The ports of a VLAN form an independent traffic domain in which the traffic generated by the nodes remains within the VLAN.

VLANs let you segment your network through the switch's management software so that you can group nodes with related functions into their own separate, logical LAN segments. These VLAN groupings can be based on similar data needs or security requirements. For example, you could create separate VLANs for the different departments in your company, such as one for Sales and another for Accounting.

VLANs offer several important benefits:

- Improved network performance

  Network performance often suffers as networks grow in size and as traffic increases. The more nodes on each LAN segment vying for bandwidth, the greater the likelihood overall network performance will decrease.

  VLANs improve network perform because VLAN traffic stays within the VLANs. The nodes of a VLAN receive traffic only from nodes of the same VLAN. This reduces the need for nodes to handle traffic not destined for them and frees up bandwidth within all the logical workgroups.

  In addition, broadcast traffic remains within a VLAN because each VLAN constitutes a separate broadcast domain. This, too, can improve overall network performance.

- Increased security

  Because network traffic generated by a node in a VLAN is restricted only to the other nodes of the same VLAN, you can use VLANs to control the flow of packets in your network and prevent packets from flowing to unauthorized end nodes.

- Simplified network management

  VLANs can also simplify network management. Before the advent of VLANs, physical changes to the network often had to be made at the switches in the wiring closets. For example, if an employee changed departments, changing the employee's LAN segment assignment often required a change to the wiring at the switch.

  With VLANS, you can use the switch's management software to change the LAN segment assignments of end nodes, without having to physically move workstations or move cables from one switch port to another port.

Virtual LANs can also span more than one switch. This makes it possible to create VLANs of end nodes that are connected to switches located in different physical locations.

The switch supports the following types of VLANs you can create yourself:

- Port-based VLANs
- Tagged VLANs

These VLANs are described in the following sections.

Port-based VLAN Overview

As the “Overview” on page 928 explains, a VLAN consists of a group of ports that form an independent traffic domain on one or more Ethernet switches. Traffic generated by the end nodes remain within their respective VLANs and does not cross over to the end nodes of other VLANs unless there is an interconnection device, such as a router or Layer 3 switch.

A port-based VLAN is a group of ports on a Gigabit Ethernet Switch that form a logical Ethernet segment. Each port of a port-based VLAN can belong to only one VLAN at a time.

A port-based VLAN can have as many or as few ports as needed. The VLAN can consist of all the ports on an Ethernet switch, or just a few ports. A port-based VLAN also can span switches and consist of ports from multiple Ethernet switches.

Note
The switch is pre-configured with one port-based VLAN, called the Default_VLAN. All ports on the switch are members of this VLAN.

The parts that make up a port-based VLAN are:

- VLAN name
- VLAN Identifier
- Untagged ports
- Port VLAN Identifier

VLAN Name

To create a port-based VLAN, you must give it a name. The name should reflect the function of the network devices that are to be members of the VLAN. Examples include Sales, Production, and Engineering.

VLAN Identifier

Every VLAN in a network must have a unique number assigned to it. This number is called the VLAN identifier (VID). This number uniquely identifies a VLAN in the switch and the network.

If a VLAN consists only of ports located on one physical switch in your network, you assign it a unique VID that is different from all other VLANs in your network.

If a VLAN spans multiple switches, then assign the same VID for the VLAN on the different switches. Then the switches are able to recognize and forward frames belonging to the same VLAN even though the VLAN spans multiple switches.

For example, if you had a port-based VLAN named Marketing that spanned three switches, assign the Marketing VLAN on each switch the same VID.

You can assign this number manually or allow the management software to do it automatically. If you allow the management software to do it automatically, it selects the next available VID. This is acceptable when you are creating a new, unique VLAN.

If you are creating a VLAN that is part of a larger VLAN that spans several switches, then you need to assign the number yourself so that the VLAN has the same VID on all the switches.

Port VLAN Identifier

Each port in a port-based VLAN must have a port VLAN identifier (PVID). The switch associates a frame to a port-based VLAN by the PVID assigned to a port on which a frame is received, and forwards a frame only to those ports with the same PVID. Consequently, all ports of a port-based VLAN must have the same PVID. In addition, the PVID of the ports in a VLAN must match the VLAN's VID.

For example, if you create a port-based VLAN on the switch and assign it a VID of 5, assign the PVID for each port in the VLAN to 5.

Some switches and switch management programs require that you assign the PVID value for each port manually. However, the management software performs this task automatically. The software automatically assigns a PVID to a port, making it identical to the VID of the VLAN to which the port is a member, when you assign the port as an untagged member to a VLAN.

Untagged Ports

You need to specify which ports on the switch are to be members of a port-based VLAN. Ports in a port-based VLAN are referred to as *untagged ports* and the frames received on the ports as *untagged frames*. The names derive from the fact that the frames received on a port do not contain any information that indicates VLAN membership, and that VLAN membership is determined solely by a port's PVID. (There is another type of VLAN where VLAN membership is determined by information within the frames themselves, rather than by a port's PVID. This type of VLAN is explained in "Tagged VLAN Overview" on page 936.)

A port on the switch can be an untagged member of only one port-based VLAN at a time. An untagged port *cannot* be assigned to two port-based VLANs simultaneously.

Guidelines to Creating a Port-based VLAN

Below are the guidelines to creating a port-based VLAN.

- Each port-based VLAN must be assigned a unique VID. If a particular VLAN spans multiples switches, each part of the VLAN on the different switches should be assigned the same VID.
- A port can be an untagged member of only one port-based VLAN at a time.
- The PVID of a port is identical to the VID of the VLAN where the port is an untagged member. The PVID value is automatically assigned by the switch.
- A port-based VLAN that spans multiple switches requires a port on each switch where the VLAN is located to function as an interconnection between the switches where the various parts of the VLAN reside.
- The switch can support up to a total of 4094 port-based, tagged, protected ports, and MAC address-based VLANs.
- A port set to the 802.1x authenticator or supplicant role must be changed to the 802.1x none role before you can change its untagged VLAN assignment. After the VLAN assignment is made, the port's role can be changed back again to authenticator or supplicant, if desired.
- You cannot delete the Default VLAN from the switch.
- Deleting an untagged port from the Default VLAN without assigning it to another VLAN results in the port being an untagged member of no VLAN.

Drawbacks of Port-based VLANs

There are several drawbacks to port-based VLANs:

- It is not easy to share network resources, such as servers and printers, across multiple VLANs. A router or Layer 3 switch must be added to the network to provide a means for interconnecting the port-based VLANs. The introduction of a router into your network could create security issues from unauthorized access to your network.
- A VLAN that spans several switches requires a port on each switch for the interconnection of the various parts of the VLAN. For example, a VLAN that spans three switches would require one port on each switch to interconnect the various sections of the VLAN. In network configurations where there are many individual VLANs that span switches, many ports could end up being used ineffectively just to interconnect the various VLANs.

Port-based Example 1

Figure 176 illustrates an example of one AT-FS970M switch with three port-based VLANs. (The Default VLAN is not shown in the following examples.)

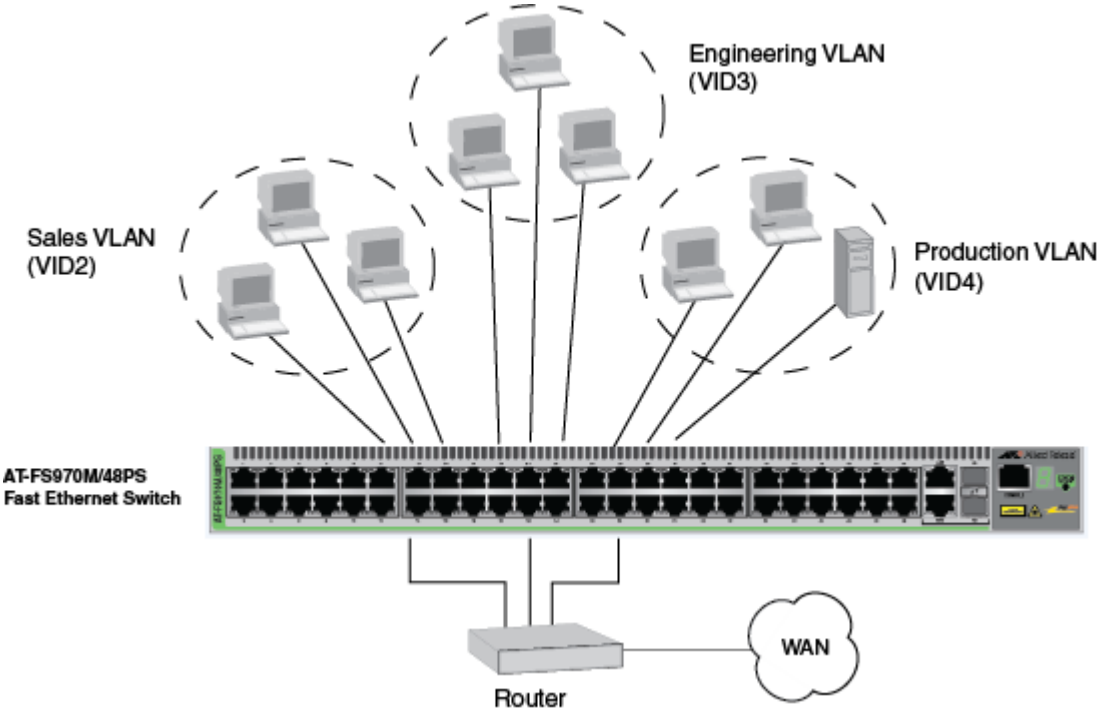

Figure 176. Port-based VLAN - Example 1

The table below lists the port assignments for the Sales, Engineering, and Production VLANs on the switch.

Switch	Sales VLAN (VID 2)	Engineering VLAN (VID 3)	Production VLAN (VID 4)
AT-FS970M Switch	Ports 1, 3 - 5 (PVID 2)	Ports 9, 11 - 13 (PVID 3)	Ports 17 - 19, 21 (PVID 4)

Each VLAN has a unique VID. You assign a VID number when you create a VLAN.

The ports have been assigned PVID values. A port's PVID is assigned automatically by the switch when you create the VLANs. The PVID of a port is the same as the VID in which the port is an untagged member.

In the example, each VLAN has one port connected to the router. The router interconnects the various VLANs and functions as a gateway to the WAN.

Port-based Example 2

Figure 177 illustrates more port-based VLANs. In this example, two VLANs, Sales and Engineering, span two switches.

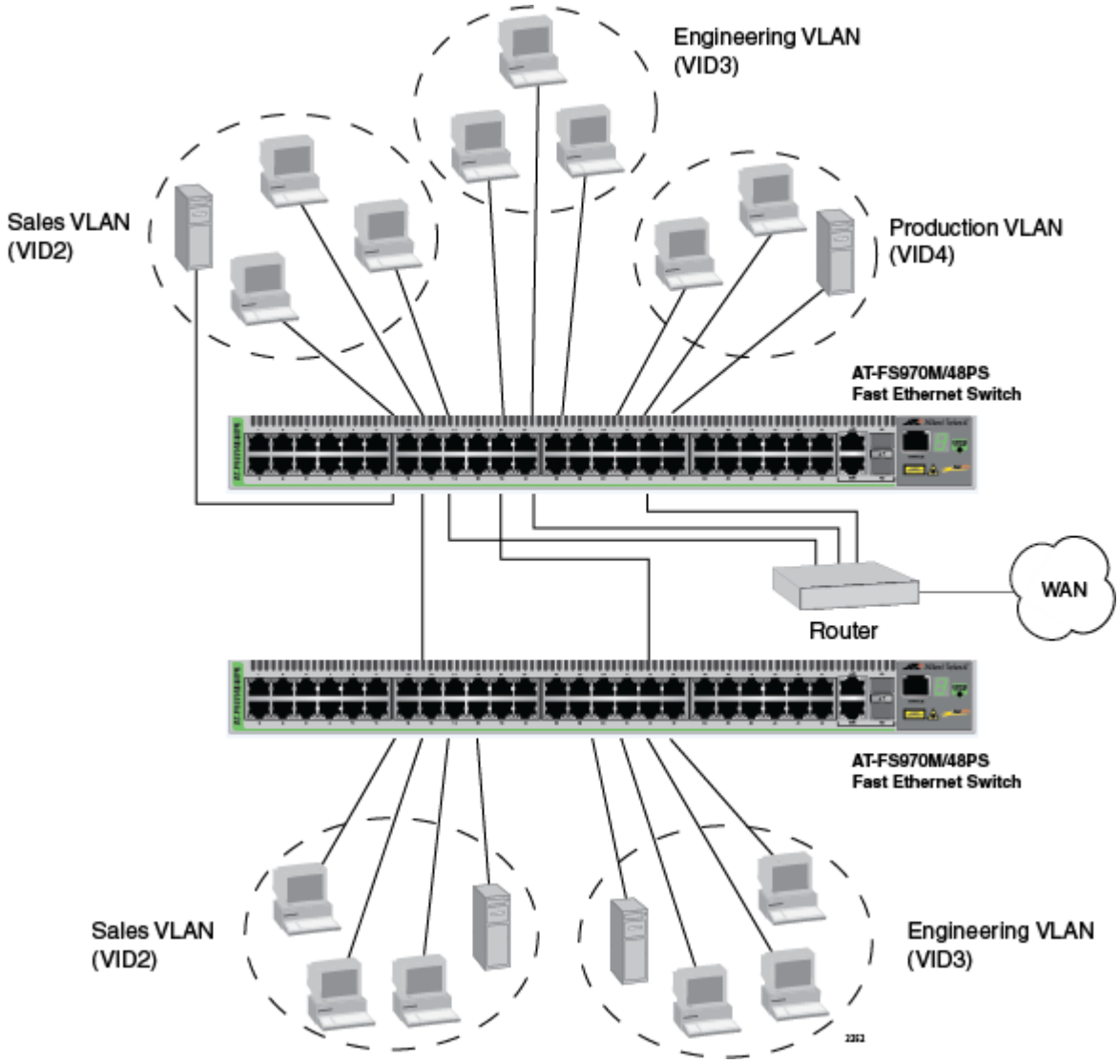

Figure 177. Port-based VLAN - Example 2

The table below lists the port assignments for the Sales, Engineering, and Production VLANs on the switches:

Switch	Sales VLAN (VID 2)	Engineering VLAN (VID 3)	Production VLAN (VID 4)
AT-FS970M Switch (top)	Ports 1 - 6 (PVID 2)	Ports 9 - 13 (PVID 3)	Ports 17, 19 - 21 (PVID 4)
AT-FS970M Switch (bottom)	Ports 2 - 4, 6, 8 (PVID 2)	Ports 16, 18-20, 22 (PVID 3)	none

- Sales VLAN - This VLAN spans both switches. It has a VID value of 2 and consists of six untagged ports on the top switch and five untagged ports on the bottom switch.

  The two parts of the VLAN are connected by a direct link from port 4 on the top switch to port 3 on the bottom switch. This direct link allows the two parts of the Sales VLAN to function as one logical LAN segment.

  Port 6 on the top switch connects to the router. This port allows the Sales VLAN to exchange Ethernet frames with the other VLANs and to access the WAN.

- Engineering VLAN - The workstations of this VLAN are connected to ports 9 to 13 on the top switch and ports 16, 18 to 20, and 22 on the bottom switch.

  Because this VLAN spans multiple switches, it needs a direct connection between its various parts to provide a communications path. This is provided in the example with a direct connection from port 10 on the top switch to port 19 on the bottom switch.

  This VLAN uses port 12 on the top switch as a connection to the router and the WAN.

- Production VLAN - This is the final VLAN in the example. It has the VLAN of 4, and its ports have been assigned the PVID also of 4.

  The nodes of this VLAN are connected only to the top switch. So this VLAN does not require a direct connection to the bottom switch. However, it uses port 20 as a connection to the router.

Tagged VLAN Overview

The second type of VLAN is the tagged VLAN. VLAN membership in a tagged VLAN is determined by information within the frames that are received on a port. This differs from a port-based VLAN, where the PVIDs assigned to the ports determine VLAN membership.

The VLAN information within an Ethernet frame is referred to as a *tag* or *tagged header*. A tag, which follows the source and destination addresses in a frame, contains the VID of the VLAN to which the frame belongs (IEEE 802.3ac standard). As explained earlier in this chapter in “VLAN Identifier” on page 930, this number uniquely identifies each VLAN in a network.

When the switch receives a frame with a VLAN tag, referred to as a *tagged frame*, the switch forwards the frame only to those ports that share the same VID.

A port to receive or transmit tagged frames is referred to as a *tagged port*. Any network device connected to a tagged port must be IEEE 802.1q compliant. This is the standard that outlines the requirements and standards for tagging. The device must be able to process the tagged information on received frames and add tagged information to transmitted frames.

The benefit of a tagged VLAN is that the tagged ports can belong to more than one VLAN at one time. This can greatly simplify the task of adding shared devices to the network. For example, a server can be configured to accept and return packets from many different VLANs simultaneously.

Tagged VLANs are also useful where multiple VLANs span across switches. You can use one port per switch to connect all VLANs on the switch to another switch.

The IEEE 802.1q standard describes how this tagging information is used to forward the traffic throughout the switch. The handling of frames tagged with VIDs coming into a port is straightforward. If the incoming frame’s VID tag matches one of the VIDs of a VLAN of which the port is a tagged member, the frame is accepted and forwarded to the appropriate ports. If the frame’s VID does not match any of the VLANs that the port is a member of, the frame is discarded.

The parts of a tagged VLAN are similar to those for a port-based VLAN. They are:

- ❒ VLAN Name
- ❒ VLAN Identifier
- ❒ Tagged and Untagged Ports
- ❒ Port VLAN Identifier

Note
For explanations of VLAN name and VLAN identifier, refer back to "VLAN Name" on page 930 and "VLAN Identifier" on page 930.

Tagged and Untagged Ports

You need to specify which ports will be members of the VLAN. In the case of a tagged VLAN, it is usually a combination of both untagged ports and tagged ports. You specify which ports are tagged and which are untagged when you create the VLAN.

An untagged port, whether a member of a port-based VLAN or a tagged VLAN, can be in only one VLAN at a time. However, a tagged port can be a member of more than one VLAN. A port can also be an untagged member of one VLAN and a tagged member of different VLANs simultaneously.

Port VLAN Identifier

As explained earlier in the discussion on port-based VLANs, the PVID of a port determines the VLAN where the port is an untagged member.

Because a tagged port determines VLAN membership by examining the tagged header within the frames that it receives and not the PVID, you might conclude that there is no need for a PVID. However, the PVID is used if a tagged port receives an untagged frame— a frame without any tagged information. The port forwards the frame based on the port's PVID. This is only in cases where an untagged frame arrives on a tagged port. Otherwise, the PVID on a tagged port is ignored.

Guidelines to Creating a Tagged VLAN

Below are the guidelines to creating a tagged VLAN.

- Each tagged VLAN must have a unique VID. If a VLAN spans multiple switches, each part of the VLAN on the different switches must have the same VID.
- A tagged port can be a member of multiple VLANs.
- An untagged port can be an untagged member of only one VLAN at a time.
- The switch can support up to a total of 4094 port-based, tagged, protected ports, and MAC address-based VLANs.

Tagged VLAN Example

Figure 178 illustrates how tagged ports can be used to interconnect IEEE 802.1q based products.

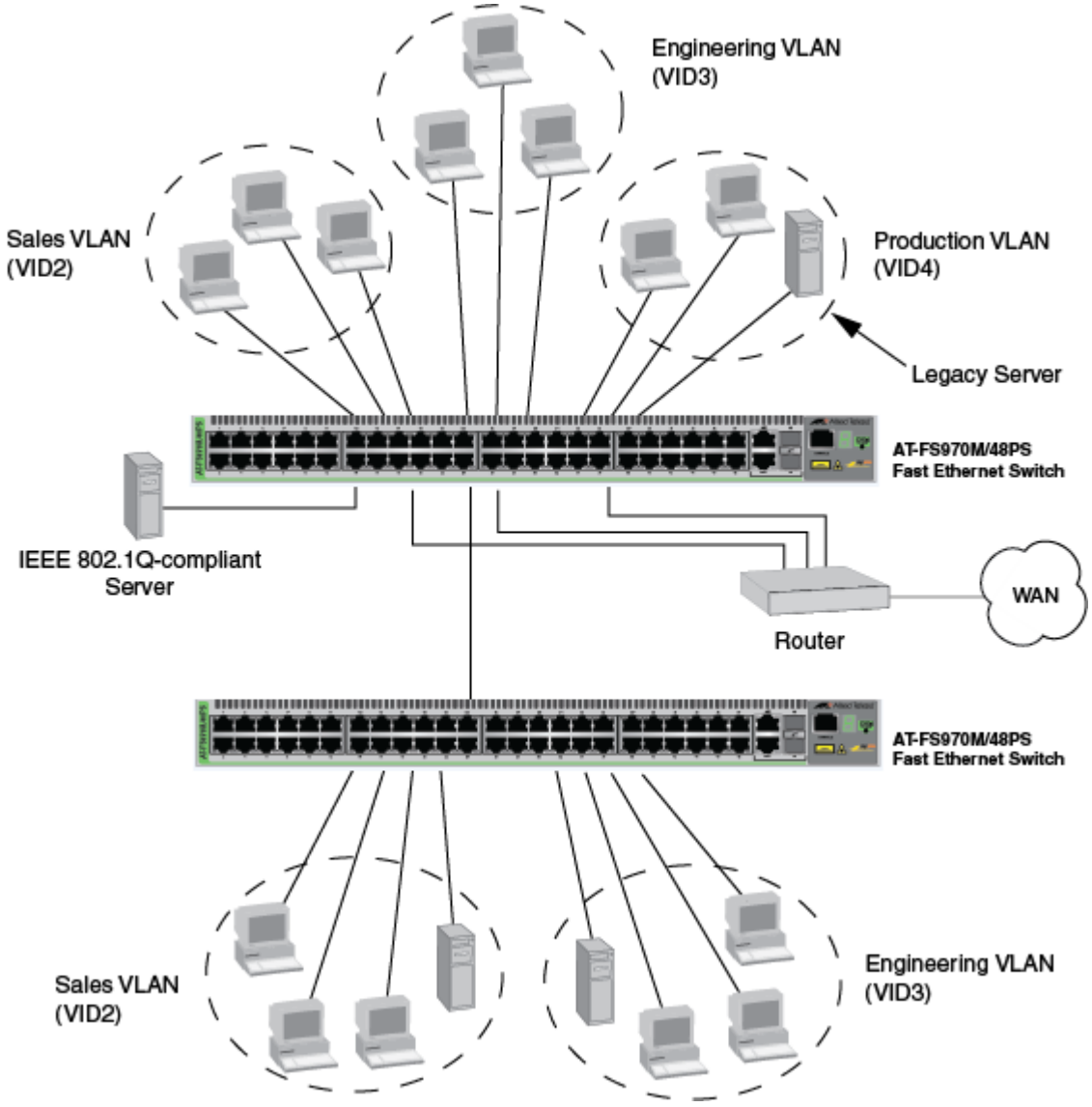

Figure 178. Example of a Tagged VLAN

The port assignments for the VLANs are described in Table 97.

Table 97. VLAN Port Assignments

Switch	**Sales VLAN (VID 2)**		**Engineering VLAN (VID 3)**		**Production VLAN (VID 4)**	
	Untagged Ports	Tagged Ports	Untagged Ports	Tagged Ports	Untagged Ports	Tagged Ports
AT-FS970M Switch (top)	1, 3 to 5 (PVID 2)	2, 10	9, 11 to 13 (PVID 3)	2, 10	17, 19 to 21 (PVID 4)	2
AT-FS970M Switch (bottom)	2, 4, 6, 8 (PVID 2)	9	16, 18, 20, 22 (PVID 3)	9	none	none

This example is nearly identical to the “Port-based Example 2” on page 934. Tagged ports have been added to simplify network implementation and management.

One of the tagged ports is port 2 on the top switch. This port has been made a tagged member of the three VLANs. It is connected to an IEEE 802.1q compliant server, meaning the server can handle frames from multiple VLANs. Now all three VLANs can access the server without going through a router or other interconnection device.

It is important to note that even though the server is accepting frames from and transmitting frames to more than one VLAN, data separation and security remain.

Two other tagged ports are used to simplify network design in the example. They are port 10 on the top switch and port 9 on the lower switch. These ports have been made tagged members of the Sales and Engineering VLANs so that they can carry traffic from both VLANs, simultaneously. These ports provide a common connection that enables different parts of the same VLAN to communicate with each other while maintaining data separation between VLANs.

In comparison, the Sales and Engineering VLANs in the “Port-based Example 2” on page 934 each had to have its own individual network link between the switches to connect the different parts of the VLANs. But with tagged ports, you can use one data link to carry data traffic from several VLANs, while still maintaining data separation and security. The tagged frames, when received by the switch, are delivered only to those ports that belong to the VLAN from which the tagged frame originated.

Creating VLANs

To create VLANs, use the VLAN command in the VLAN Configuration mode. You must specify a name and a VID for a new VLAN in the command. A name can have up to 20 characters. Giving the VLANs unique names make them easier to identify.

A new VLAN also needs a VID number, which has a range of 2 to 4094. (The VID 1 is reserved for the Default_VLAN.) Each VLAN on the switch must be assigned a unique VID. VLANs that span more than one switch should be assigned the same VID number on each switch.

Here is the format of the command:

```
vlan vid [name name]
```

This example creates the Engineering VLAN and assigns it a VID of 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 5 name Engineering
```

Note
The VLAN name field is used only as a description in the SHOW VLAN command output. It cannot be a substituted for the VID when specifying a specific VLAN in other commands.

This example creates four new VLANs that have the VIDs of 4, 5, 6 and 11:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 4-6,11
```

Note
You cannot specify a name when creating more than one VLAN.

New VLANs do not have any ports. To add untagged ports, refer to "Adding Untagged Ports to VLANs" on page 942. To add tagged ports, refer to "Adding Tagged Ports to VLANs" on page 944.

Adding Untagged Ports to VLANs

To add a port to a VLAN as an untagged port, it may be necessary to first set its mode with the SWITCHPORT MODE ACCESS command in the Port Interface mode. Once a port's mode is set to access, it functions as an untagged port. However, this step may not be necessary because the default mode setting for all ports is as untagged ports. In fact, the only situation where you are likely to use the command is on ports that need to function as untagged ports again after acting as tagged ports. Here is the format of the command:

```
switchport mode access [ingress-filter enable|disable]
```

For an explanation of the INGRESS-FILTER parameter, refer to "SWITCHPORT MODE ACCESS" on page 960.

After you've set the mode of a port to access (or if it is already set to that mode), you can use the SWITCHPORT ACCESS VLAN command, which is also found in the Port Interface mode, to assign it as an untagged member of a VLAN. Here is the format of the command:

```
switchport access vlan vid
```

The VID parameter is the VLAN to which you want to add the untagged port. If you do not know the number, use the SHOW VLAN ALL command in the User Exec mode or the Privileged Exec mode to view the VLANs on the switch. You can specify just one VID in the command because a port can be an untagged member of just one VLAN at a time. The designated VLAN must already exist on the switch.

This example of the commands designates ports 5 and 7 as untagged ports and adds them to a VLAN with the VID 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5,port1.0.7
awplus(config-if)# switchport mode access
awplus(config-if)# switchport access vlan 12
```

When the switch adds the ports to VLAN 12, it removes them from their current VLAN assignments because a port can be an untagged member of just one VLAN at a time.

This example designates ports 11 to 18 as untagged ports of a VLAN with the VID 4. The SWITCHPORT MODE ACCESS command is omitted because the example assumes the ports are already designated as untagged ports:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11-port1.0.18
awplus(config-if)# switchport access vlan 4
```

Adding Tagged Ports to VLANs

There are three steps to adding ports as tagged ports to VLANs:

1. Set the mode of the ports to trunk so that they function as tagged ports. This is performed with the SWITCHPORT MODE TRUNK command.

2. Assign the ports to VLANs with the SWITCHPORT TRUNK ALLOWED VLAN command.

3. Specify the VLAN for untagged ingress packets. This VLAN is referred to as the native VLAN. The command is the SWITCHPORT TRUNK NATIVE VLAN command.

You cannot add a port as a tagged member to a VLAN until after you set its VLAN mode to trunk with the SWITCHPORT MODE TRUNK command. Afterwards, you can assign it as a tagged port to as many VLANs as you want. The command has the format shown here:

```
switchport mode trunk [ingress-filter enable|disable]
```

For an explanation of the optional INGRESS-FILTER parameter, refer to “SWITCHPORT MODE TRUNK” on page 961.

Once a port is labeled as a tagged port, you can add it to VLANs as a tagged member with the SWITCHPORT TRUNK ALLOWED VLAN command. The command has this format:

```
switchport trunk allowed vlan add vid
```

The VID parameter is the ID number of the VLAN to which you want to add the port as a tagged port. You can specify more than one VLAN because tagged ports can belong to more than one VLAN at a time. The VLANs must already exist on the switch.

Both of these commands are located in the Port Interface mode.

This example of the commands adds port 23 as a tagged member to a VLAN with the VID 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.23
awplus(config-if)# switchport mode trunk
awplus(config-if)# switchport trunk allowed vlan add 5
```

This example adds ports 18 to 21 as tagged members to VLANs with the VIDs 7 and 13:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.18-port1.0.21
awplus(config-if)# switchport mode trunk
awplus(config-if)# switchport trunk allowed vlan add 7,13
```

Although tagged ports are primarily intended to handle tagged packets, they may also handle untagged packets. These are packets that do not have any VLAN IDs. To forward these types of packets, tagged ports need to be able to assign them to a particular VLAN on the switch.

This is controlled with what is called native VLANs. A native VLAN is simply the ID number of a VLAN to which a tagged port assigns its ingress untagged frames. For example, a tagged VLAN that is assigned the native VLAN 12 assigns all ingress untagged packets to that VLAN and forwards the packet on to ports in that particular VLAN. A port can have only one native VLAN.

The command for setting the native VLAN of tagged ports is the SWITCHPORT TRUNK NATIVE VLAN command, in the Port Interface mode. Here is the command's format:

```
switchport trunk native vlan vid
```

The VID parameter is the ID number of the VLAN that is to be the native VLAN of the untagged port. You can specify just one VID because a tagged port can have just one native VLAN. The VLAN must already exist on the switch.

This example adds ports 22 and 23 as tagged members to VLANs with the VIDs 8 and 9. The example designates the native VLAN for ingress untagged packets on the ports as VLAN 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.22-port1.0.23
awplus(config-if)# switchport mode trunk
awplus(config-if)# switchport trunk allowed vlan add 8,9
awplus(config-if)# switchport trunk native vlan 15
```

This example changes the native VLAN of port 16 to VLAN 23. The example assumes that the port is already a tagged port:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16
awplus(config-if)# switchport trunk native vlan 23
```

Removing Untagged Ports from VLANs

To remove untagged ports from their current VLAN assignments and return them back to the Default VLAN, use the NO SWITCHPORT ACCESS VLAN command in the Port Interface mode. You do not specify a VLAN ID number in the command because a port can be an untagged member of just one VLAN at a time. The switch removes the designated port from whichever VLAN it is an untagged member and returns it back to the Default_VLAN.

You can remove more than one port at a time from a VLAN, and the same command can be used to remove untagged ports from different VLANs.

This example removes untagged port 5 from its current VLAN assignment and returns it to the Default_VLAN:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# no switchport access vlan
```

This example removes untagged ports 10 to 14 from their current VLAN assignments and returns them to the Default_VLAN. This example works even if the ports are untagged members of different VLANs.

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.10-port1.0.14
awplus(config-if)# no switchport access vlan
```

Removing Tagged Ports from VLANs

Use the SWITCHPORT TRUNK ALLOWED VLAN command to remove ports as tagged members from VLANs. This command is actually used for both adding and removing tagged ports. The format of the command when it is used to remove ports is shown here:

```
switchport trunk allowed vlan none|remove vid
```

To remove a port from all its tagged VLAN assignments, use the NONE parameter. Otherwise, use the REMOVE parameter and enter the ID numbers of the VLANs from which the port is to be removed.

This example removes tagged ports 18 and 19 from the VLAN with the VID 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.18,port1.0.19
awplus(config-if)# switchport trunk allowed vlan remove 7
```

If, after removing a port from all its tagged VLAN assignments, you do not want it to function as a tagged port on the switch, use the NO SWITCHPORT TRUNK command to remove the trunk mode. This example removes ports 8 and 12 as tagged members from all their VLAN assignments and removes the trunk mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.8,port1.0.12
awplus(config-if)# switchport trunk allowed vlan none
awplus(config-if)# no switchport trunk
```

Deleting VLANs

To delete VLANs from the switch, use the NO VLAN command in the VLAN Configuration mode. You cannot delete the Default_VLAN. The untagged ports of deleted VLANs are automatically returned back to the Default_VLAN. Here is the format of the command:

```
no vlan vid
```

This example deletes the VLAN with the VID 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# no vlan 12
```

Displaying the VLANs

To display the VLANs on the switch, use the SHOW VLAN ALL command in the User Exec mode and Privileged Exec mode:

```
awplus# show vlan all
```

An example of the information is shown in Figure 179.

```
VLAN ID   Name         Type      State    Member ports
                                          (u)-Untagged, (t) Tagged
=======   =======      =======   =======  ==========================
1         default      STATIC    ACTIVE   1(u) 20(u) 21(u) 22(u) 23(u)
                                          26(u) 27(u) 28(u)
5         Sales        STATIC    ACTIVE   11(u) 12(u) 13(u) 14(u) 24(u)
                                          25(u)
5         Engineering  STATIC    ACTIVE   2(u) 3(u) 4(u) 5(u) 6(u) 7(u)
                                          8(u) 15(u) 16(u) 17(u) 25(t)
18        Marketing    STATIC    ACTIVE   9(u) 10(u) 18(u) 19(u) 25(t)
```

Figure 179. SHOW VLAN ALL Command

The information is described in Table 99 on page 956.

Chapter 63

Port-based and Tagged VLAN Commands

The VLAN commands are summarized in Table 98 and described in detail within the chapter.

Table 98. Port-based and Tagged VLAN Commands

Command	Mode	Description
“NO SWITCHPORT ACCESS VLAN” on page 952	Port Interface	Removes untagged ports from VLANs.
“NO SWITCHPORT TRUNK” on page 953	Port Interface	Removes the tagged designation from ports.
“NO SWITCHPORT TRUNK NATIVE VLAN” on page 954	Port Interface	Reestablishes the Default_VLAN as the native VLAN of tagged ports.
“NO VLAN” on page 955	VLAN Configuration	Deletes VLANs from the switch.
“SHOW VLAN” on page 956	User Exec and Privileged Exec	Displays all the VLANs on the switch.
“SWITCHPORT ACCESS VLAN” on page 958	Port Interface	Adds untagged ports to a VLAN.
“SWITCHPORT MODE ACCESS” on page 960	Port Interface	Designates ports as untagged ports.
“SWITCHPORT MODE TRUNK” on page 961	Port Interface	Designates ports as tagged ports.
“SWITCHPORT TRUNK ALLOWED VLAN” on page 963	Port Interface	Adds and removes tagged ports from VLANs.
“SWITCHPORT TRUNK NATIVE VLAN” on page 966	Port Interface	Designates native VLANs for tagged ports.
“VLAN” on page 968	VLAN Configuration	Creates VLANs.

NO SWITCHPORT ACCESS VLAN

Syntax

```
no switchport access vlan
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to return untagged ports to the Default_VLAN.

> **Note**
> You cannot return ports to the Default_VLAN if they are set to the authenticator role for 802.1x port-based network access control. You must first remove the authenticator role. For instructions, refer to “NO DOT1X PORT-CONTROL” on page 1155.

Confirmation Command

“SHOW VLAN” on page 956

Example

This example removes untagged port 5 from its current VLAN assignment and returns it to the Default VLAN:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# no switchport access vlan
```

NO SWITCHPORT TRUNK

Syntax

```
no switchport trunk
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to remove the trunk mode from ports. Ports cannot be assigned as tagged ports to VLANs once the trunk mode has been removed.

> **Note**
> You must first remove a port from all tagged VLAN assignments before you can remove its tagged designation. For instructions, refer to "SWITCHPORT TRUNK ALLOWED VLAN" on page 963.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example removes the trunk mode from ports 23 and 24:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.23-port1.0.24
awplus(config-if)# no switchport trunk
```

NO SWITCHPORT TRUNK NATIVE VLAN

Syntax

```
no switchport trunk native vlan
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to reestablish the Default_VLAN as the native VLAN of tagged ports. The native VLAN of a tagged port specifies the appropriate VLAN for ingress and egress untagged packets. A tagged port can have only one native VLAN.

Note
This command will not work if the tagged port is already a tagged member of the Default_VLAN because a port cannot be both a tagged and untagged member of the same VLAN.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example reestablishes the Default_VLAN as the native VLAN for tagged ports 18 and 19:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.18,port1.0.19
awplus(config-if)# no switchport trunk native vlan
```

NO VLAN

Syntax

```
no vlan vid
```

Parameters

vid
Specifies the VID of the VLAN you want to delete.

Mode

VLAN Configuration mode

Description

Use this command to delete port-based or tagged VLANs from the switch. Here are the guidelines to this command:

- You cannot delete the Default_VLAN.
- The switch automatically returns the untagged ports of a deleted VLAN to the Default_VLAN, as untagged ports.
- Static addresses assigned to the ports of a deleted VLAN become obsolete and should be deleted from the MAC address table. For instructions, refer to "NO MAC ADDRESS-TABLE STATIC" on page 432.
- To delete a VLAN that has authenticator or supplicant ports for 802.1x port-based network access control, you must first change the ports to the 802.1x none role. For instructions, refer to "NO DOT1X PORT-CONTROL" on page 1155.

Confirmation Command

"SHOW VLAN" on page 956

Example

This example deletes the VLAN with the VID 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# no vlan 5
```

SHOW VLAN

Syntax

```
show vlan vid |all
```

Parameters

vid

Specifies the VID of the VLAN you want to display.

all

Specifies all the VLANs on the switch to display.

Modes

User Exec mode and Privileged Exec mode

Description

Use this command to display all the tagged and untagged VLANs on the switch. An example of the information is shown in Figure 180.

```
VLAN ID   Name         Type      State    Member ports
                                          (u)-Untagged, (t) Tagged
=======   =======      =======   =======  ==========================
1         default      STATIC    ACTIVE   1(u) 20(u) 21(u) 22(u) 23(u)
                                          26(u) 27(u) 28(u)
5         Sales        STATIC    ACTIVE   11(u) 12(u) 13(u) 14(u) 24(u)
                                          25(u)
5         Engineering  STATIC    ACTIVE   2(u) 3(u) 4(u) 5(u) 6(u) 7(u)
                                          8(u) 15(u) 16(u) 17(u) 25(t)
18        Marketing    STATIC    ACTIVE   9(u) 10(u) 18(u) 19(u) 25(t)
```

Figure 180. SHOW VLAN Command

The columns in the table are described here:

Table 99. SHOW VLAN Command

Parameter	Description
VLAN ID	The ID numbers of the VLANs.
VLAN name	The names of the VLANs.
Type	The VLAN type, which is either Port Based for port-based and tagged VLANs or DYNAMIC for VLANs created by GVRP.

Table 99. SHOW VLAN Command (Continued)

Parameter	Description
State	The states of the VLANs. A VLAN has an Active state if it has at least one tagged or untagged port and an Inactive state if it does not have any ports.
Member Ports	The untagged (u) and tagged (t) ports of the VLANs.

Example

The following example displays the tagged and untagged VLANs on the switch:

```
awplus# show vlan
```

SWITCHPORT ACCESS VLAN

Syntax

```
switchport access vlan vid
```

Parameters

vid

Specifies the ID number of the VLAN to which you want to add untagged ports. You can specify only one VID.

Mode

Port Interface mode

Description

Use this command to add untagged ports to VLANs. Please review the following information before using this command:

- The specified VLAN must already exist.
- A port can be an untagged member of only one VLAN at a time. When you add a port to a VLAN as an untagged member, the switch automatically removes it from its current untagged VLAN assignment before moving it to its new assignment. For example, if you add port 4 as an untagged port to a VLAN, the switch automatically removes the port from the VLAN in which it is currently an untagged member.
- The PVID of an untagged port is automatically changed to match the VID number of the VLAN where it is added. For instance, if you add port 4 as an untagged member of a VLAN with a VID of 15, the PVID for port 4 is automatically changed to 15.
- If the ports are configured as authenticator or supplicant ports for 802.1x port-based network access control, you must change the ports to the 802.1x none role before you can change their VLAN assignments.

Confirmation Command

“SHOW VLAN” on page 956

Examples

This example adds ports 5 and 7 as untagged ports to a VLAN with the VID 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5,port1.0.7
awplus(config-if)# switchport access vlan 12
```

This example returns port 15 as an untagged port to the Default_VLAN, which has the VID 1:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# switchport access vlan 1
```

Returning ports to the Default_VLAN can also be accomplished with the NO SWITCHPORT ACCESS VLAN. See "NO SWITCHPORT ACCESS VLAN" on page 952.

SWITCHPORT MODE ACCESS

Syntax

```
switchport mode access [ingress-filter enable|disable]
```

Parameters

enable
: Activates ingress filtering.

disable
: Disables ingress filtering.

Mode

Port Interface mode

Description

Use this command to designate ports as untagged ports. This is the first command to adding ports as untagged ports to VLANs. The second command is “SWITCHPORT ACCESS VLAN” on page 958.

The access mode is the default setting for all ports on the switch. Consequently, you only need to perform this command for ports that were changed to the trunk mode for tagged packets and now need to be returned to the access mode for untagged packets.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example designates ports 17 to 24 as untagged ports:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17-port1.0.24
awplus(config-if)# switchport mode access
```

SWITCHPORT MODE TRUNK

Syntax

```
switchport mode trunk [ingress-filter enable|disable]
```

Parameters

enable
: Activates ingress filtering so the tagged port accepts only tagged packets that have one of its tagged VIDs.

disable
: Disables ingress filtering so the tagged port accepts all tagged packets.

Mode

Port Interface mode

Description

Use this command to label ports as tagged ports. This is the first command to adding ports as tagged ports to VLANs. The second command is "SWITCHPORT TRUNK ALLOWED VLAN" on page 963.

The INGRESS-FILTER parameter controls whether the tagged port accepts or rejects tagged packets containing VIDs that do not match any of its tagged VIDs. If ingress filtering is enabled, any frame received on the 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. If ingress filtering is disabled, the tagged port accepts all tagged packets.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

This example designates ports 4 to 6 as tagged ports:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4-port1.0.6
awplus(config-if)# switchport mode trunk
```

This example designates port 18 as a tagged port and disables ingress filtering so that it accepts all tagged packets:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.18
awplus(config-if)# switchport mode trunk ingress-filter
disable
```

SWITCHPORT TRUNK ALLOWED VLAN

Syntaxes for Adding Tagged Ports to VLANs

```
switchport trunk allowed vlan all
```

```
switchport trunk allowed vlan add vid
```

```
switchport trunk allowed vlan except vid
```

Syntaxes for Removing Tagged Ports from VLANs

```
switchport trunk allowed vlan remove vid
```

```
switchport trunk allowed vlan none
```

Parameters

vlan all
: Adds the port as a tagged port to all the VLANs on the switch.

add vid
: Adds the port as a tagged port to the designated VLAN. You can specify more than one VID.

except vid
: Adds the port as a tagged port to all the VLANs on the switch, except for the designated VLAN. You can specify more than one VID.

remove vid
: Removes the port as a tagged port from the designated VLAN. You can specify more than one VID.

none
: Removes the port as a tagged port from all its tagged VLAN assignments.

Mode

Port Interface mode

Description

Use this command to add tagged ports to VLANs or to remove tagged ports from VLANs. Here are the guidelines to adding tagged ports:

- You must designate ports as tagged ports before you can add them to VLANs. The command for designating tagged ports is "SWITCHPORT MODE TRUNK" on page 961.

- Ports can be tagged members of more than one VLAN at a time.
- The specified VLANs must already exist. To create VLANs, see “VLAN” on page 968.
- Adding a port as a tagged member of a VLAN does not change its other tagged and untagged VLAN assignments, because ports can be tagged members of more than one VLAN at a time. For instance, if you add port 6 as a tagged port to a new VLAN, there is no change to the port’s other tagged and untagged VLAN memberships.

Here are the guidelines to removing tagged ports from VLANs:

- Removing a tagged port from a VLAN does not change any of its other tagged and untagged VLAN assignments.
- Ports that are set to the authenticator or supplicant role for 802.1x port-based network access control must be changed to the 802.1x none role before they can be removed from a VLAN. You can reassign their roles after you change their VLAN assignments.

Confirmation Command

“SHOW VLAN” on page 956

Examples of Adding Tagged Ports to VLANs

This example designates port 5 as a tagged port and adds it to the VLAN with a VID of 22:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# switchport mode trunk
awplus(config-if)# switchport trunk allowed vlan add 22
```

This example designates ports 18 to 21 as tagged ports and adds them to the VLANs with VIDs of 7 and 9:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.18-port1.0.21
awplus(config-if)# switchport mode trunk
awplus(config-if)# switchport trunk allowed vlan add 7,9
```

This example adds port 15 as a tagged port to all the VLANs. It assumes that the port is already designated as a tagged port:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# switchport trunk allowed vlan all
```

This example adds ports 22 to 24 as tagged ports to all the VLANs, except for the VLAN with a VID of 11. The example assumes that the ports are already designated as tagged ports:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.22-port1.0.24
awplus(config-if)# switchport trunk allowed vlan except 11
```

Examples of Removing Tagged Ports from VLANs

This example removes tagged port 17 from the VLAN with a VID of 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17
awplus(config-if)# switchport trunk allowed vlan remove 8
```

This example removes ports 19 and 22 from all their tagged VLAN assignments:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.19,port1.0.22
awplus(config-if)# switchport trunk allowed vlan none
```

SWITCHPORT TRUNK NATIVE VLAN

Syntax

```
switchport trunk native vlan vid|none
```

Parameters

vid

Specifies the VID of the VLAN that will act as the default VLAN for all ingress and egress untagged packets on the tagged port. You can enter just one VID.

none

Reestablishes the Default_VLAN as the native VLAN of the port. This is equivalent to the NO form of this command.

Mode

Port Interface mode

Description

Use this command to designate native VLANs for tagged ports. The native VLAN of a tagged port specifies the appropriate VLAN for ingress untagged packets. A tagged port can have only one native VLAN, and the VLAN must already exist on the switch.

Note
You cannot assign a native VLAN to a port that is already a tagged member of that VLAN because a port cannot be both a tagged and untagged member of the same VLAN.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

This example designates VLAN 17 as the native VLAN for tagged port 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# switchport mode trunk
awplus(config-if)# switchport trunk native vlan 17
```

This example reestablishes the Default_VLAN as the native VLAN for tagged ports 18 and 20:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.18,port1.0.20
awplus(config-if)# switchport trunk native vlan none
```

VLAN

Syntax

vlan *vid* [name *name*]

Parameters

vid

Specifies a VLAN identifier. The range is 2 to 4094. The VID 1 is reserved for the Default_VLAN. The VID cannot be the same as the VID of an existing VLAN on the switch. You can specify more than one VID to create more than one VLAN at a time.

If this VLAN will be unique in your network, its VID should also be unique. If this VLAN will be part of a larger VLAN that spans multiple switches, the VID value for the VLAN should be the same on each switch. For example, if you are creating a VLAN called Sales that will span three switches, you should assign the Sales VLAN on each switch the same VID value.

name

Specifies a name for a new VLAN. A name can be from 1 to 20 characters in length. The first character must be a letter; it cannot be a number. VLANs will be easier to identify if their names reflect the functions of their subnetworks or workgroups (for example, Sales or Accounting). A name cannot contain spaces or special characters, such as asterisks (*) or exclamation points (!). A name cannot be the same as a name of an existing VLAN on the switch. If a VLAN is unique in your network, then its name should be unique as well. A VLAN that spans multiple switches should have the same name on each switch.

If you are creating more than one VLAN, do not include this parameter.

Note
The VLAN name field is used only as a description in the SHOW VLAN command output. It cannot be a substituted for the VID when specifying a specific VLAN in other commands.

Mode

VLAN Configuration mode

Description

Use this command to create port-based and tagged VLANs. You can create just one VLAN at a time.

Confirmation Command

"SHOW VLAN" on page 956

Examples

This example creates a new VLAN with the VID 5 and the name Engineering:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 5 name Engineering
```

This example creates a new VLAN with the VID 17 and the name Manufacturing:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 17 name Manufacturing
```

This example creates new VLANs with the VIDs 6 to 11, 15 and 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 6-11,15,23
```

Chapter 64

GARP VLAN Registration Protocol

This chapter covers the following topics:

Overview

The GARP VLAN Registration Protocol (GVRP) allows network devices to share VLAN information and to use the information to modify existing VLANs or create new VLANs, automatically. 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, which is an application of the Generic Attribute Registration Protocol (GARP), 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 the designated 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 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 if there are active nodes in the VLANs. If all nodes of a dynamic GVRP VLAN are shut down, and there are no active links, GVRP deletes it from the switch.

A dynamic GVRP port in a static VLAN remains a member of the VLAN as long as there are active VLAN members. If all members of the VLAN become inactive or there are no active links, GVRP removes the dynamic port from the VLAN, but does not delete the VLAN if the VLAN is a static VLAN.

Figure 181 provides an example of how GVRP works.

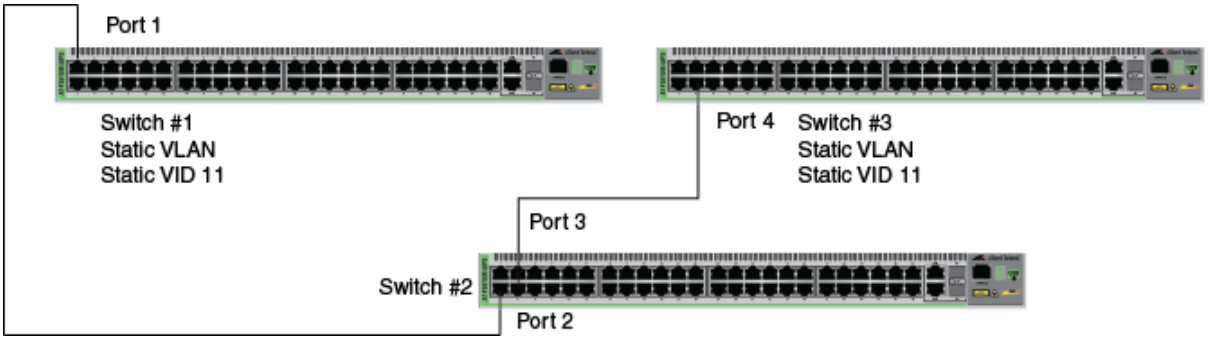

Figure 181. GVRP Example

The example consists of three switches. Switches #1 and #3 have the Sales VLAN, but switch #2 does not. Consequently, the end nodes of the two parts of the Sales VLANs cannot communicate with each other.

Without GVRP, you would have to manually add the Sales VLAN to switch #2. But with GVRP, the VLAN is added automatically. Here is how GVRP would resolve the problem in the example.

1. Port 1 on switch #1 sends to port 2 on switch #2 a PDU that contains the VIDs of all the VLANs on the switch, including VID 11 for the Sales VLAN.

2. Switch #2 examines the PDU it receives on port 2 and notes that it does not have a VLAN with a VID 11. In response, it creates the VLAN as a dynamic GVRP VLAN, assigning it a VID 11 and the name GVRP_VLAN_11. (The name of a dynamic GVRP VLAN has the prefix “GVRP_VLAN_”, followed by the VID number.) The switch then adds port 2, the port that received the PDU, as a tagged member of the VLAN.

3. Switch #2 sends a PDU from port 3 containing all the VIDs of the VLANs on the switch, including the new GVRP_VLAN_11 with its VID of 11. (Note that port 3 is not yet a member of the VLAN. Ports are added to VLANs when they receive PDUs from other network devices, not when they transmit PDUs.)

4. Switch #3 receives the PDU on port 4 and, after examining it, notes that one of the VLANs on switch #2 has the VID 11, 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 port 4, is a member of the VLAN. If it is not a member, it automatically adds the port to the VLAN as an 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 port 4 to switch #2.

6. Switch #2 receives the PDU on port 3 and then adds the port as a tagged dynamic GVRP port to the dynamic GVRP_VLAN_11 VLAN.

There is now a communications path for the end nodes of the Sales VLAN on switches #1 and #3. GVRP created the new GVRP_VLAN_11 dynamic GVRP VLAN with a VID of 11 on switch #2 and added ports 2 and 3 to the VLAN as tagged dynamic GVRP ports.

Guidelines

Here are the guidelines to GVRP:

- GVRP is supported with STP, RSTP, MSTP or without spanning tree.
- Both ports that constitute a network link between the switch and the other device must be running GVRP.
- You cannot modify or delete dynamic GVRP VLANs.
- You cannot remove dynamic GVRP ports from static or dynamic VLANs.
- To be detected by GVRP, a VLAN must have at least one active node or have at least one port with a valid link to an end node. GVRP cannot detect a VLAN that does not have any active nodes or valid port links.
- Resetting 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 are active, meaning that the ports participate in GVRP. Allied Telesis recommends disabling GVRP on those ports that are connected to GVRP-inactive devices, meaning devices that do not feature GVRP.
- PDUs are transmitted from only those switch ports where GVRP is enabled.

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 couple of suggestions to protect against this type of 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 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 create the VLANs, at least not automatically. 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 command. After the command is entered, the switch immediately begins to transmit PDUs from those ports where GVRP is enabled and to learn dynamic GVRP VLANs. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# gvrp enable
```

For reference information, refer to “GVRP ENABLE” on page 994.

Enabling GIP on the Switch

The *GARP Information Propagation* (GIP) component can be enabled separately from GVRP on the switch. GIP must be enabled if the switch is using GVRP. The command for activating GIP is the GVRP APPLICANT STATE ACTIVE command in the Global Configuration mode. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# gvrp applicant state active
```

For reference information, refer to "GVRP APPLICANT STATE ACTIVE" on page 992.

Enabling GVRP on the Ports

To activate GVRP on the ports so that they transmit GVRP PDUs, use the GVRP REGISTRATION NORMAL command in the Port Interface mode. Because the default setting for GVRP on the ports is enabled, you should only need to use this command if you want to enable GVRP after disabling it on a port.

This example of the command activates GVRP on ports 12, 13 and 17:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12,port1.0.13,port1.0.17
awplus(config-if)# gvrp registration normal
```

For reference information, refer to “GVRP REGISTRATION” on page 995.

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 definitions.) The timers have to be set the same on all GARP-active network devices, and the Join Timer and Leave Timer have to be set according to the following equation:

Join Timer <= (2 x (Leave Timer))

The commands for setting the timers are in the Global Configuration mode. They are:

```
gvrp timer join value

gvrp timer leave value

gvrp timer leaveall value
```

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:

```
awplus> enable
awplus# configure terminal
awplus(config)# gvrp timer join 20
awplus(config)# gvrp timer leave 80
awplus(config)# gvrp timer leaveall 1000
```

For reference information, refer to "GVRP TIMER JOIN" on page 996, "GVRP TIMER LEAVE" on page 997 and "GVRP TIMER LEAVEALL" on page 998.

Disabling GVRP Timers on the Switch

To disable GVRP timer configurations, use the NO GVRP TIMER commands in the Global Configuration mode. They are:

```
no gvrp timer join

no gvrp timer leave

no gvrp timer leaveall
```

Use these commands to reset GVRP timers to the default values for each individual parameter. The default values are:

GVRP timer join: 20

GVRP timer leave: 60

GVRP timer leave all: 1000

For reference information, refer to “NO GVRP TIMER JOIN” on page 1000, “NO GVRP TIMER LEAVE” on page 1001 and “NO GVRP TIMER LEAVEALL” on page 1002.

Disabling GVRP on the Ports

To disable GVRP on the ports, use the GVRP REGISTRATION NONE command in the Port Interface mode. This example of the command deactivates GVRP on ports 4 and 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4-1.0.5
awplus(config-if)# gvrp registration none
```

For reference information, refer to "GVRP REGISTRATION" on page 995.

Disabling GIP on the Switch

You can disable the GARP Information Propagation (GIP) component separately from GVRP on the switch. GIP must be enabled if the switch is using GVRP. There is never any reason to disable GIP. Even if the switch is not performing GVRP, you can still leave GIP enabled.

The command for disabling GIP is GVRP APPLICANT STATE NORMAL command. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# gvrp applicant state normal
```

For reference information, refer to “GVRP APPLICANT STATE NORMAL” on page 993.

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 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 "NO GVRP ENABLE" on page 999.

Restoring the GVRP Default Settings

To disable GVRP and to return the timers to their default settings, use the PURGE GVRP command in the Global Configuration mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# purge gvrp
```

For reference information, refer to “PURGE GVRP” on page 1003.

Displaying GVRP

Although there are five commands that display GVRP information, you will probably only need the SHOW GVRP TIMER command in the Privileged Exec mode. This command displays the status of GVRP and GIP on the switch and the three timer settings. Here is the command:

```
awplus# show gvrp timer
```

Here is an example of the information the command provides.

```
GVRP Status ............ Disabled
GVRP GIP Status ........ Disabled
GVRP Join Timer ........ 30
GVRP Leave Timer ....... 60
GVRP Leave All Timer ... 1000
```

Figure 182. SHOW GVRP TIMER Command

For reference information, refer to "SHOW GVRP APPLICANT" on page 1004, "SHOW GVRP CONFIGURATION" on page 1005, "SHOW GVRP MACHINE" on page 1006, "SHOW GVRP STATISTICS" on page 1007 and "SHOW GVRP TIMER" on page 1009.

Chapter 65

GARP VLAN Registration Protocol Commands

The GARP VLAN registration protocol commands are summarized in Table 100 and described in detail within the chapter.

Table 100. GARP VLAN Registration Protocol Commands

Command	Mode	Description
“CONVERT DYNAMIC VLAN” on page 991	VLAN Configuration	Converts dynamic GVRP VLANs and port assignments to static.
“GVRP APPLICANT STATE ACTIVE” on page 992	Global Configuration	Enables GIP on the switch.
“GVRP APPLICANT STATE NORMAL” on page 993	Global Configuration	Disables GIP.
“GVRP ENABLE” on page 994	Global Configuration	Enables GVRP.
“GVRP REGISTRATION” on page 995	Port Interface	Set a port’s GVRP status.
“GVRP TIMER JOIN” on page 996	Global Configuration	Sets the GARP Join Timer.
“GVRP TIMER LEAVE” on page 997	Global Configuration	Sets the GARP Leave Timer.
“GVRP TIMER LEAVEALL” on page 998	Global Configuration	Sets the GARP Leave All timer.
“NO GVRP ENABLE” on page 999	Global Configuration	Disables GVRP on the switch.
“NO GVRP TIMER JOIN” on page 1000	Global Configuration	Disables the GARP Join Timer.
“NO GVRP TIMER LEAVE” on page 1001	Global Configuration	Disables the GARP Leave Timer.
“NO GVRP TIMER LEAVEALL” on page 1002	Global Configuration	Disables the GARP Leave All timer.
“PURGE GVRP” on page 1003	Global Configuration	Disables GVRP on the switch and returns the timers to their default values.

Table 100. GARP VLAN Registration Protocol Commands (Continued)

Command	Mode	Description
“SHOW GVRP APPLICANT” on page 1004	User Exec and Privileged Exec	Displays parameters for the GIP-connected ring for the GARP application:
“SHOW GVRP CONFIGURATION” on page 1005	User Exec and Privileged Exec	Displays parameters for the internal database for the GARP application.
“SHOW GVRP MACHINE” on page 1006	User Exec and Privileged Exec	Displays parameters for the GID state machines for the GARP application.
“SHOW GVRP STATISTICS” on page 1007	User Exec and Privileged Exec	Displays GARP packet and message counters.
“SHOW GVRP TIMER” on page 1009	User Exec and Privileged Exec	Displays the GARP time values.

CONVERT DYNAMIC VLAN

Syntax

```
convert dynamic vlan
```

Parameters

None

Mode

VLAN Configuration mode

Description

Use this command to convert dynamic GVRP VLANs and dynamic GVRP port assignments to static VLANs and static port assignments.

Example

This example converts dynamic GVRP VLANs and dynamic GVRP port assignments to static VLANs and static port assignments on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# convert dynamic vlan
```

GVRP APPLICANT STATE ACTIVE

Syntax

```
gvrp applicant state active
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enable GIP on the switch. GIP must be enabled for GVRP to operate properly.

Example

This example enables GIP on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# gvrp applicant state active
```

GVRP APPLICANT STATE NORMAL

Syntax

```
gvrp applicant state normal
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable GIP on the switch.

> **Note**
> Do not disable GIP if the switch is running GVRP. GIP is required for proper GVRP operation.

Example

This example disables GIP on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# gvrp applicant state normal
```

GVRP ENABLE

Syntax

```
gvrp enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enable GVRP on the switch.

Example

This example enables GVRP on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# gvrp enable
```

GVRP REGISTRATION

Syntax

```
gvrp registration normal|none
```

Parameters

normal
Enables GVRP on a port. This is the default setting.

none
Disables GVRP on a port.

Mode

Port Interface mode

Description

Use this command to enable or disable GVRP on a port. A port where GVRP is enabled transmits GVRP PDUs. A port where GVRP is disabled does not send GVRP PDUs.

Examples

This example enables GVRP on ports 5 and 6:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5,port1.0.6
awplus(config-if)# gvrp registration normal
```

This example disables GVRP on port 20:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.20
awplus(config-if)# gvrp registration none
```

GVRP TIMER JOIN

Syntax

```
gvrp timer join value
```

Parameters

value

Specifies the Join Timer in centiseconds, which are one hundredths of a second. The range is 20 to 60 centiseconds. The default is 20 centiseconds.

Mode

Global Configuration mode

Description

Use this command to set the GARP Join Timer. This timer must be set in relation to the GVRP Leave Timer according to the following equation:

Join Timer <= (2 x (GVRP Leave Timer))

Note
The setting for this timer must be the same on all GVRP-active network devices.

Example

This command sets the Join Timer to 0.3 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# gvrp timer join 30
```

GVRP TIMER LEAVE

Syntax

```
gvrp timer leave value
```

Parameters

value

Specifies the Leave Timer in centiseconds, which are one hundredths of a second. The range is 30 to 180 centiseconds. The default is 60 centiseconds.

Mode

Global Configuration mode

Description

Use this command to set the GARP Leave Timer.

Note
The setting for this timer must be the same on all GVRP-active network devices.

Example

This command sets the Leave Timer to 0.8 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# gvrp timer leave 80
```

GVRP TIMER LEAVEALL

Syntax

```
gvrp timer leaveall value
```

Parameters

value

Specifies the Leave All Timer in centiseconds. The range is 500 to 3000 centiseconds. The default is 1000 centiseconds.

Mode

Global Configuration mode

Description

Use this command to set the GARP Leave All timer.

Note
The settings for this timer must be the same on all GVRP-active network devices.

Example

This command sets the Leave All timer to 10 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# gvrp timer leaveall 1000
```

NO GVRP ENABLE

Syntax

```
no gvrp enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable GVRP on the switch.

Example

This example disables GVRP on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no gvrp enable
```

NO GVRP TIMER JOIN

Syntax

```
no gvrp timer join
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable GVRP Join Timer configurations and return the GVRP Join Timer to its default value. This timer must only be disabled in relation to the GVRP Leave Timer according to the following equation:

Join Timer <= (2 x (GVRP Leave Timer))

> **Note**
> The setting for this timer must be the same on all GVRP-active network devices.

Example

This command sets the Join Timer to 0.2 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# no gvrp timer join
```

NO GVRP TIMER LEAVE

Syntax

```
no gvrp timer leave value
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable the GARP Leave Timer and return the GVRP Leave Timer to its default value. This timer must only be disabled in relation to the GVRP Join Timer according to the following equation:

Join Timer <= (2 x (GVRP Leave Timer))

Note
The setting for this timer must be the same on all GVRP-active network devices.

Example

This command sets the Leave Timer to 0.6 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# no gvrp timer leave
```

NO GVRP TIMER LEAVEALL

Syntax

```
no gvrp timer leaveall
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable the GARP Leave All timer and return the GVRP Leave All timer to its default value.

> **Note**
> The settings for this timer must be the same on all GVRP-active network devices.

Example

This command sets the Leave All timer to 10 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# no gvrp timer leaveall
```

PURGE GVRP

Syntax

```
purge gvrp
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable GVRP on the switch and to return the timers to their default values.

Example

This example disables GVRP on the switch and returns the timers to their default values:

```
awplus> enable
awplus# configure terminal
awplus(config)# purge gvrp
```

SHOW GVRP APPLICANT

Syntax

```
show gvrp applicant
```

Parameter

None

Mode

Privileged Exec mode

Description

Use this command to display the following parameters for the GIP-connected ring for the GARP application:

- GARP Application
- GIP contact
- STP ID

Example

This example displays the GIP-connected ring parameters:

```
awplus# show gvrp applicant
```

SHOW GVRP CONFIGURATION

Syntax

```
show gvrp configuration
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the following parameters for the internal database for the GARP application. Each attribute is represented by a GID index within the GARP application.

- GARP Application
- GID Index
- Attribute
- Used

Example

The following example displays the values of the internal database parameters:

```
awplus# show gvrp configuration
```

SHOW GVRP MACHINE

Syntax

```
show gvrp machine
```

Parameter

None

Mode

Privileged Exec mode

Description

Use this command to display the following parameters for the GID state machines for the GARP application. The output is shown on a per-GID index basis; each attribute is represented by a GID index within the GARP application.

- VLAN
- Port
- App
- Reg

Example

This example displays the GID state machine parameters:

```
awplus# show gvrp machine
```

SHOW GVRP STATISTICS

Syntax

```
show gvrp statistics
```

Parameter

None

Mode

Privileged Exec mode

Description

Use this command to display the current values of the following GARP packet and message counters:

- GARP application
- Receive: Total GARP Packets
- Transmit: Total GARP Packets
- Receive: Invalid GARP Packets
- Receive Discarded: GARP Disabled
- Receive Discarded: Port Not Listening
- Transmit Discarded: Port Not Sending
- Receive Discarded: Invalid Port
- Receive Discarded: Invalid Protocol
- Receive Discarded: Invalid Format
- Receive Discarded: Database Full
- Receive GARP Messages: LeaveAll
- Transmit GARP Messages: LeaveAll
- Receive GARP Messages: JoinEmpty
- Transmit GARP Messages: JoinEmpty
- Receive GARP Messages: JoinIn
- Transmit GARP Messages: JoinIn
- Receive GARP Messages: LeaveEmpty
- Transmit GARP Messages: LeaveEmpty
- Receive GARP Messages: LeaveIn
- Transmit GARP Messages: LeaveIn

- Receive GARP Messages: Empty
- Transmit GARP Messages: Empty
- Receive GARP Messages: Bad Message
- Receive GARP Messages: Bad Attribute

Example

This example displays the values of GARP packet and message counters:

```
awplus# show gvrp statistics
```

SHOW GVRP TIMER

Syntax

```
show gvrp timer
```

Parameter

None

Mode

Privileged Exec mode

Description

Use this command to display the current values for the following GARP application parameters:

- GARP application protocol
- GVRP status
- GVRP GIP status
- GVRP Join Time
- GVRP Leave Time
- GVRP Leaveall Time
- Port information
- Mode

Example

This example displays the values of the GARP application parameters:

```
awplus# show gvrp timer
```

Chapter 66

MAC Address-based VLANs

This chapter contains the following topics:

Overview

As explained in Chapter 62, “Port-based and Tagged VLANs” on page 927, VLANs are used to create independent LAN segments within a network and are typically employed to improve network performance or security. The AT-FS970M Switch offers several different types of VLANs, including port-based, tagged, and private VLANs. Membership in these VLANs is determined either by the port VLAN identifiers (PVIDs) assigned to the ports on the switch or, in the case of tagged traffic, by the VLAN identifiers within the packets themselves.

This chapter describes VLANs that are based on the source MAC addresses of the end nodes that are connected to the switch. With MAC address-based VLANs, only those nodes whose source MAC addresses are entered as members of the VLANs can share and access the resources of the VLANs. This is in contrast to port-based and tagged VLANs where any node that has access to a switch port can join them as a member.

One of the principle advantages of this type of VLAN is that it simplifies the task of managing network users that roam. These are users whose work requires that they access the network from different points at different times. The challenge for a network administrator is providing these users with the same resources regardless of the points at which they access the network. If you employed port-based or tagged VLANs for roaming users, you might have to constantly reconfigure the VLANs, moving ports to and from different virtual LANs, so that the users always have access to the same network resources. But with MAC address-based VLANs, the switch can assign network users to the same VLANs and network resources regardless of the ports from which they access the network.

Egress Ports

Implementing MAC address-based VLANs involves more than entering the MAC addresses of the end nodes of the VLAN members. You must also designate the egress ports on the switch for the packets from the nodes. The egress ports define the limits of flooding of packets when a port receives a unicast packet with an unknown destination address (that is, an address that has not been learned by the MAC address table). Without knowing the egress ports of a MAC address-based VLAN, the switch would be forced to flood the packets on all ports, possibly resulting in security violations in which end nodes receive packets from other nodes in different VLANs.

Table 101 on page 1013 illustrates a simple example of the mapping of addresses to egress ports for a MAC address-based VLAN of six nodes. The example consists of four workstations, a printer, and a server. Workstation 1, for instance, is connected to port 1 on the switch and is mapped to egress ports 5 for the server and 6 for the printer.

Table 101. Mappings of MAC Addresses to Egress Ports Example

MAC address	End Node	Switch Egress Port
00:30:84:54:1A:45	Workstation 1 (Port 1)	5, 6
00:30:84:C3:5A:11	Workstation 2 (Port 2)	5, 6
00:30:84:22:67:17	Workstation 3 (Port 3)	5, 6
00:30:84:78:75:1C	Workstation 4 (Port 4)	5, 6
00:30:79:7A:11:10	Server (Port 5)	1-4
00:30:42:53:10:3A	Printer (Port 6)	1-4

Obviously, mapping source MAC addresses to egress ports can become cumbersome if you are dealing with a MAC address-based VLAN that encompasses many ports and nodes. Fortunately, the egress ports of a VLAN are considered as a community and, as such, need only be designated as an egress port of one address in the VLAN to be considered an egress port of all the addresses.

For instance, referring to the previous example, if workstation 1 sends a packet containing an unknown destination MAC address, the switch does not flood the packet to just ports 5 and 6, even though those are the designated egress ports for packets from workstation 1. Rather, it floods it out all egress ports assigned to all the MAC addresses of the VLAN, except, of course, the port where the packet was received. In the example, the switch would flood the packet out ports 2 through 6.

The community characteristic of egress ports in MAC address-based VLANs relieves you from having to map each address to its corresponding egress port. Instead, you only need to be sure that all the egress ports in a MAC address-based VLAN are assigned to at least one address.

It is also important to note that a MAC address must be assigned at least one egress port to be considered a member of a MAC address-based VLAN. VLAN membership of packets from a source MAC address not assigned any egress ports is determined by the PVID of the port where the packets are received.

Because egress ports are considered as a community within a VLAN, you can simplify the mappings by assigning all the egress ports to just one MAC address and assigning the rest of the addresses to just one port. This makes adding or deleting MAC addresses or egress ports easier. Here is how the example might look.

Table 102. Revised Example of Mappings of MAC Addresses to Egress Ports

MAC Address	End Node	Egress Port
00:30:84:54:1A:45	Workstation 1 (Port 1)	1-6
00:30:84:C3:5A:11	Workstation 2 (Port 2)	1
00:30:84:22:67:17	Workstation 3 (Port 3)	1
00:30:84:78:75:1C	Workstation 4 (Port 4)	1
00:30:79:7A:11:10	Server (Port 5)	1
00:30:42:53:10:3A	Printer (Port 6)	1

The switch can support more than one MAC-address VLAN at a time, and ports can be egress members of more than one VLAN. While this can prove useful in some situations, it can also result in VLAN leakage in which traffic of one VLAN crosses the boundary into other VLANs.

The problem arises in the case of unknown unicast traffic. If the switch receives a packet from a member of a MAC address-based VLAN with an unknown destination address, it floods the packet on all egress ports of the VLAN. If the VLAN contains a port that is also serving as an egress port of another VLAN, the node connected to the port receives the flooded packets, even if it does not belong to the same VLAN as the node that generated the packet.

Here is an example. Assume that port 4 on a switch has been designated an egress port of three MAC address-based VLANs. Any unknown unicast traffic that the switch receives that belongs to any of the VLANs will be flooded out port 4. This means that whatever device is connected to the port receives the flooded traffic form all three VLANs.

If security is a major concern for your network, you might not want to assign ports as egress ports to more than one VLAN at a time when planning your MAC address-based VLANs.

When a packet whose source MAC address is part of a MAC address-based VLAN arrives on a port, the switch performs one of the following actions:

- If the packet's destination MAC address is not in the MAC address table, the switch floods the packet out all egress ports of the VLAN, excluding the port where the packet was received.
- If the packet's destination MAC address is in the MAC address table, and if the port where the address was learned is one of the VLAN's egress ports, the switch forwards the packet to the port.

- If the packet's destination MAC address is in the MAC address table, but the port where the address was learned is not one of the VLAN's egress ports, the switch discards the packet.

VLANs that Span Switches

To create a MAC address-based VLAN that spans switches, you must replicate the MAC addresses of the VLAN nodes on all the switches where the VLAN exists. The same MAC address-based VLAN on different switches must have the same list of MAC addresses.

Figure 183 illustrates an example of a MAC address-based VLAN that spans two AT-FS970M Switches. The VLAN consists of three nodes on each switch. Table 103 on page 1016 lists the details of the VLAN on the switches. Note that each VLAN contains the complete set of MAC addresses of all VLAN nodes along with the appropriate egress ports on the switches.

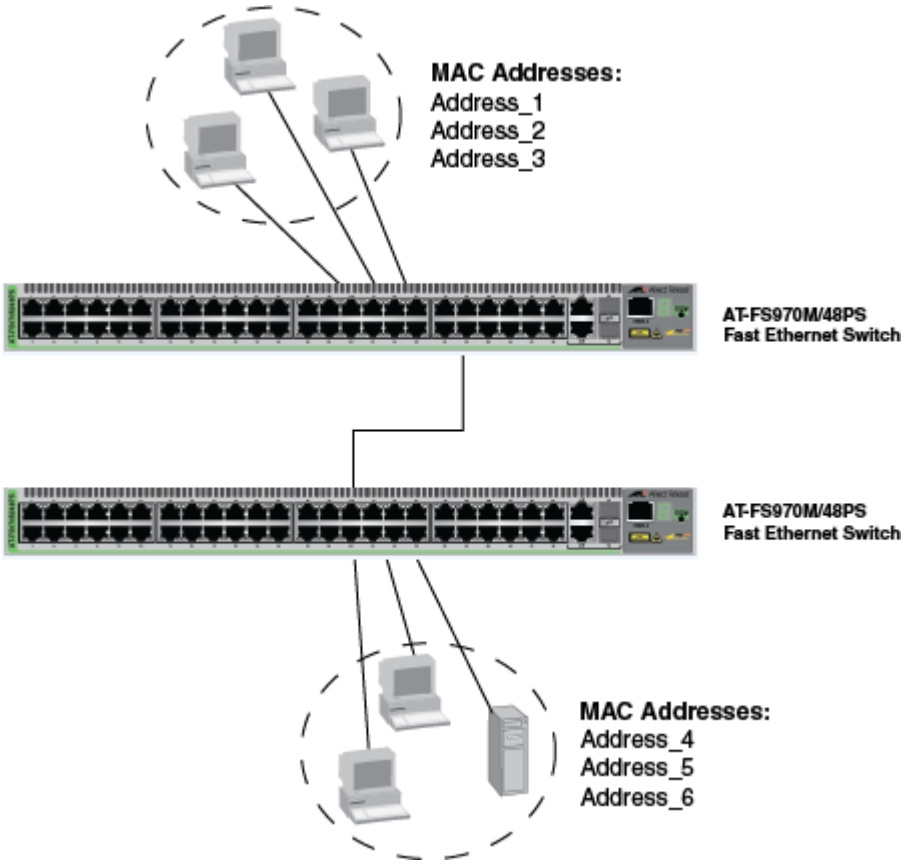

Figure 183. Example of a MAC Address-based VLAN that Spans Switches

Table 103. Example of a MAC Address-based VLAN Spanning Switches

Switch A		**Switch B**	
VLAN Name: Sales		**VLAN Name: Sales**	
MAC Address	**Egress Ports**	**MAC Address**	**Egress Ports**
Address_1	1,3,4,5	Address_1	11,12,14,16
Address_2	1	Address_2	11
Address_3	1	Address_3	11
Address_4	1	Address_4	11
Address_5	1	Address_5	11
Address_6	1	Address_6	11

VLAN Hierarchy

The switch employs a VLAN hierarchy when handling untagged packets that arrive on a port that is an egress port of a MAC address-based VLAN as well as an untagged port of a port-based VLAN. (A port can be a member of both types of VLANs at the same time.) The rule is that a MAC address-based VLAN takes precedence over that of a port-based VLAN.

When an untagged packet arrives on a port, the switch first compares the source MAC address of the packet against the MAC addresses of all the MAC address-based VLANs on the device. If there is a match, the switch considers the packet as a member of the corresponding MAC address-based VLAN and not the port-based VLAN, and forwards it out the egress ports defined for the corresponding MAC address-based VLAN.

If there is no match, the switch considers the packet as a member of the port-based VLAN and forwards the packet according to the PVID assigned to the port. For an explanation of a PVID, refer to “Port-based VLAN Overview” on page 930.

Guidelines

Here are the guidelines to MAC address-based VLANs:

- The switch can support up to a total of 4094 port-based, tagged, private, and MAC address-based VLANs.
- The egress ports of a MAC address-based VLAN function as a community in that assigning a port to one MAC address implicitly defines that port as an egress port of all the addresses in the same VLAN.
- A source MAC address must be assigned to at least one egress port to be considered part of a MAC address-based VLAN. Otherwise, VLAN membership is determined by the PVID of the port where the packets are received.
- A port can be an egress port of more than one MAC address-based VLAN at one time.
- MAC addresses can belong to only one MAC address-based VLAN at a time.
- Broadcast packets cross VLAN boundaries when a port is an egress port of a MAC address-based VLAN and an untagged member of a port-based VLAN. Given that there is no way for the switch to determine the VLAN to which the broadcast packet belongs, it floods the packet on all ports of all affected VLANs.
- Entering MAC addresses as part of a MAC address-based VLAN does not add them into the MAC address table. The addresses are added to the MAC address table during the normal learning process of the switch.
- MAC address-based VLANs are supported in edge switches, where end nodes are connected directly to the switches, as well as in intermediary switches, where the switches are connected to other Ethernet switches or hubs.
- The maximum number of MAC addresses that the switch can support in all its MAC address-based VLANs is 1024 addresses.
- MAC address-based VLANs do not support multicast MAC addresses.
- Egress ports cannot be part of static or LACP trunks.

General Steps

There are three main steps to creating a MAC address-based VLAN:

1. Use the VLAN MACADDRESS command in the VLAN Configuration mode to assign a name and a VID to the new VLAN, and to designate the VLAN as a MAC address-based VLAN.

2. Use the VLAN SET MACADDRESS command in the Global Configuration mode to assign the MAC addresses to the VLAN.

3. Use the VLAN SET MACADDRESS command in the Port Interface mode to assign the MAC addresses to the egress ports.

The steps must be performed in this order.

Creating MAC Address-based VLANs

The VLAN MACADDRESS command in the VLAN Configuration mode is the first command to creating this type of VLAN. This command assigns a new VLAN a name and a VID. Here is the format of the command:

```
vlan vid name name type macaddress
```

The range of the VID is 2 to 4094. The VID of the VLAN must be unique from all other VLANs on the switch. The name of a VLAN can be up to 20 characters. It cannot contain any spaces, and the first character must be a letter, not a number.

This example of the command creates a new MAC address-based VLAN with the VID 12 and the name QA:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 12 name QA type macaddress
```

For instructions on how to add MAC addresses and egress ports, refer to "Adding MAC Addresses to VLANs and Designating Egress Ports" on page 1020.

Adding MAC Addresses to VLANs and Designating Egress Ports

The MAC addresses and egress ports are specified with the VLAN SET MACADDRESS command in the Global Configuration mode and Port Interface mode. Enter the command in the Global Configuration mode when you want to add MAC addresses to VLANs. To designate the egress ports of addresses, enter the same command in the Port Interface mode.

The command has the same format in both the Global Configuration mode and Port Interface mode. The format is shown here:

`vlan set` *`vid macaddress|destaddress mac-address`*

The VID parameter specifies the VID of the MAC address-based VLAN to which the address is to be added, and the MAC-ADDRESS parameter is the address, which has to be entered in this format:

`xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx`

The MACADDRESS and DESTADDRESS keywords are equivalent. You can use either one in the command.

In this example of the command, the MAC address 2A:98:2C:AC:18:A4 is added to port 6 in a MAC address-based VLAN that has the VID 18:

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# vlan set 18 macaddress 2a:98:2c:ad:18:a4`	Use the VLAN SET MACADDRESS to add the MAC address to the VLAN.
`awplus(config)# interface port1.0.6`	Enter the Port Interface mode for port 6.
`awplus(config-if)# vlan set 18 macaddress 2a:98:2c:ac:18:a4`	Enter the VLAN SET MACADDRESS command again to designate port 6 as an egress port of the address.

Removing MAC Addresses

To remove MAC addresses from egress ports in a MAC address-based VLAN, use the NO VLAN MACADDRESS command in the Port Interface mode. This example of the command removes the MAC address 11:8A:92:CE:76:28 from ports 6 to 8, in a VLAN that has the VID 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.6-port1.0.8
awplus(config-if)# no vlan 23 macaddress 11:8a:92:ce:76:28
```

Before MAC addresses can be completely removed from this type of VLAN, you must first remove them from their egress ports, as illustrated in the previous example. Afterwards, you can again use the NO VLAN MACADDRESS command, but in the Global Configuration mode, and delete them from the VLANs. This example completely removes the same MAC address from the same VLAN as in the previous example:

```
awplus> enable
awplus# configure terminal
awplus(config)# no vlan 23 macaddress 11:8a:92:ce:76:28
```

Deleting VLANs

To delete MAC address-based VLANs from the switch, use the NO VLAN command in the VLAN Configuration mode. You can delete only one VLAN at a time. Here is the format of the command:

```
no vlan vid
```

This example deletes the VLAN with the VID 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# no vlan 23
```

Displaying VLANs

To display the MAC address-based VLANS on the switch, use the SHOW VLAN MACADDRESS command in the Privileged Exec mode:

```
awplus# show vlan macaddress
```

An example is shown in Figure 184.

```
VLAN 5 MAC Associations:
   Total number of associated MAC addresses: 5
   -------------------------------------------------
   MAC Address             Ports
   -------------------------------------------------
   5A:9E:84:31:23:85       port1.0.13-port1.0.18
   1A:87:9B:52:36:D5       port1.0.18
   26:72:9A:CB:1A:E4       port1.0.18
   89:01:BC:64:95:12       port1.0.18
   B2:89:10:02:1C:AE       port1.0.18
   -------------------------------------------------
VLAN 11 MAC Associations:
   Total number of associated MAC addresses: 5
   -------------------------------------------------
   MAC Address             Ports
   -------------------------------------------------
   78:3e:56:C8:AE:19       port1.0.8-port1.0.12
   AE:4B:76:18:54:C4       port1.0.12
   E7:98:03:12:C4:C5       port1.0.12
   7B:89:B2:AB:C4:57       port1.0.12
   89:EB:7B:34:82:CE       port1.0.12
   -------------------------------------------------
```

Figure 184. SHOW VLAN MACADDRESS Command

The fields are described in Table 105 on page 1033.

Example of Creating a MAC Address-based VLAN

Here is an example of how to create this type of VLAN. This example creates the VLAN detailed in Table 102 on page 1014. The example is named Sales and given the VID 21:

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# vlan database`	Use the VLAN DATABASE command to enter the VLAN Configuration mode.
`awplus(config-vlan)# vlan 21 name Sales type macaddress`	Use the VLAN MACADDRESS to assign the name Sales and the VID 21 to the new VLAN, and to designate it as a MAC address-based VLAN.
`awplus(config-vlan)# exit`	Return to the Global Configuration mode.
	Use the VLAN SET MACADDRESS command in the Global Configuration mode to assign the MAC addresses to the VLAN.

`awplus(config)# vlan set 21 macaddress 00:30:84:54:1a:45`
`awplus(config)# vlan set 21 macaddress 00:30:84:c3:5a:11`
`awplus(config)# vlan set 21 macaddress 00:30:84:22:67:17`
`awplus(config)# vlan set 21 macaddress 00:30:84:78:75:1c`
`awplus(config)# vlan set 21 macaddress 00:30:79:7a:11:10`
`awplus(config)# vlan set 21 macaddress 00:30:42:53:10:3a`	

`awplus(config)# exit`	Return to the Privileged Exec mode.
`awplus# show vlan macaddress`	Use the SHOW VLAN MACADDRESS command to confirm the MAC addresses.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# interface port1.0.1`	Enter the Port Interface mode for port 1.

	Use the VLAN SET MACADDRESS command in the Port Interface mode to designate port 1 as an egress port of all the MAC addresses.
awplus(config-if)# vlan set 21 macaddress 00:30:84:54:1a:45 awplus(config-if)# vlan set 21 macaddress 00:30:84:c3:5a:11 awplus(config-if)# vlan set 21 macaddress 00:30:84:22:67:17 awplus(config-if)# vlan set 21 macaddress 00:30:84:78:75:1c awplus(config-if)# vlan set 21 macaddress 00:30:79:7a:11:10 awplus(config-if)# vlan set 21 macaddress 00:30:42:53:10:3a	
awplus(config-if)# end	Return to the Privileged Exec mode.
awplus# show vlan macaddress	Confirm the configuration, again with the SHOW VLAN MACADDRESS command.
awplus# configure terminal	Enter the Global Configuration mode.
awplus(config)# interface port1.0.2-port1.0.6	Enter the Port Interface mode for ports 2 to 6.
awplus(config-if)# vlan set 21 macaddress 00:30:84:54:1a:45	Use the VLAN SET MACADDRESS command in the Port Interface mode to assign the ports one MAC address.
awplus(config-if)# end	Return to the Privileged Exec mode.
awplus# show vlan macaddress	Confirm the configuration with the SHOW VLAN MACADDRESS command.

Chapter 67

MAC Address-based VLAN Commands

The MAC address-based VLAN commands are summarized in Table 104 and described in detail within the chapter.

Table 104. MAC Address-based VLAN Commands

Command	Mode	Description
“NO VLAN” on page 1028	VLAN Configuration	Deletes VLANs from the switch.
“NO VLAN MACADDRESS (Global Configuration Mode)” on page 1029	Global Configuration	Removes MAC addresses from VLANs.
“NO VLAN MACADDRESS (Port Interface Mode)” on page 1030	Port Interface	Removes MAC addresses from egress ports.
“SHOW VLAN MACADDRESS” on page 1032	Privileged Exec	Displays MAC address-based VLANs.
“VLAN MACADDRESS” on page 1034	VLAN Configuration	Assigns names and VIDs to new VLANs.
“VLAN SET MACADDRESS (Global Configuration Mode)” on page 1036	Global Configuration	Adds MAC addresses to VLANs.
“VLAN SET MACADDRESS (Port Interface Mode)” on page 1038	Port Interface	Adds MAC addresses to egress ports.

NO VLAN

Syntax

```
no vlan vid
```

Parameters

vid

Specifies the VID of the VLAN you want to delete. You can specify just one VID.

Mode

VLAN Configuration mode

Description

Use this command to delete MAC address-based VLANs from the switch. You can delete only one VLAN at a time with this command.

Confirmation Command

“SHOW VLAN MACADDRESS” on page 1032

Example

This example deletes a MAC address-based VLAN with the VID 18:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# no vlan 18
```

NO VLAN MACADDRESS (Global Configuration Mode)

Syntax

```
no vlan vid macaddress|destaddress mac-address
```

Parameters

vid

Specifies the VID of the VLAN to be modified.

mac-address

Specifies the MAC address to be removed from the VLAN. The MAC address must be entered in this format:

xx:xx:xx:xx:xx:xx

Note
The MACADDRESS and DESTADDRESS keywords are equivalent.

Mode

Global Configuration mode

Description

Use this command to remove MAC addresses from MAC address-based VLANs. You can remove only one address at a time with this command. The command does not accept ranges or wildcards.

MAC addresses cannot be deleted if they are assigned to egress ports. To remove MAC addresses from egress ports, refer to "NO VLAN MACADDRESS (Port Interface Mode)" on page 1030.

Confirmation Command

"SHOW VLAN MACADDRESS" on page 1032

Example

This example removes the MAC address 23:AC:2A:92:C1:53 from a MAC address-based VLAN with the VID 11:

```
awplus> enable
awplus# configure terminal
awplus(config)# no vlan 11 macaddress 23:ac:2a:92:c1:53
```

NO VLAN MACADDRESS (Port Interface Mode)

Syntax

```
no vlan vid macaddress|destaddress mac-address
```

Parameters

vid
: Specifies the VID of the VLAN to be modified.

mac-address
: Specifies the MAC address to be removed from the VLAN. The MAC address must be entered in this format:

  xx:xx:xx:xx:xx:xx

Note
The MACADDRESS and DESTADDRESS keywords are equivalent.

Mode

Port Interface mode

Description

Use this command to remove MAC addresses from egress ports in MAC address-based VLANs.

Confirmation Command

“SHOW VLAN MACADDRESS” on page 1032

Examples

This example removes the MAC address 00:30:84:32:8A:5D from egress ports 1 and 4 in a VLAN that has the VID 17:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.4
awplus(config)# no vlan 17 macaddress 00:30:84:32:8a:5d
```

This example removes the MAC address 00:30:84:75:11:B2 from the egress port 11 to 14 in a VLAN with the VID 24:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11-port1.0.14
awplus(config)# no vlan 24 macaddress 00:30:84:75:11:b2
```

SHOW VLAN MACADDRESS

Syntax

```
show vlan macaddress
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the MAC addresses and the egress ports of the MAC address-based VLANs on the switch. An example is shown in Figure 185.

```
VLAN 11 MAC Associations:
  Total number of associated MAC addresses: 5
  ------------------------------------------------
  MAC Address            Ports
  ------------------------------------------------
  5A:9E:84:31:23:85      port1.0.4-port1.0.8
  1A:87:9B:52:36:D5      port1.0.4
  26:72:9A:CB:1A:E4      port1.0.4
  89:01:BC:64:95:12      port1.0.4
  B2:89:10:02:1C:AE      port1.0.4
  ------------------------------------------------
VLAN 12 MAC Associations:
  Total number of associated MAC addresses: 5
  ------------------------------------------------
  MAC Address            Ports
  ------------------------------------------------
  78:3e:56:C8:AE:19      port1.0.15-port1.0.22
  AE:4B:76:18:54:C4      port1.0.15
  E7:98:03:12:C4:C5      port1.0.15
  7B:89:B2:AB:C4:57      port1.0.15
  89:EB:7B:34:82:CE      port1.0.15
  ------------------------------------------------
```

Figure 185. SHOW VLAN MACADDRESS Command

The information is described here.

Table 105. SHOW VLAN MACADDRESS Command

Parameter	Description
VLAN *VID* MAC Associations	The VID of the MAC address-based VLAN.
Total Number of Associate MAC Addresses	Total number of MAC addresses that are assigned to the VLAN.
MAC Address	The MAC addresses of the VLAN.
Ports	The egress ports of the MAC addresses.

Example

The following example displays the MAC addresses and egress ports of the MAC address-based VLANs on the switch:

```
awplus# show vlan macaddress
```

VLAN MACADDRESS

Syntax

```
vlan vid name name type macaddress
```

Parameters

vid

Specifies a VLAN identifier in the range of 2 to 4094. VID 1 is reserved for the Default_VLAN. You can specify only one VID.

The VID of a VLAN should be unique from all other VLANs in a network, unless a VLAN spans multiple switches, in which case its VID should be the same on all switches on which the VLAN resides. For example, to create a VLAN called Sales that spans three switches, you would assign it the same VID value on each switch.

name

Specifies a name of up to 20 characters for the VLAN. The first character of the name must be a letter; it cannot be a number. VLANs will be easier to identify if their names reflect the functions of their subnetworks or workgroups (for example, Sales or Accounting). A name cannot contain spaces or special characters, such as asterisks (*) or exclamation points (!). A name cannot be the same as a name of an existing VLAN on the switch. A VLAN that spans multiple switches should have the same name on each switch.

Mode

VLAN Configuration mode

Description

Use this command to create new MAC address-based VLANs. You can create just one VLAN at a time.

After creating a VLAN, use “VLAN SET MACADDRESS (Global Configuration Mode)” on page 1036 to add MAC addresses to it and “VLAN SET MACADDRESS (Port Interface Mode)” on page 1038 to assign the addresses to egress ports.

Confirmation Command

“SHOW VLAN MACADDRESS” on page 1032

Example

This example creates a MAC address-based VLAN that has the name Sales and the VID 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# vlan 3 name Sales type macaddress
```

VLAN SET MACADDRESS (Global Configuration Mode)

Syntax

```
vlan set vid macaddress|destaddress mac-address
```

Parameters

vid

Specifies the VID of the VLAN to be modified.

mac-address

Specifies the MAC address to be added to the VLAN. The MAC address must be entered in this format:

xx:xx:xx:xx:xx:xx

Note
The MACADDRESS and DESTADDRESS keywords are equivalent.

Mode

Global Configuration mode

Description

Use this command to add MAC addresses to MAC address-based VLANs. You can add only one address at a time with this command. You cannot use ranges or wildcards.

The specified VLAN must already exist. Refer to “VLAN MACADDRESS” on page 1034 for instructions on how to create MAC address-based VLANs. To add MAC addresses to egress ports, use “VLAN SET MACADDRESS (Port Interface Mode)” on page 1038.

Confirmation Command

“SHOW VLAN MACADDRESS” on page 1032

Examples

This example adds the MAC address 00:30:84:32:8A:5D to a MAC address-based VLAN that has the VID 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan set 4 macaddress 00:30:84:32:8a:5d
```

This example adds the MAC address 00:30:84:32:76:1A to a MAC address-based VLAN with the VID 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan set 12 macaddress 00:30:84:32:76:1a
```

VLAN SET MACADDRESS (Port Interface Mode)

Syntax

```
vlan set vid macaddress|destaddress mac-address
```

Parameters

vid

Specifies the VID of the VLAN to be modified.

mac-address

Specifies the MAC address to assign to an egress port. The MAC address must be entered in this format:

xx:xx:xx:xx:xx:xx

Note
The MACADDRESS and DESTADDRESS keywords are equivalent.

Mode

Port Interface mode

Description

Use this command to assign MAC addresses to egress ports for MAC address-based VLANs. The specified MAC address must already be assigned to the VLAN. For instructions, refer to “VLAN SET MACADDRESS (Global Configuration Mode)” on page 1036.

Confirmation Command

“SHOW VLAN MACADDRESS” on page 1032

Examples

This example assigns the MAC address 00:30:84:32:8A:5C to egress ports 1 and 4 in a VLAN whose VID is 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.4
awplus(config-if)# vlan set 3 macaddress 00:30:84:32:8a:5c
```

This example assigns the MAC address 00:30:84:75:11:B2 to ports 11 to 14 in a VLAN that has the VID 24:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.4
awplus(config-if)# vlan set 24 macaddress 00:30:84:75:11:b2
```

Chapter 68

Private Port VLANs

This chapter provides the following topics:

Overview

Private VLANs (also called private port VLANs) create special broadcast domains in which the traffic of the member ports is restricted to just uplink ports. Ports in a private VLAN are only allowed to forward traffic to and receive traffic from a designated uplink port, and are prohibited from forwarding traffic to each other.

An example application of a private VLAN would be a library in which user booths each have a computer with Internet access. In this situation, it would usually be undesirable to allow communication between these individual PCs. Connecting the computers to ports within a private isolated VLAN would enable each computer to access the Internet or a library server via a single connection, while preventing access between the computers in the booths.

Another application for private VLANs is to simplify IP address assignments. Ports can be isolated from each other while still belonging to the same subnet.

A private VLAN generally consists of one or more host ports and an uplink port.

Host Ports

The host ports of a private VLAN can only forward traffic to, and receive traffic from, an uplink port, and are prohibited from forwarding traffic to each other. A private VLAN can have any number of host ports on the switch, up to all the ports, minus the uplink port. A port can be a host port of only one private VLAN at a time.

The host ports are untagged. VLAN membership is defined by their PVIDs. The devices to which they are connected should not send tagged packets.

Uplink Port

The uplink port can be a promiscuous port or a trunk port.

An uplink port can communicate with all host ports in the private VLAN. A promiscuous port acts like an untagged uplink port for a private VLAN. Each private VLAN can have multiple promiscuous ports.

A trunk port may be configured as an uplink for a private VLAN.

Private VLAN Functionality

The following describes host and uplink port functionality in a private VLAN, and how private VLANs can be configured.

Host ports:

- Cannot communicate with each other.
- Can communicate with uplink ports.
- Can communicate with appropriately configured trunk ports.

Uplink ports:

- Promiscuous ports:
  - Promiscuous ports act as untagged trunk ports.
  - A private VLAN can have more than one promiscuous port.
- Trunk ports:
  - A private VLAN can be assigned to a trunk port as the native VLAN.
  - A private VLAN can be assigned to a trunk port as a tagged VLAN.
  - A trunk port that has been assigned a private VLAN can be assigned other VLANs.

Guidelines

Here are the guidelines to private VLANs:

- A private VLAN can have any number of host ports, up to all the ports on the switch, minus the uplink port.
- A promiscuous port can be an uplink port of just one private VLAN at a time, however, a private VLAN can have more than one uplink port.
- The host ports of private VLANs are untagged ports, and as such, transmit only untagged traffic.
- The switch can support private, port-based, tagged, and MAC address-based VLANs at the same time
- Host ports cannot be members of both private VLANs and port-based or tagged VLANs at the same time.

Creating Private VLANs

The command to initially create private VLANs is the PRIVATE-VLAN command in the VLAN Configuration mode. Here is the command's format:

```
private-vlan vid
```

The VID number has the range of 2 to 4094. The VID of a private VLAN must be unique from all other VLANs on the switch.

This example assigns the VID 26 to a new private VLAN:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# private-vlan 26
```

New private VLANs do not have any host or uplink ports. To add ports, refer to "Adding Host and Uplink Ports" on page 1046.

Adding Host and Uplink Ports

Private VLANs have host ports and uplink ports. A private VLAN can have more than one uplink port. The devices connected to the hosts ports of a private VLAN can only communicate with the uplink port, and not with each other. The host ports and the uplink port can be added in any order to a private VLAN.

The SWITCHPORT MODE PRIVATE-VLAN HOST command in the Port Interface mode is used to add host ports to private VLANs. The command has this format:

```
switchport mode private-vlan host vid
```

The VID parameter is the VID of the private VLAN to which you are adding host ports. The private VLAN must already exist on the switch. Private VLANs are created with the PRIVATE-VLAN command, explained in “Creating Private VLANs” on page 1045. This example of the command adds ports 2 to 7 as host ports of a private VLAN that has the VID 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2-port1.0.7
awplus(config-if)# switchport mode private-vlan host 15
```

The promiscuous uplink port of a private VLAN is designated with the SWITCHPORT MODE PRIVATE-VLAN PROMISCUOUS command in the Port Interface mode. Here is its format:

```
switchport mode private-vlan promiscuous vid
```

The VID parameter has the same function in this command as it does in the command for adding host ports. It designates the VLAN to which you want to add the port. This example of the command adds port 16 as an uplink port to a private VLAN that has the VID 23.

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16
awplus(config-if)# switchport mode private-vlan promiscuous
23
```

Note
To add a private VLAN to a trunk port, either as a tagged VLAN or as the native VLAN, refer to “SWITCHPORT TRUNK ALLOWED VLAN” on page 963 or “SWITCHPORT TRUNK NATIVE VLAN” on page 966, respectively.

Deleting VLANs

To delete private VLANs from the switch, use the NO VLAN command in the VLAN Configuration mode. The host and uplink ports of deleted private VLANs are automatically returned by the switch to the Default_VLAN. Here is the format of the command:

```
no vlan vid
```

The VID parameter is the VID of the private VLAN you want to delete. The command lets you delete only one VLAN at a time. You cannot delete the Default_VLAN.

This example deletes a VLAN that has the VID 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# no vlan 23
```

Displaying Private VLANs

The SHOW VLAN PRIVATE-VLAN command in the Privileged Exec mode displays the private VLANs currently existing on the switch, along with their host and uplink ports. Here is the command:

```
awplus# show vlan private-vlan
```

Here is an example of the display.

```
Private VLANs:
VID               Ports
-------------------------------------------------
12                4-8
28                17-24
```

Figure 186. SHOW VLAN PRIVATE-VLAN Command

Chapter 69

Private Port VLAN Commands

The private port VLAN commands are summarized in Table 106 and described in detail within the chapter.

Table 106. Private Port VLAN Commands

Command	Mode	Description
“NO VLAN” on page 1050	VLAN Configuration	Deletes VLANs from the switch.
“PRIVATE-VLAN” on page 1051	VLAN Configuration	Creates private port VLANs.
“SHOW VLAN PRIVATE-VLAN” on page 1052	Privileged Exec	Displays the private port VLANs on the switch.
“SWITCHPORT MODE PRIVATE-VLAN HOST” on page 1053	Port Interface	Adds host ports to private port VLANs.
“SWITCHPORT MODE PRIVATE-VLAN PROMISCUOUS” on page 1054	Port Interface	Adds uplink ports to private port VLANs.

NO VLAN

Syntax

```
no vlan vid
```

Parameters

vid

Specifies the VID of the VLAN you want to delete. You can specify just one VID.

Mode

VLAN Configuration mode

Description

Use this command to delete private port VLANs from the switch. You can delete one VLAN at a time with this command.

Confirmation Command

“SHOW VLAN PRIVATE-VLAN” on page 1052

Example

This example deletes a VLAN that has the VID 16:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# no vlan 16
```

PRIVATE-VLAN

Syntax

```
private-vlan vid
```

Parameters

vid

Specifies a VLAN identifier. The range is 2 to 4094. The VID 1 is reserved for the Default_VLAN. The VID must be unique from all VIDs of VLANs that currently exist on the switch. You can specify only one VID.

Mode

VLAN Configuration mode

Description

Use this command to create new private port VLANs. You can create just one VLAN at a time. Refer to "SWITCHPORT MODE PRIVATE-VLAN HOST" on page 1053 to add host ports to a new VLAN, and to "SWITCHPORT MODE PRIVATE-VLAN PROMISCUOUS" on page 1054 to designate an uplink port.

Confirmation Command

"SHOW VLAN PRIVATE-VLAN" on page 1052

Example

This example creates a private port VLAN with the VID 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# vlan database
awplus(config-vlan)# private-vlan 23
```

SHOW VLAN PRIVATE-VLAN

Syntax

```
show vlan private-vlan
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the private-port VLANs on the switch. Here is an example of the information.

```
Private VLANs:
VID               Ports
-------------------------------------------------
12                4-8
28                17-24
```

Figure 187. SHOW VLAN PRIVATE-VLAN Command

Example

The following example displays the private-port VLANs on the switch:

```
awplus# show vlan private-vlan
```

SWITCHPORT MODE PRIVATE-VLAN HOST

Syntax

```
switchport mode private-vlan host vid
```

Parameters

vid

Specifies the VID of a private port VLAN to which ports are to be added as hosts. Specify a value between 1 and 4094.

Mode

Port Interface mode

Description

Use this command to add host ports to private port VLANs. Devices connected to host ports in a private port VLAN can only communicate with the uplink port.

Confirmation Command

"SHOW VLAN PRIVATE-VLAN" on page 1052

Example

This example adds ports 15 to 18 as host ports of a private port VLAN with the VID 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15-port1.0.18
awplus(config-if)# switchport mode private-vlan host 23
```

SWITCHPORT MODE PRIVATE-VLAN PROMISCUOUS

Syntax

```
switchport mode private-vlan promiscuous vid
```

Parameters

vid

Specifies the VID of a private port VLAN to which you are adding a promiscuous uplink port.

Mode

Port Interface mode

Description

Use this command to add a promiscuous uplink port to a private port VLAN. A promiscuous port can be an uplink port of just one private VLAN at a time.

Confirmation Command

“SHOW VLAN PRIVATE-VLAN” on page 1052

Example

This example adds port 14 as an uplink port to a private port VLAN with the VID 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.14
awplus(config-if)# switchport mode private-vlan promiscuous
15
```

Chapter 70
Voice VLAN Commands

The voice VLAN commands are summarized in Table 107 and described in detail within the chapter.

Table 107. Voice VLAN Commands

Command	Mode	Description
“NO SWITCHPORT VOICE VLAN” on page 1056	Port Interface	Removes ports from voice VLANs.
“SWITCHPORT VOICE DSCP” on page 1057	Port Interface	Configures the Layer 3 DSCP value advertised when LLDP-MED Network Policy TLVs are transmitted.
“SWITCHPORT VOICE VLAN” on page 1058	Port Interface	Adds ports to voice VLANs.

NO SWITCHPORT VOICE VLAN

Syntax

```
no switchport voice vlan
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to remove a port from a voice VLAN. A port retains the CoS priority and DSCP values that were assigned to it when it was a voice VLAN member.

This command removes LLDP-MED network policy configuration for a voice device connected to these ports, but does not change the spanning-tree edge port status.

Confirmation Command

“SHOW VLAN” on page 956

Example

This example removes the voice VLAN assignment from port 1.0.24, and in turn, disables the transmission of LLDP-MED network policy information for voice devices on port 1.0.24:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.24
awplus(config-if)# no switchport voice vlan
```

SWITCHPORT VOICE DSCP

Syntax

```
switchport voice dscp value
```

Parameters

value
Specifies a DSCP value of 0 to 63.

Mode

Port Interface mode

Description

Use this command to assign a DSCP value to be advertised on a voice VLAN enabled port. A port transmits this value in its LLDP-MED network policy TLV to an IP phone, which, in turn, sends its packets using this DSCP value. A port can have both voice VLAN DSCP and CoS values.

Use the NO form of this command to remove a DSCP value from a port without replacing it with a new value. A DSCP value of 0 will be advertised.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

This example assigns the DSCP value 61 to ports 1.0.18 and 1.0.19:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.18,port1.0.19
awplus(config-if)# switchport voice dscp 61
```

This example removes the DSCP value from port 1.0.3, and a DSCP value of 0 will be advertised:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# no switchport voice dscp
```

SWITCHPORT VOICE VLAN

Syntax

`switchport voice vlan <vid>|priority <value>|dynamic`

Parameters

vid

Specifies the ID number (VID) of the VLAN that functions as the voice VLAN for ports. You can specify only one VID. The range is 1 to 4094.

priority

Configures 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.

dynamic

Specifies the VLAN ID with which the IP phone should send tagged packets that will be assigned by RADIUS authentication.

Mode

Port Interface mode

Description

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 form 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.

LLDP-MED advertisements, including Network Policy TLVs, are transmitted via a port if:

- LLDP is enabled (LLDP RUN command).
- The port is configured to transmit LLDP advertisements—enabled by default (LLDP TRANSMIT RECEIVE command).

- 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.

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), in the RADIUS Accept message when authenticating a phone attached to this port.

If the ports have been set to be edge ports by the SWITCHPORT VOICE VLAN command, the NO form of this command will leave them unchanged as edge ports. To set them back to their default non-edge port configuration, use the NO SPANNING-TREE PORTFAST command (refer to "NO SPANNING-TREE PORTFAST" on page 859).

The default setting for this feature is disabled.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

"SHOW LLDP LOCAL-INFO INTERFACE" on page 1333

Examples

This example tells IP phones connected to port 1.0.5 to send voice data tagged for VLAN 10:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# switchport voice vlan 10
```

This example assigns the CoS value 5 to ports 1.0.2 and 1.0.3:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2-port1.0.3
awplus(config-if)# switchport voice vlan priority 5
```

This example removes the CoS value from port 1.0.16 and returns to the default CoS value, 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16
awplus(config-if)# no switchport voice vlan priority
```

This example dynamically configures the VLAN ID advertised to IP phones connected to port 1.0.1, based on the VLAN assigned by RADIUS authentication (with the RADIUS attribute, Egress-VLANID, in the RADIUS

accept packet):

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# switchport voice vlan dynamic
```

Section IX

Port Security

This section contains the following chapters:

Chapter 71

MAC Address-based Port Security

This chapter contains the following topics:

Overview

This feature lets you control access to the ports on the switch based on the source MAC addresses of the network devices. You specify the maximum number of source MAC addresses that ports can learn. Ports that learn their maximum number of addresses discard packets that have new, unknown addresses, preventing access to the switch by any further devices.

As an example, if you configure port 3 on the switch to learn no more than five source MAC addresses, the port learns up to five address and forwards the ingress packets of the devices that belong to those addresses. If the port receives ingress packets that have source MAC addresses other than the five it has already learned, it discards those packets to prevent the devices from passing traffic through the switch.

Static Versus Dynamic Addresses

The MAC addresses that the ports learn can be stored as either static or dynamic addresses in the MAC address table in the switch. Ports that store the addresses as static addresses never learn any new addresses after they have learned their maximum number. In contrast, ports that store the addresses as dynamic addresses can learn new addresses when addresses are timed out from the table by the switch. The addresses are aged out according to the aging time of the MAC address table.

Note
For background information on the aging time of the MAC address table, refer to “Overview” on page 416.

Intrusion Actions

The intrusion actions define what the switch does when ports that have learned their maximum number of MAC addresses receive packets that have unknown source MAC addresses. The possible settings are:

- Protect - Ports discard those frames that have unknown MAC addresses. No other action is taken. For example, if port 14 is configured to learn 18 addresses, it starts to discard packets with unknown source MAC addresses after learning 18 MAC addresses.
- Restrict - This is the same as the protect action, except that the switch sends SNMP traps when the ports discard frames. For example, if port 12 is configured to learn two addresses, the switch sends a trap every time the port, after learning two addresses, discards a packet that has an unknown MAC address.
- Shutdown - The switch disables the ports and sends SNMP traps. For example, if port 5 is configured to learn three MAC addresses, it is disabled by the switch to prevent it from forwarding any further traffic if it receives a packet with an unknown source MAC address,

after learning three addresses. The switch also sends an SNMP trap.

Guidelines

Here are the guidelines to MAC address-based port security:

- The filtering of a packet occurs on the ingress port, not on the egress port.
- You cannot use MAC address-based port security and 802.1x port-based access control on the same port. To configure a port as an Authenticator or Supplicant in 802.1x port-based access control, you must remove MAC address-based port security.
- This type of port security is supported on optional SFP modules.
- You can manually add static addresses to ports that are configured for this security. The manually added addresses are not counted against the maximum number of addresses the ports can learn.

Configuring Ports

There are three things you need to decide before you configure MAC address-based port security on the ports. They are:

- What is the maximum number of source MAC addresses the ports can learn?
- Should the source MAC addresses learned by the ports be stored as dynamic or static addresses in the MAC address table?
- Is the intrusion action protect, restrict, or shutdown?

See Table 108 for a list of the commands.

Table 108. MAC Address-based Port Security Commands and Descriptions

To	Use This Command	Range
Set the maximum number of source MAC addresses a port can learn.	SWITCHPORT PORT-SECURITY MAXIMUM *value*	0 to 255 addresses
Configure ports to save the source MAC addresses as dynamic addresses in the MAC address table.	SWITCHPORT PORT-SECURITY AGING	-
Configure ports to save the source MAC addresses as static addresses in the MAC address table.	NO SWITCHPORT PORT-SECURITY AGING	-
Set the intrusion action on the ports.	SWITCHPORT PORT-SECURITY VIOLATION PROTECT|RESTRICT| SHUTDOWN	-

These commands are found in the Port Interface mode and can be entered in any order when you configure the ports.

Here are a few examples on how to use the commands. In this first example, ports 4 and 5 are configured to learn up to 25 source MAC addresses each, and to store the addresses as static addresses in the MAC address table. The intrusion action is set to protect so that the ports discard packets with unknown MAC addresses after they have learned the maximum number of addresses, but the switch does not send SNMP traps:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4,port1.0.5
awplus(config-if)# switchport port-security maximum 25
awplus(config-if)# no switchport port-security aging
awplus(config-if)# switchport port-security violation
protect
```

This example configures port 16 to learn 45 MAC addresses. The addresses are stored as dynamic addresses in the table so that inactive addresses are deleted, permitting the port to learn new addresses. The intrusion action is set to restrict so that the switch sends SNMP traps if the port, after learning 45 source MAC addresses, discards packets with unknown source MAC addresses:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16
awplus(config-if)# switchport port-security maximum 45
awplus(config-if)# switchport port-security aging
awplus(config-if)# switchport port-security violation
restrict
```

This example configures ports 8 and 20 to learn up to five MAC addresses each. The addresses are stored as static addresses in the table, so that they are never aged out, even when the source nodes are inactive. The intrusion action is set to Shutdown, which disables the ports if they receive packets with unknown source packets after they learn five MAC addresses:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.8,port1.0.20
awplus(config-if)# switchport port-security maximum 5
awplus(config-if)# no switchport port-security aging
awplus(config-if)# switchport port-security violation
shutdown
```

After configuring the ports, go to "Displaying Port Settings" on page 1070 to confirm the settings before activating port security.

Enabling MAC Address-based Security on Ports

After you have configured a port for MAC address-based security, as explained in “Configuring Ports” on page 1066, and confirmed the settings, as explained in “Displaying Port Settings” on page 1070, you are ready to activate the feature on the ports. This is accomplished with the SWITCHPORT PORT-SECURITY command in the Port Interface mode. This example of the command activates port security on ports 16 to 24:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16-port1.0.24
awplus(config-if)# switchport port-security
```

To confirm the activation, return to “Displaying Port Settings” on page 1070. The Security Enabled field in the SHOW PORT-SECURITY INTERFACE command should have a status of Yes.

Disabling MAC Address-based Security on Ports

To remove MAC address-based security from ports, use the NO SWITCHPORT PORT-SECURITY command in the Port Interface mode. This example of the command removes port security from port 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.23
awplus(config-if)# no switchport port-security
```

Note
To activate ports that were disabled by the shutdown intrusion action, refer to "NO SHUTDOWN" on page 221.

Displaying Port Settings

There are two commands that display information about the MAC address-based port security on the ports on the switch. The one that you are likely to use the most often is the SHOW PORT-SECURITY INTERFACE command in the Privileged Exec mode. It displays all the possible information. Here is the format of the command:

```
show port-security interface port
```

This example displays the settings for port 2:

```
awplus# show port-security interface port1.0.2
```

An example is shown in Figure 188.

```
Port Security Configuration - Port1.0.2
-----------------------------------------------
Security Enabled          : YES
Port Status               : ENABLED
Violation Mode            : PROTECT
Aging                     : NO
Maximum MAC Addresses     : 0
Current Learned Addresses : 0
Lock Status               : UNLOCKED
Security Violation Count  : 0
```

Figure 188. SHOW PORT-SECURITY INTERFACE Command

The fields are defined in Table 110 on page 1076.

If you are interested in viewing just the number of packets the ports have discarded because they had invalid source MAC addresses, you can use the SHOW PORT-SECURITY INTRUSTION INTERFACE command. Here is the format of the command:

```
show port-security intrusion interface port
```

This example displays the number of discarded packets on port 17:

```
awplus# show port-security intrusion interface port1.0.17
```

Figure 189 is an example of the information.

```
Port Security Intrusion List (Last 256 Intrusions)
------------------------------------------------------
Interface: Port 1.0.17    -   2 intrusion(s) detected

0015.77b1.8510  eccd.6d48.4488
```

Figure 189. Example of SHOW PORT-SECURITY INTRUSION INTERFACE Command

Chapter 72

MAC Address-based Port Security Commands

The MAC address-based port security commands are summarized in Table 109 and described in detail within the chapter.

Table 109. MAC Address-based Port Security Commands

Command	Mode	Description
“NO SWITCHPORT PORT-SECURITY” on page 1074	Port Interface	Removes MAC address-based security from ports.
“NO SWITCHPORT PORT-SECURITY AGING” on page 1075	Port Interface	Configures ports to add the source MAC addresses as static MAC address in the MAC address table.
“SHOW PORT-SECURITY INTERFACE” on page 1076	Privileged Exec	Displays the security mode settings of the ports
“SHOW PORT-SECURITY INTRUSION INTERFACE” on page 1079	Privileged Exec	Displays the number of packets the ports have discarded.
“SWITCHPORT PORT-SECURITY” on page 1081	Port Interface	Activates MAC address-based security on ports.
“SWITCHPORT PORT-SECURITY AGING” on page 1082	Port Interface	Configures ports to add the source MAC addresses as dynamic MAC address in the MAC address table.
“SWITCHPORT PORT-SECURITY MAXIMUM” on page 1083	Port Interface	Specifies the maximum number of dynamic MAC addresses that ports can learn.
“SWITCHPORT PORT-SECURITY VIOLATION” on page 1084	Port Interface	Specifies the intrusion actions of the ports.

NO SWITCHPORT PORT-SECURITY

Syntax

```
no switchport port-security
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to remove MAC address-based security from the ports.

> **Note**
> To activate ports that were disabled by the shutdown intrusion action, refer to “NO SHUTDOWN” on page 221.

Confirmation Command

“SHOW PORT-SECURITY INTERFACE” on page 1076

Example

This example removes MAC address-based security from port 14:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.14
awplus(config-if)# no switchport port-security
```

NO SWITCHPORT PORT-SECURITY AGING

Syntax

```
no switchport port-security aging
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to configure ports to add source MAC addresses as static addresses in the MAC address table. Because static addresses are never deleted from the table, ports that learn their maximum numbers of source MAC addresses cannot learn new addresses, even when the source nodes of the learned addresses are inactive.

Confirmation Command

"SHOW PORT-SECURITY INTERFACE" on page 1076

Example

This example configures ports 6 and 10 to store the source MAC addresses as static addresses in the MAC address table:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.6,port1.0.10
awplus(config-if)# no switchport port-security aging
```

SHOW PORT-SECURITY INTERFACE

Syntax

```
show port-security interface port
```

Parameters

port

Specifies the port whose security mode settings you want to view. You can display more than one port at a time.

Mode

Privileged Exec mode

Description

Use this command to display the security settings of the ports on the switch. An example of the information is shown in Figure 190.

```
Port Security Configuration - Port1.0.15
-----------------------------------------
Security Enabled          : YES
Port Status               : ENABLED
Violation Mode            : PROTECT
Aging                     : NO
Maximum MAC Addresses     : 0
Current Learned Addresses : 0
Lock Status               : UNLOCKED
Security Violation Count  : 0
```

Figure 190. SHOW PORT-SECURITY INTERFACE Command

The fields are described in Table 110.

Table 110. SHOW PORT-SECURITY INTERFACE Command

Field	Description
Port	Port number.
Security Enabled	The current status of MAC address-based security on the port. The security is active if the status is Yes and inactive if the status is No. To activate or deactivate security on the port, refer to “SWITCHPORT PORT-SECURITY” on page 1081 or “NO SWITCHPORT PORT-SECURITY” on page 1074, respectively.

Table 110. SHOW PORT-SECURITY INTERFACE Command (Continued)

Field	Description
Port Status	The status of the port. The status can be Enabled or Disabled. A port that has a status of Enabled can forward network traffic. A port that has a Disabled status was shut down by the switch because it has an intrusion action of shutdown, and it received a packet with an unknown source MAC address after learning its maximum number of addresses. A port can also have a status of Disabled if it was manually disabled with the SHUTDOWN command. To reactivate a port with a Disabled status, use "NO SHUTDOWN" on page 221.
Violation Mode	The intrusion action of the port. The actions are: ❒ Protect - Protect intrusion action ❒ Restrict - Restrict intrusion action ❒ Shutdown - Shut down intrusion action
Aging	The status of MAC address aging on the port. If the aging status is No, the MAC addresses that are learned on the port are added as static MAC addresses to the MAC address table, so that they are retained even when the source nodes are inactive. If the aging status is Yes, the MAC addresses that are learned on the port are stored as dynamic MAC addresses and are deleted when the source nodes are inactive. To configure the port to save the source MAC addresses as static addresses, refer to "NO SWITCHPORT PORT-SECURITY AGING" on page 1075. To configure the port to save the source MAC addresses as dynamic addresses, refer to "SWITCHPORT PORT-SECURITY AGING" on page 1082.

Table 110. SHOW PORT-SECURITY INTERFACE Command (Continued)

Field	Description
Maximum MAC Addresses	The maximum number of dynamic MAC addresses the port is allowed to learn. To set this parameter, refer to "SWITCHPORT PORT-SECURITY MAXIMUM" on page 1083.
Current Learned Addresses	The number of MAC addresses that have been learned on the port.
Lock Status	Whether or not the port has learned its maximum number of MAC addresses. The port will have a Locked status if it has learned its maximum number of MAC addresses, and an Unlocked status if it has not learned its maximum number of MAC addresses.
Security Violation Count	The number of ingress packets the port has discarded because they had unknown source MAC address. The port does not discard packets until after it has learned its maximum number of MAC addresses. This information is also available with "SHOW PORT-SECURITY INTRUSION INTERFACE" on page 1079.

Example

This example displays the port security settings for ports 5 to 8:

```
awplus# show port-security interface port1.0.5-port1.0.8
```

SHOW PORT-SECURITY INTRUSION INTERFACE

Syntax

```
show port-security intrusion interface port
```

Parameter

port

Specifies a port. You can specify more than one port at a time.

Modes

Privileged Exec mode

Description

Use this command to display the number of packets the ports have had to discard because the packets had unknown source MAC addresses. The ports begin to discard packets after learning their maximum number of source MAC addresses. This information is also available with "SHOW PORT-SECURITY INTERFACE" on page 1076.

Figure 191 provides an example of the information.

```
Port Security Intrusion List
------------------------------------------------------------
Interface: Port 1.0.4     -   122 intrusion(s) detected
```

Figure 191. SHOW PORT-SECURITY INTRUSION INTERFACE Command

Example

This command displays the number of discarded packets on port 15:

```
awplus# show port-security intrusion interface port1.0.15
```

Figure 192 on page 1080 is an example of the information.

```
Port Security Intrusion List

Port Security Intrusion List (Last 10 Intrusions)
------------------------------------------------------------
Interface: Port 1.0.5     -   132 intrusion(s) detected

000:0900:127E 000:0900:127F 000:0900:027D
000:0900:027E 000:0900:027F 000:0900:1279
000:0900:127A 000:0900:127B 000:0900:127C
000:0900:127D
```

Figure 192. Example of SHOW PORT-SECURITY INTRUSION INTERFACE Command

SWITCHPORT PORT-SECURITY

Syntax

```
switchport port-security
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to activate MAC address-based security on ports.

Confirmation Command

"SHOW PORT-SECURITY INTERFACE" on page 1076

Example

This example activates MAC address-based security on port 3 and ports 16 to 18:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.3,port1.0.16-port1.0.18
awplus(config-if)# switchport port-security
```

SWITCHPORT PORT-SECURITY AGING

Syntax

```
switchport port-security aging
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to configure the ports to add the source MAC addresses as dynamic MAC address in the MAC address table. Ports that learn their maximum numbers of addresses can learn new addresses as inactive addresses are deleted from the table.

Confirmation Command

“SHOW PORT-SECURITY INTERFACE” on page 1076

Example

This example sets port 2 to store its learned MAC addresses as dynamic addresses in the MAC address table:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# switchport port-security aging
```

SWITCHPORT PORT-SECURITY MAXIMUM

Syntax

```
switchport port-security maximum value
```

Parameters

value

Specifies the maximum number of dynamic MAC addresses ports can learn. The range is 0 to 255 addresses. The default is 0 addresses.

Mode

Port Interface mode

Description

Use this command to specify the maximum number of dynamic MAC addresses that ports can learn. Ports that learn their maximum numbers of MAC addresses discard ingress packets with unknown MAC addresses.

Use the no form of this command, NO SWITCHPORT PORT-SECURITY MAXIMUM, to set the command to its default value of 100 addresses.

Confirmation Command

"SHOW PORT-SECURITY INTERFACE" on page 1076

Example

This example sets port 2 to learn up to 15 dynamic MAC addresses:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# switchport port-security maximum 15
```

SWITCHPORT PORT-SECURITY VIOLATION

Syntax

```
switchport port-security violation protect|restrict|
shutdown
```

Parameters

protect
Discards invalid frames. This is the default setting.

restrict
Discards invalid frames and sends SNMP traps.

shutdown
Sends SNMP traps and disables the ports.

Mode

Port Interface mode

Description

Use this command to specify the intrusion actions of the switch. The intrusion actions determine how the switch responds when ports that have learned their maximum number of MAC addresses receive ingress frames that have unknown source MAC addresses.

The no form of this command, NO SWITCHPORT PORT-SECURITY VIOLATION, returns the value to protect which is the default setting.

Confirmation Command

“SHOW PORT-SECURITY INTERFACE” on page 1076

Examples

This example sets the intrusion action for port 5 to protect. The port, after learning its maximum number of MAC addresses, discards all ingress packets that have unknown MAC addresses:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# switchport port-security violation
protect
```

This example sets the intrusion action for ports 22 to 24 to restrict. After learning their maximum numbers of MAC addresses, the ports discard packets with unknown source MAC addresses, and the switch sends SNMP traps:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.22-port1.0.24
awplus(config-if)# switchport port-security violation
restrict
```

This example sets the intrusion action on port 2 to shutdown. The switch disables the port and sends an SNMP trap if the port learns its maximum number of MAC addresses and then receives an ingress packet with another unknown source MAC address:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# switchport port-security violation
shutdown
```

Chapter 73

802.1x Port-based Network Access Control

This chapter contains the following topics:

Overview

This chapter explains 802.1x port-based network access control. This port security feature lets you control who can send traffic through and receive traffic from the individual switch ports. The switch does not allow an end node to send or receive traffic through a port until the user of the node has been authenticated by a RADIUS server.

This feature is used to prevent unauthorized individuals from connecting a computer to a switch port or using an unattended workstation to access your network resources. Only those users designated as valid network users on a RADIUS server are permitted to use the switch to access the network.

This port security method uses the RADIUS authentication protocol. The management software of the switch includes RADIUS client software. If you have already read Chapter 98, “RADIUS and TACACS+ Clients” on page 1509, then you know that you can also use the RADIUS client software on the switch, along with a RADIUS server on your network, to create new remote manager accounts.

Note
RADIUS with Extensible Authentication Protocol (EAP) extensions is the only supported authentication protocol for 802.1x port-based network access control. This feature is not supported with the TACACS+ authentication protocol.

Here are several terms to keep in mind when using this feature.

- Supplicant - A supplicant is an end user or end node that wants to access the network through a switch port. A supplicant may also be referred to as a client.
- Authenticator - The authenticator is a port that prohibits network access until a supplicant has logged on and been validated by the RADIUS server.
- Authentication server - The authentication server is the network device that has the RADIUS server software. This is the device that does the actual authenticating of the supplicants.

The switch does not authenticate any supplicants connected to its ports. Its function is to act as an intermediary between the supplicants and the authentication server during the authentication process.

Authentication Process

Below is a brief overview of the authentication process that occurs between a supplicant, authenticator, and authentication server. For further details, refer to the IEEE 802.1x standard.

- Either the authenticator (that is, a switch port) or the supplicant initiates an authentication message exchange. The switch initiates an exchange when it detects a change in the status of a port (such as when the port transitions from no link to valid link), or if it receives a packet on the port with a source MAC address not in the MAC address table.
- An authenticator starts the exchange by sending an EAP-Request/Identity packet. A supplicant starts the exchange with an EAPOL-Start packet, to which the authenticator responds with an EAP-Request/Identity packet.
- The supplicant responds with an EAP-Response/Identity packet to the authentication server via the authenticator.
- The authentication server responds with an EAP-Request packet to the supplicant via the authenticator.
- The supplicant responds with an EAP-Response packet containing a username and password.
- The authentication server sends either an EAP-Success packet or EAP-Reject packet to the supplicant via the authenticator.
- Upon successful authorization of the supplicant by the authentication server, the switch adds the supplicant's MAC address to the MAC address as an authorized address and begins forwarding network traffic to and from the authorized supplicant.
- When the supplicant sends an EAPOL-Logoff message, the switch removes the supplicant's MAC address from the MAC address table, preventing the supplicant from sending or receiving any further traffic from the port.

Port Roles

Part of the task to implementing this feature is specifying the roles of the ports on the switch. The roles are listed here:

- None
- Authenticator
- Supplicant

None Role

Switch ports in the none role do not participate in port-based access control. They forward traffic without authenticating the supplicants of the network devices. This is the default setting for the switch ports.

> **Note**
> A RADIUS authentication server cannot authenticate itself and must communicate with the switch through a port that is not configured as an authenticator port.

Authenticator Role

The authenticator role activates port access control on a port. Ports in this role do not forward network traffic to or from network devices until the supplicants are authenticated by a RADIUS server. The authenticator role is appropriate when you want the switch to authenticate the supplicants of network devices before they can use the network.

Supplicant Role

A switch port in the supplicant role acts as a supplicant. It has to log on by providing a valid user name and password to the device it is connected to, typically another switch port, before forwarding traffic.

Figure 193 on page 1091 illustrates the supplicant port role. Port 1.0.11 on switch B is set to the supplicant role. Whenever switch B is power cycled or reset and initiates a link with switch A, it must log on by providing a username and password, which switch A sends to the RADIUS server for validation. (You enter this information when you configure the port for the supplicant role.)

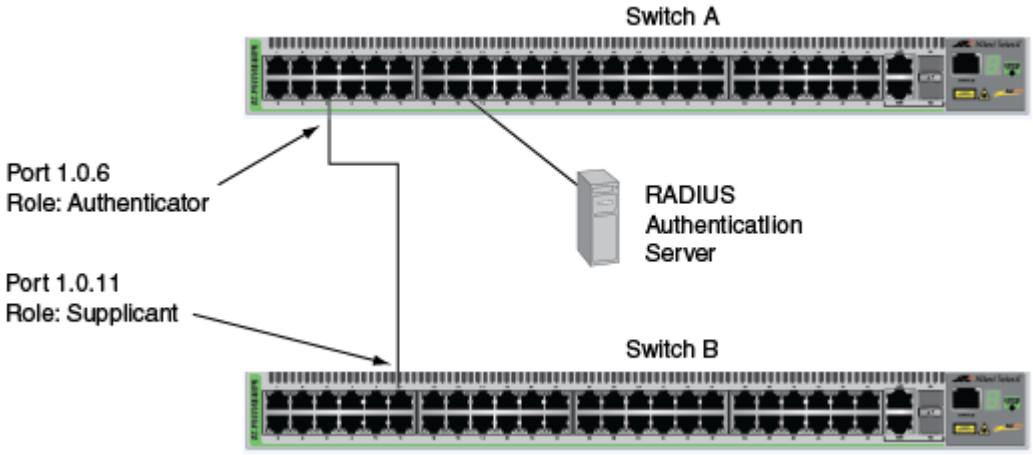

Figure 193. Example of the Supplicant Role

Authentication Methods for Authenticator Ports

Authenticator ports support two authentication methods:

- 802.1x username and password combination

  This authentication mode requires that the supplicants be assigned unique username and password combinations or digital certificates on the RADIUS server. A supplicant must provide the information either manually or automatically when initially passing traffic through an authenticator port and during reauthentications. The 802.1x client software on the supplicant either prompts the user for the necessary information or provides the information automatically.

  Assigning unique username and password combinations to your network users and requiring the users to provide the information when they initially send traffic through the switch can enhance network security by limiting network access to only those supplicants who have been assigned valid combinations. Another advantage is that the authentication is not tied to any specific computer or node. An end user can log on from any system and still be verified by the RADIUS server as a valid user of the switch and network.

  This authentication method requires 802.1x client software on the supplicant nodes.

- MAC address-based authentication

  An alternative method is to use the source MAC format as the username and password combination for the device, for example: 00-00-01-00-00-00. The supplicant is not prompted for this information. Rather, the switch extracts the source MAC address from the initial frames received from a node and automatically sends it as both the username and password of the node to the RADIUS server for authentication.

  The advantage to this approach is that the supplicant need not have 802.1x client software. The disadvantage is that because the supplicant is not prompted for a username and password combination, it does not guard against an unauthorized individual from gaining access to the network through an unattended network node or by counterfeiting a valid network MAC address.

Operational Settings for Authenticator Ports

An authenticator port can have one of three possible operational settings:

- Auto - Activates port-based authentication. The port begins in the unauthorized state, forwarding only EAPOL frames and discarding all other traffic. The authentication process begins when the link state of the port changes or the port receives an EAPOL-Start packet from a supplicant. The switch requests the identity of the supplicant and begins relaying authentication messages between the supplicant and the RADIUS authentication server. After the supplicant is validated by the RADIUS server, the port begins forwarding all traffic to and from the supplicant.
- Force-authorized - Automatically places the port in the authorized state without any authentication exchange required. The port transmits and receives normal traffic without authenticating the supplicant.
- Force-unauthorized - Causes the port to remain in the unauthorized state, ignoring all attempts by the supplicant to authenticate. The port forwards EAPOL frames, but discards all other traffic. This setting is analogous to disabling a port.

As mentioned earlier, the switch itself does not authenticate supplicants. That function is performed by the authentication server and the RADIUS server software. The switch acts as an intermediary for the authentication server by denying access to the network by the supplicant until the supplicant has been validated by the authentication server.

Operating Modes for Authenticator Ports

Authenticator ports have three modes:

- Single-host mode
- Multi-host mode
- Multi-supplicant mode

Single-Host Mode

An authenticator port set to the single-host mode permits only one supplicant to log on and forwards only the traffic of that supplicant. After one supplicant has logged on, the port discards packets from any other supplicant.

In Figure 194, port 1.0.6 is an authenticator port set to the single-host mode. It permits only one supplicant to log on and forwards the traffic of just that supplicant.

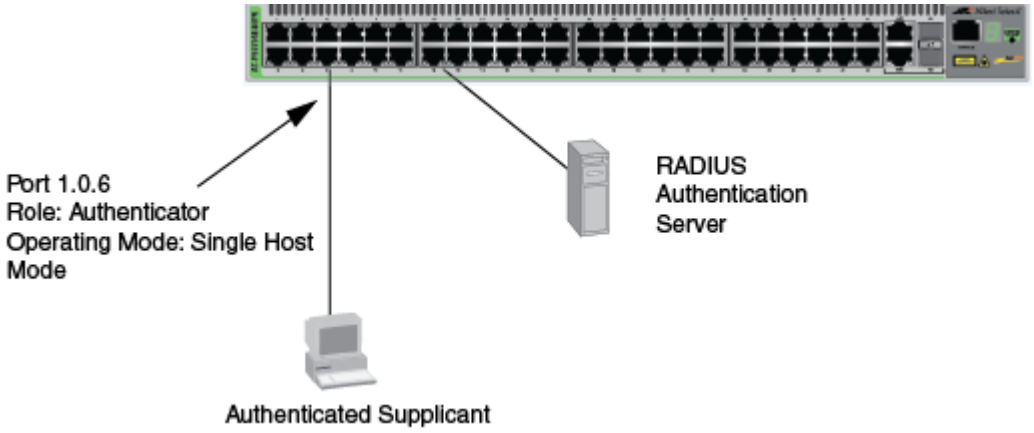

Figure 194. Single-Host Mode

Multi-Host Mode

This mode permits multiple supplicants on an authenticator port. An authenticator host forwards packets from all supplicants once one supplicant has successfully logged on. This mode is typically used in situations where you want to add 802.1x port-based network access control to a switch port that is supporting multiple supplicants, but do not want to create individual accounts for all the supplicants on the RADIUS server.

This is referred to as “piggy-backing.” After one supplicant has successfully logged on, the port permits the other supplicants to piggy-back onto the initial supplicant’s log on, so that they can forward packets through the port without being authenticated.

Note, however, that should the supplicant who performed the initial logon fail to periodically reauthenticate or log out, the authenticator port reverts to the unauthenticated state. It bars all further traffic to and from all the supplicants until the initial supplicant or another supplicant logs on.

Figure 195 is an example of this mode. Port 1.0.6 is connected to an Ethernet hub or non-802.1x compliant switch, which in turn is connected to several supplicants. The switch does not forward the supplicant traffic until one of the supplicants logs on. Afterwards, it forwards the traffic of all the supplicants.

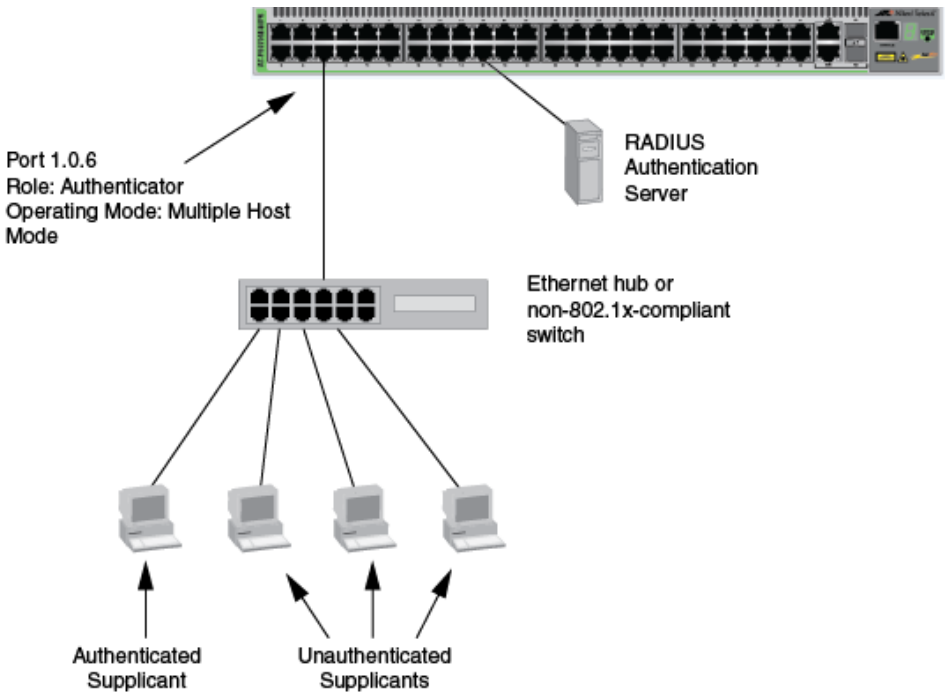

Figure 195. Multi-Host Operating Mode

If the port is configured as 802.1x Authenticator, one supplicant must have 802.1x client firmware and must provide a username and password during authentication. (The other supplicants do not need 802.1x client firmware to forward traffic through the port after one supplicant has been authenticated.)

If the port is using MAC address-based authentication, 802.1x client firmware is not required. The MAC address of the first supplicant to forward traffic through the port is used for authentication. When that supplicant is authenticated, all supplicants have access to the port.

As mentioned earlier, should the supplicant who performed the initial logon fail to reauthenticate when necessary or log out, the port reverts to the unauthenticated state, blocking all traffic to and from all supplicants. Another supplicant must be authenticated in order for all remaining supplicants to continue to forward traffic through the port.

Multi-Supplicant Mode

This mode authenticates all the supplicants on an authenticator port. This mode is appropriate in situations where an authenticator port is supporting more than one supplicant, and you want all supplicants to be authenticated. A switch can support up to a maximum of 208 supplicants.

If the authentication method is MAC address-based, the authenticator port uses the MAC addresses of the supplicants as the username and password combinations. The port accepts and forwards traffic only from those supplicants whose MAC addresses have been entered on the RADIUS server and denies access to all other users.

An example of this authenticator operating mode is illustrated in Figure 196 on page 1097. The supplicants are connected to a hub or non-802.1x compliant switch which is connected to an authenticator port on the switch. If the port is configured as 802.1x Authenticator, the supplicants must successfully authenticate before they can forward traffic through the switch.

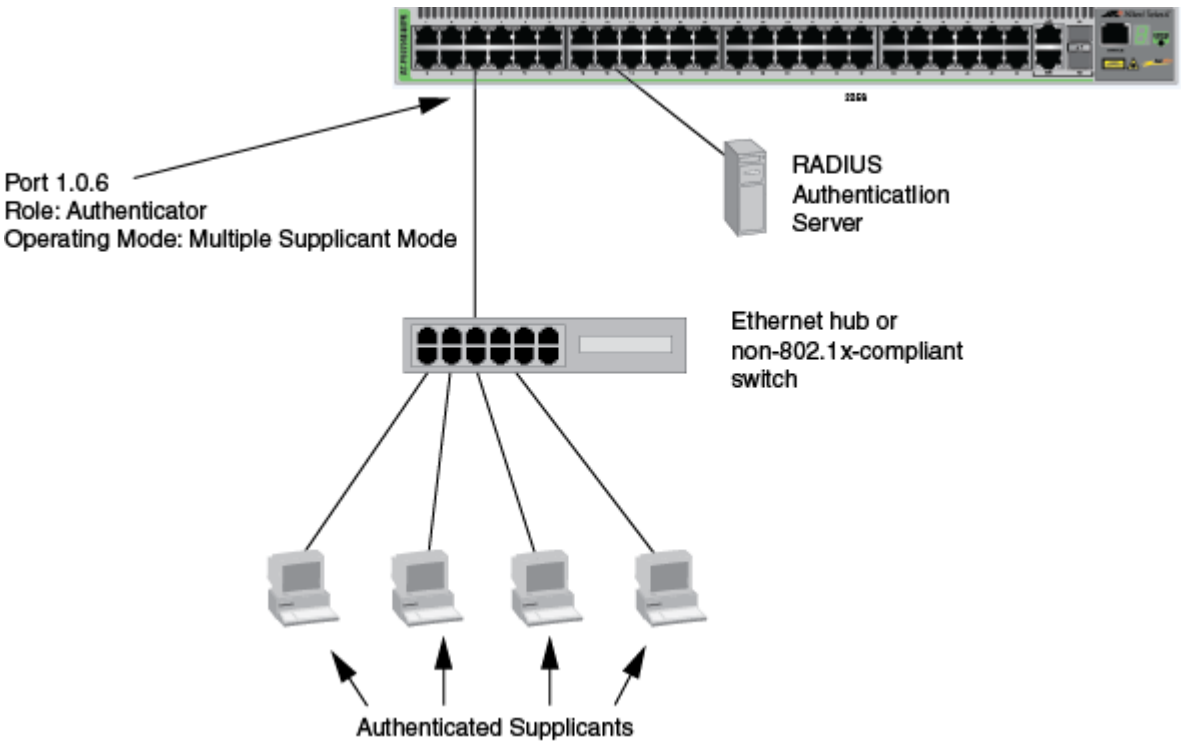

Figure 196. Multi-Supplicant Mode

Supplicant and VLAN Associations

One of the challenges to managing a network is accommodating end users who roam. These are individuals whose work requires that they access the network resources from different points at different times. The difficulty arises in providing them with access to the same network resources and, conversely, restricting them from unauthorized areas, regardless of the workstation from where they access the network. A closely related issue is where a workstation is employed at various times by different individuals with unique requirements in terms of network resources and security levels.

Providing network users with access to their network resources while also maintaining network security is often achieved through the use of VLANs. As explained in Chapter 62, “Port-based and Tagged VLANs” on page 927, a VLAN is an independent traffic domain where the traffic generated by the nodes within the VLAN is restricted to nodes of the same VLAN, unless there is a router or Layer 3 device. Different users are assigned to different VLANs depending on their resource requirements and security levels.

The problem with a port-based VLAN is that VLAN membership is determined by the port on the switch to which the device is connected. If a different device that needs to belong to a different VLAN is connected to the port, the port must be moved manually to the new VLAN using the management software.

With 802.1x port-based network access control, you can link a username and password combination or MAC address to a specific VLAN so that the switch automatically moves the port to the appropriate VLAN when a supplicant logs on. This frees the network manager from having to reconfigure VLANs as end users access the network from different points or where the same workstation is used by different individuals at different times.

To use this feature, you have to enter a VLAN identifier, along with other information, when you create a supplicant account on the RADIUS server. The server passes the identifier to the switch when a user logs on with a valid username and password combination or MAC address, depending on the authentication method. The information to provide on the RADIUS server is outlined in “Supplicant VLAN Attributes on the RADIUS Server” on page 1100.

How the switch responds when it receives VLAN information during the authentication process can differ depending on the operating mode of the authenticator port.

Single-Host Mode

Here are the operating characteristics for the switch when an authenticator port is set to the single-host mode:

- If the switch receives a valid VLAN ID from the RADIUS server, it moves the authenticator port to the designated VLAN and changes the port to the authorized state. Only the authenticated supplicant is allowed to use the port. All other supplicants are denied entry.
- If the switch receives an invalid VLAN ID from the RADIUS server (for example, the VID of a nonexistent VLAN), it leaves the port in the unauthorized state to deny access to the port.

Multi-Host Mode

Here are the operating characteristics for the switch when an authenticator port is set to the multi-host mode:

- If the switch receives a valid VLAN ID from the RADIUS server, it moves the authenticator port to the designated VLAN and changes the port to the authorized state. All supplicants are allowed access to the port and the same VLAN after the initial authentication.
- If the switch receives an invalid VLAN ID from the RADIUS server (for example, the VID of a nonexistent VLAN), it leaves the port in the unauthorized state to deny access to the port.

Multi-Supplicant Mode

The initial authentication on an authenticator port running in the multi-supplicant mode is handled in the same fashion as with the single-host mode.

In multi-supplicant mode, how the switch handles subsequent authentications on the same port depends on whether dynamic VLAN creation is in one of the following states:

Disabled - NO AUTH DYNAMIC-VLAN-CREATION

If dynamic VLAN creation is disabled by issuing NO AUTH DYNAMIC-VLAN-CREATION, all supplicants that successfully authenticate will be made part of the VLAN of which the authenticator port is a member, regardless of the VLAN ID attribute in the RADIUS server response.

Enabled for single dynamic VLAN creation - AUTH DYNAMIC-VLAN-CREATION SINGLE

If dynamic VLAN creation is enabled by issuing AUTH DYNAMIC-VLAN-CREATION SINGLE, the first supplicant is authenticated and put in its VLAN per the RADIUS server response. Additional supplicants authenticating to the same VLAN as the first authenticated supplicant will be authenticated and placed in the VLAN. However, all other supplicants authenticating to a different VLAN will be denied access.

Enabled for multi dynamic VLAN creation - AUTH DYNAMIC-VLAN-CREATION MULTI

If dynamic VLAN creation is enabled by issuing AUTH DYNAMIC-VLAN-CREATION MULTI, each supplicant that successfully authenticates will be placed in its own VLAN.

Supplicant VLAN Attributes on the RADIUS Server

The following information must be entered as part of a supplicant's account on the RADIUS server when associating a supplicant to an untagged VLAN.

- Tunnel-Type
  The protocol to be used by the tunnel specified by Tunnel-Private-Group-Id. The only supported value is VLAN (13).
- Tunnel-Medium-Type
  The transport medium to be used for the tunnel specified by Tunnel-Private-Group-Id. The only supported value is 802 (6).
- Tunnel-Private-Group-ID
  The ID of the tunnel the authenticated user should use. This must be the name of VID of the VLAN of the switch.

The following information must be entered as part of a supplicant's account on the RADIUS server when associating a supplicant to a tagged VLAN:

Egress-VLANID attribute (specified in RFC4675 - used to specify 802.1Q tagged and untagged VLAN assignments with LLDP-MED/VoiceVLAN). The only supported value is Egress-VLANID (56).

For example: Egress-VLANID := 0x3100005A represents Tagged with VLANID = 90.

Note
Only "Tagged" is supported, that is the attribute value must begin with 0x31. For untagged VLANs, use Tunnel-Private-Group-ID.

Guest VLAN

An authenticator port in the unauthorized state typically accepts and transmits only 802.1x packets while waiting to authenticate a supplicant. However, you can configure an authenticator port to be a member of a guest VLAN when no supplicant is logged on or when a supplicant has failed authentication. Any supplicant using the port is not required to log on and has full access to the resources of the guest VLAN.

If the switch receives 802.1x packets on the port, signalling that a supplicant is logging on, the authentication process continues normally. If dynamic VLAN creation is enabled using AUTH DYNAMIC-VLAN-CREATION SINGLE, the authenticator port will be moved to the VLAN assigned by the RADIUS Server. If dynamic VLAN creation is disabled using NO AUTH DYNAMIC-VLAN-CREATION, after successful authentication, the port will be moved to Default VLAN 1, or the configured native VLAN (if a VLAN is configured). When the supplicant logs off, the port automatically returns to the guest VLAN.

Note
The Guest VLAN feature is only supported on an authenticator port in the Single-host operating mode.

Guidelines

Here are the general guidelines to this feature:

- Ports operating under port-based access control do not support dynamic MAC address learning.
- A port that is connected to a RADIUS authentication server must not be set to the authenticator role because an authentication server cannot authenticate itself.
- The authentication method of an authenticator port can be either 802.1x or MAC address-based, but not both.
- A supplicant connected to an authenticator port set to the 802.1x authentication method must have 802.1x client software.
- A supplicant does not need 802.1x client software if the authentication method of an authenticator port is MAC address-based.
- The maximum number of supported supplicants on the entire switch is 208.
- An 802.1x username and password combination is not tied to the MAC address of an end node. This allows end users to use the same username and password when working at different workstations.
- After a supplicant has successfully logged on, the MAC address of the end node is added to the switch's MAC address table as an authenticated address. It remains in the table until the supplicant logs off the network or fails to reauthenticate, at which point the address is removed. The address is not timed out, even if the node becomes inactive.

Note
End users of 802.1x port-based network access control should be instructed to always log off when they are finished with a work session. This can prevent unauthorized individuals from accessing the network through unattended network workstations.

- Authenticator ports cannot use MAC address-based port security. For further information, refer to Chapter 71, "MAC Address-based Port Security" on page 1063.
- Authenticator ports cannot be members of static port trunks, LACP port trunks, or a port mirror.
- A port set to the supplicant role and connected to another port that is not set to the authenticator role will begin to forward traffic after a timeout period and without logging on.
- Authenticator ports cannot use GVRP.

- You cannot change the untagged VLAN assignment of a port after it has been designated as an authenticator port. To change the untagged VLAN assignment of an authenticator port, you must first remove the authenticator designation. You can reapply the authenticator role to the port after moving it to its new VLAN assignment. Dynamic VLANs are supported only if the native VLAN is the default (that is, 1).
- To use the Guest VLAN feature, you have to manually create the VLAN. The switch does not create it automatically.
- The switch supports EAP-MD5, EAP-TLS, EAP-TTLS, and EAP-PEAP authentication methods.
- The switch must have a management IP address to communicate with the RADIUS server. For background information, refer to Chapter 13, "IPv4 and IPv6 Management Addresses" on page 295.

Here are the guidelines to adding VLAN assignments to supplicant accounts on a RADIUS server:

- The VLAN must be an 802.1q VLAN.
- The VLAN must already exist on the switch.
- A supplicant can have only one VLAN associated with it on the RADIUS server.
- When a supplicant logs on, the switch port is moved to an untagged/tagged VLAN as per the authenticator server's response.

Enabling 802.1x Port-Based Network Access Control on the Switch

To activate 802.1x Port-based Network Access Control on the switch, go to the Global Configuration mode and enter the AAA AUTHENTICATION DOT1X DEFAUT GROUP RADIUS command. The command has no parameters. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# aaa authentication dot1x default group
radius
```

Note
You should configure the RADIUS client on the switch before activating port-based access control. For instructions, refer to Chapter 98, “RADIUS and TACACS+ Clients” on page 1509 or Chapter 99, “RADIUS and TACACS+ Client Commands” on page 1525.

Configuring Authenticator Ports

Designating Authenticator Ports

You have to designate ports as authenticator ports before you can configure their settings. There are three DOT1X PORT-CONTROL commands for designating authenticator ports.

The DOT1X PORT-CONTROL AUTO command designates ports such that they immediately begin to function as authenticator ports, blocking all traffic until supplicants successfully authenticate. This example of the command configures ports 1.0.1 and 1.0.5 to immediately commence functioning as authenticator ports.

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.5
awplus(config-if)# dot1x port-control auto
```

Caution
Using the DOT1X PORT-CONTROL AUTO command when the switch is part of a live network interrupts network operations because the designated ports stop forwarding traffic until the supplicants log on.

Designating the Authentication Methods

A port can be configured for either 802.1x authentication or MAC based authentication.

To enable 802.1x authentication, use the DOTX PORT-CONTROL AUTO command. To configure a port to the MAC address authentication method, use the AUTH-MAC ENABLE command. This example configures port 1.0.16 as an authenticator port that uses the MAC address authentication method:

```
awplus> enable
awplus# configure terminal
awplus(config)# aaa authentication auth-mac default group
radius
awplus(config)# radius-server host 176.225.15.23 key abt54
awplus(config)# interface port1.0.16
awplus(config-if)# auth-mac enable
```

If, after configuring an authenticator port for MAC address authentication, you decide to change it back to 802.1x authentication, use the NO AUTH-MAC ENABLE command and then use the DOTX PORT-CONTROL AUTO command. This example of the command restores 802.1x authentication to port 1.0.12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12
awplus(config-if)# no auth-mac enable
awplus(config-if)# dotx port-control auto
```

Configuring the Operating Modes

As explained in “Operating Modes for Authenticator Ports” on page 1094, authenticator ports have three operating modes:

- Single-host mode - For authenticator ports that are connected to a single node.
- Multi-host mode- For authenticator ports that are connected to multiple nodes. The ports forward all traffic after just one supplicant successfully logs on.
- Multi-supplicant mode - For authenticator ports that are connected to multiple nodes. The supplicants must log on individually before the ports forward their traffic.

The command for setting the operating mode is the AUTH HOST-MODE command in the Port Interface mode. The format of the command is shown here:

```
auth host-mode single-host| multi-host| multi-supplicant
```

This example configures port 1.0.1 as an authenticator port that uses the single-host mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# auth host-mode single-host
```

This example configures port 1.0.8 to use the multi-host mode so that it forwards traffic from all supplicants after just one supplicant logs on:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.8
awplus(config-if)# dot1x port-control auto
awplus(config-if)# auth host-mode multi-host
```

This example configures ports 1.0.16 to 1.0.19 to use the MAC address authentication method and the multi-supplicant mode so that the nodes are authenticated individually:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16-port1.0.19
awplus(config-if)# auth-mac enable
awplus(config-if)# auth host-mode multi-supplicant
```

Configuring Reauthentication

Table 111 lists the commands in the Port Interface mode for configuring reauthentication on authenticator ports. Reauthentication causes authenticator ports to periodically re-initiate authentication of supplicants. This is an additional security feature that protects your network by having supplicants periodically repeat the authentication process.

Table 111. Reauthentication Commands

To	Use This Command	Range
Activate reauthentication so that supplicants must periodically reauthenticate.	AUTH REAUTHENTICATION	-
Specify the time interval for reauthentication.	AUTH TIMEOUT REAUTH-PERIOD *value*	1 to 65,535 seconds
Remove reauthentication from ports.	NO AUTH REAUTHENTICATION	-

This example activates reauthentication on authenticator ports 1.0.21 and 1.0.22 so that the supplicants must reauthenticate every 2 hours (7200 seconds):

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.21,port1.0.22
awplus(config-if)# dot1x port-control auto
awplus(config-if)# auth reauthentication
awplus(config-if)# auth timeout reauth-period 7200
```

This example deactivates reauthentication on port 1.0.21:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.21
awplus(config-if)# no auth reauthentication
```

Removing Ports from the Authenticator Role

To remove ports from the authenticator role so that they forward traffic without authenticating supplicants, go to the Port Interface mode of the ports and enter the NO DOT1X PORT-CONTROL command. This example removes the authenticator role from ports 1.0.1 to 1.0.4 and 1.0.18:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1-port1.0.4,port1.0.18
awplus(config-if)# no dot1x port-control
```

Configuring Supplicant Ports

This section reviews the commands for configuring supplicant ports.

Designating Supplicant Ports

Use the DOT1X PORT-CONTROL SUPPLICANT command in the Port Interface mode to activate the supplicant role on ports. This example of the command activates the supplicant role on port 1.0.17:

Note
Before activating the supplicant role on a port, the 802.1x port-based network access control must first be enabled on the switch using the AAA AUTHENTICATION DOT1X DEFAULT GROUP RADIUS command. Refer to “Enabling 802.1x Port-Based Network Access Control on the Switch” on page 1104.

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17
awplus(config-if)# dot1x port-control supplicant
```

Configuring Supplicant Ports

Table 112 lists the commands for assigning usernames and passwords to supplicant ports. Supplicant ports must have usernames and passwords to supply to the authenticator ports to which they are connected.

Table 112. Username and Password Commands for Supplicant Ports

To Do This Task	Use This Command	Range
Assign usernames to supplicant ports.	DOT1X SUPPLICANT-PARAMS USERNAME *username*	1 to 16 alphanumeric characters (A to Z, a to z, 1 to 9)
Assign passwords to supplicant ports.	DOT1X SUPPLICANT-PARAMS PASSWORD *password*	1 to 16 alphanumeric characters (A to Z, a to z, 1 to 9

This example of the commands configures port 1.0.15 as a supplicant port and assigns it the username srv12a and password Art78:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# dot1x port-control supplicant
awplus(config-if)# dot1x supplicant-params username srv12a
awplus(config-if)# dot1x supplicant-params password Art78
```

Note
Ports have to be set to the supplicant mode with the DOT1X PORT-CONTROL SUPPLICANT command before you can set the supplicant parameters.

Table 113 lists the additional supplicant port parameters.

Table 113. Commands for Supplicant Port Parameters

To Do This Task	Use This Command	Range
Specify authentication timeout period, which defines the time period in seconds that supplicant ports wait for replies from authenticators after sending EAP-Response frames.	DOT1X SUPPLICANT-PARAMS AUTH-PERIOD *value*	1 to 300 seconds. Default value is 30 seconds.
Specify the held timeout period, which defines the amount of time in seconds a supplicant waits to re-authenticate after an authentication attempt has failed.	DOT1X SUPPLICANT-PARAMS HELD-PERIOD *value*	0 to 65,535 seconds. Default value is 60 seconds.
Specify the maximum number of times a supplicant tries to contact an authenticator.	DOT1X SUPPLICANT-PARAMS MAX-START *value*	1 to 10. Default value is 3.

This example configures supplicant port 1.0.2 as follows:

- Username: sw2a
- Password: agt14
- Authentication timeout period: 20 seconds
- Held timeout period: 120 seconds
- Maximum starts: 5

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# dot1x port-control supplicant
awplus(config-if)# dot1x supplicant-params username sw2a
awplus(config-if)# dot1x supplicant-params password agt14
awplus(config-if)# dot1x supplicant-params auth-period 20
awplus(config-if)# dot1x supplicant-params held-period 120
awplus(config-if)# dot1x supplicant-params max-start 5
```

Note
The management software does not have a separate SHOW command for displaying the settings of supplicant ports. Instead, use “SHOW RUNNING-CONFIG INTERFACE” on page 242.

Removing Ports from the Supplicant Role

The command for removing ports from the supplicant role and returning them to the none role is the NO DOT1X PORT-CONTROL SUPPLICANT command in the Port Interface mode. This example of the command returns ports 1.0.4 and 1.0.5 to the none role from the supplicant role:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4,port1.0.5
awplus(config-if)# no dot1x port-control supplicant
```

Note
Ports lose their supplicant parameter settings when returned to the none role.

Disabling 802.1x Port-Based Network Access Control on the Switch

To disable 802.1x port-based network access control on the switch so that the ports forward packets without authentication, go to the Global Configuration mode and enter the NO AAA AUTHENTICATION DOT1X DEFAULT GROUP RADIUS command. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# no aaa authentication dot1x default group
radius
```

Note
The switch retains the configuration settings of the authenticator and supplicant ports when 802.1x port-based network access control is deactivated. Authenticator ports will also not forward traffic of connected hosts until the dot1x interface configuration has also been negated.

Displaying Authenticator Ports

To view the settings of authenticator ports on the switch, use the SHOW DOT1X INTERFACE command in the Privileged Exec mode. This example displays the authenticator settings for port 1.0.2:

```
awplus# show dot1x interface port1.0.2
```

Figure 197 is an example of what you will see.

```
Authentication Info for interface port1.0.1
   portEnabled: Enabled - portControl: Auto
   portStatus: DOWN
   reAuthenticate: Disabled
   reAuthPeriod: 3600
   PAE: quietPeriod: 60 - maxReauthReq: 2 - txPeriod: 30
   BE: suppTimeout: 30 - serverTimeout: 30
   CD: adminControlledDirections: in
   criticalVlan: Disabled
   guestVlan: Disabled
   dynamicVlanCreation: Multi-VLAN
   hostMode: Multi-Supplicant
   dot1x: Disabled
   protocolVersion: 1
   authMac: Disabled
   reAuthRelearning: Disabled
```

Figure 197. SHOW DOT1X INTERFACE Command

Displaying EAP Packet Statistics

To display EAP packet statistics of authenticator ports, use the SHOW DOT1X STATISTICS INTERFACE command. Here is an example of the information. This example displays the authenticator settings for port 1.0.2:

```
awplus> enable
awplus# show dot1x statistics interface port1.0.2
```

```
Authentication Statistics for interface port1.0.2
   EAPOL Frames Rx: 0 - EAPOL Frames Tx: 0
   EAPOL Start Frames Rx: 0 - EAPOL Logoff Frames Rx: 0
   EAP Rsp/Id Frames Rx: 0 - EAP Response Frames Rx: 0
   EAP Req/Id Frames Tx: 0 - EAP Request Frames Tx: 0
   Invalid EAPOL Frames Rx: 0 - EAP Length Error Frames Rx: 0
   EAPOL Last Frame Version Rx: 0 - EAPOL Last Frame Src: 0000.0000.0000
```

Figure 198. SHOW DOT1X STATISTICS INTERFACE Command

Chapter 74

802.1x Port-based Network Access Control Commands

The 802.1x port-based network access control commands are summarized in Table 114 and described in detail within the chapter.

Table 114. 802.1x Port-based Network Access Control Commands

Command	Mode	Description
“AAA AUTHENTICATION DOT1X DEFAULT GROUP RADIUS” on page 1121	Global Configuration	Activates 802.1x port-based network access control on the switch.
“AUTH DYNAMIC-VLAN-CREATION” on page 1122	Port Interface	Configures the ports to accept dynamic VLAN allocation.
“AUTH GUEST-VLAN” on page 1124	Port Interface	Enables and configures the Guest VLAN feature on an authenticator port.
“AUTH HOST-MODE” on page 1125	Port Interface	Sets the operating modes on authenticator ports.
“AUTH REAUTHENTICATION” on page 1127	Port Interface	Activates reauthentication on the authenticator ports.
“AUTH TIMEOUT QUIET-PERIOD” on page 1128	Port Interface	Sets the number of seconds that authenticator ports wait after a failed authentication before accepting authentication requests again.
“AUTH TIMEOUT REAUTH-PERIOD” on page 1129	Port Interface	Specifies the time interval for reauthentication of supplicants on an authenticator port.
“AUTH TIMEOUT SERVER-TIMEOUT” on page 1130	Port Interface	Sets the length of time the switch waits for a response from the authentication server.
“AUTH TIMEOUT SUPP-TIMEOUT” on page 1131	Port Interface	Sets the wait time in seconds for a response from a supplicant after a request has been sent.
“AUTH-MAC ENABLE” on page 1132	Port Interface	Activates MAC address-based authentication on authenticator ports.

Table 114. 802.1x Port-based Network Access Control Commands (Continued)

Command	Mode	Description
“AUTH-MAC REAUTH-RELEARNING” on page 1133	Port Interface	Sets the MAC address learning of the supplicant (client device) to relearning for re-authentication on the interface specified in the Interface command mode.
“DOT1X CONTROL-DIRECTION” on page 1134	Port Interface	Sets the direction of the filter for the unauthorized interface.
“DOT1X EAP” on page 1136	Global Configuration	Controls the action of the switch to EAP packets when 802.1x authentication is disabled on the switch.
“DOT1X INITIALIZE INTERFACE” on page 1138	Port Interface	Forces authenticator ports into the unauthorized state and initializes authentication.
“DOT1X MAX-REAUTH-REQ” on page 1139	Port Interface	Specifies the maximum number of times authenticator ports transmit EAP Request packets to supplicants before timing out authentication sessions.
“DOT1X PORT-CONTROL AUTO” on page 1140	Port Interface	Sets ports to the authenticator role.
“DOT1X PORT-CONTROL FORCE-AUTHORIZED” on page 1141	Port Interface	Configures ports to the 802.1x port-based authenticator role in the forced-authorized state.
“DOT1X PORT-CONTROL FORCE-UNAUTHORIZED” on page 1142	Port Interface	Configures ports to the 802.1x port-based authenticator role in the forced-unauthorized state.
“DOT1X PORT-CONTROL SUPPLICANT” on page 1143	Port Interface	Designates ports as supplicant ports.
“DOT1X SUPPLICANT-PARAMS AUTH-PERIOD” on page 1144	Port Interface	Specifies the time period in seconds that supplicant ports wait for replies from authenticators after sending EAP-Response frames.
“DOT1X SUPPLICANT-PARAMS HELD-PERIOD” on page 1145	Port Interface	Specifies the amount of time in seconds a supplicant waits to re-authenticate after an authentication attempt has failed.

Table 114. 802.1x Port-based Network Access Control Commands (Continued)

Command	Mode	Description
"DOT1X SUPPLICANT-PARAMS MAX-START" on page 1146	Port Interface	Specifies the maximum number of times a supplicant sends EAPOL-Start frames before assuming that there is no authenticator present.
"DOT1X SUPPLICANT-PARAMS PASSWORD" on page 1147	Port Interface	Assigns a password to a supplicant port.
"DOT1X SUPPLICANT-PARAMS USERNAME" on page 1148	Port Interface	Assigns a username to a supplicant port.
"DOT1X TIMEOUT TX-PERIOD" on page 1149	Port Interface	Sets the amount of time the switch waits for a reply from a supplicant to an EAP-request/identity frame.
"NO AAA AUTHENTICATION DOT1X DEFAULT GROUP RADIUS" on page 1150	Global Configuration	Disables 802.1x port-based network access control on the switch.
"NO AUTH DYNAMIC-VLAN-CREATION" on page 1151	Port Interface	Disables dynamic VLAN assignments of authenticator ports.
"NO AUTH GUEST-VLAN" on page 1152	Port Interface	Disables the Guest VLAN feature on an authenticator port.
"NO AUTH REAUTHENTICATION" on page 1153	Port Interface	Removes reauthentication from authenticator ports.
"NO AUTH-MAC ENABLE" on page 1154	Port Interface	Deactivates MAC address-based authentication on authenticator ports.
"NO DOT1X PORT-CONTROL" on page 1155	Port Interface	Removes ports from the authenticator role.
"NO DOT1X PORT-CONTROL SUPPLICANT" on page 1156	Port Interface	Removes ports from the supplicant role.
"SHOW AUTH-MAC INTERFACE" on page 1157	Privileged Exec	Displays the parameter settings of authenticator ports.
"SHOW AUTH-MAC SESSIONSTATISTICS INTERFACE" on page 1158	Privileged Exec	Displays the session status of the authenticator ports.
"SHOW AUTH-MAC STATISTICS INTERFACE" on page 1159	Privileged Exec	Displays the authentication statistics of authenticator ports.
"SHOW AUTH-MAC SUPPLICANT INTERFACE" on page 1160	Privileged Exec	Displays the supplicant state on authenticator ports.

Table 114. 802.1x Port-based Network Access Control Commands (Continued)

Command	Mode	Description
“SHOW DOT1X” on page 1161	Privileged Exec	Displays whether 802.1x port-based network access control is enabled or disabled on the switch and the IP address of the RADIUS server.
“SHOW DOT1X INTERFACE” on page 1162	Privileged Exec	Displays the parameter settings of authenticator ports.
“SHOW DOT1X STATISTICS INTERFACE” on page 1163	Privileged Exec	Displays EAP packet statistics on authenticator ports.
“SHOW DOT1X SUPPLICANT INTERFACE” on page 1164	Privileged Exec	Displays the supplicant state on authenticator ports.

AAA AUTHENTICATION DOT1X DEFAULT GROUP RADIUS

Syntax

```
aaa authentication dot1x default group radius
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate 802.1x port-based network access control on the switch. The default setting for this feature is disabled.

Note
You should activate and configure the RADIUS client software on the switch before activating port-based access control. For instructions, refer to Chapter 98, "RADIUS and TACACS+ Clients" on page 1509 or Chapter 99, "RADIUS and TACACS+ Client Commands" on page 1525.

Confirmation Command

"SHOW DOT1X" on page 1161

Example

This example activates 802.1x port-based network access control on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# aaa authentication dot1x default group
radius
```

AUTH DYNAMIC-VLAN-CREATION

Syntax

```
auth dynamic-vlan-creation single| multi
```

Parameters

single
: Single dynamic VLAN.

multi
: Multiple dynamic VLAN.

Mode

Port Interface mode

Description

Use this command to dynamically assign a supplicant to a VLAN as instructed by the RADIUS Server.

Use the NO AUTH DYNAMIC-VLAN-CREATION to disable this feature (refer to “NO AUTH DYNAMIC-VLAN-CREATION” on page 1151).

Confirmation Command

“SHOW AUTH-MAC INTERFACE” on page 1157 or “SHOW DOT1X INTERFACE” on page 1162

Examples

This example activates single dynamic VLAN assignment on authenticator port 1.0.18. When the initial supplicant logs on, the switch moves the port to the VLAN specified in the supplicant’s account on the RADIUS server.

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.18
awplus(config-if)# dot1x port-control auto
awplus(config-if)# auth dynamic-vlan-creation single
```

This example activates multiple dynamic VLAN assignment on authenticator port 1.0.4.

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4
awplus(config-if)# dot1x port-control auto
awplus(config-if)# auth dynamic-vlan-creation multiple
```

AUTH GUEST-VLAN

Syntax

```
auth guest-vlan vid
```

Parameters

vid

Specifies the ID number of a VLAN that is the guest VLAN of an authenticator port. You can enter just one VID.

Mode

Port Interface mode

Description

Use this command to specify the VID of the VLAN that acts as the guest VLAN of an authenticator port. An authenticator port remains in a guest VLAN until a supplicant successfully logs on, at which point, it is moved to a configured VLAN; or if the dynamic VLAN setting is enabled, it will be moved to the VLAN specified in a supplicant's account on the RADIUS server.

A port must already be designated as an authenticator port before you can use this command.

To remove the VID of a guest VLAN from an authenticator port, refer to "NO AUTH GUEST-VLAN" on page 1152.

Example

This example designates ports 1.0.1 to 1.0.4 as authenticator ports and specifies VID 12 as the guest VLAN:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1-port1.0.4
awplus(config-if)# dot1x port-control auto
awplus(config-if)# auth guest-vlan 12
```

AUTH HOST-MODE

Syntax

```
auth host-mode single-host| multi-host| multi-supplicant
```

Parameters

single-host
: Specifies the single-host operating mode. An authenticator port set to this mode forwards packets only from the one supplicant who initially logs on. This is the default setting.

multi-host
: Specifies the multi-host operating mode. An authenticator port set to this mode forwards all packets after one supplicant logs on. This is referred to as piggy-backing.

multi-supplicant
: Specifies the multi-supplicant operating mode. An authenticator port set to this mode requires that all supplicants log on.

Mode

Port Interface mode

Description

Use this command to set the operating modes on authenticator ports. For background information, refer to "Operating Modes for Authenticator Ports" on page 1094.

Confirmation Command

"SHOW AUTH-MAC INTERFACE" on page 1157 or "SHOW DOT1X INTERFACE" on page 1162

Examples

This example configures authenticator ports 1.0.4 and 1.0.6 to the single-host operating mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4,port1.0.6
awplus(config-if)# auth host-mode single-host
```

This example configures authenticator port 1.0.8 to the multi-host operating mode, so that networks users can use the port after just one user logs on:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.8
awplus(config-if)# auth host-mode multi-host
```

This example configures authenticator ports 1.0.12 and 1.0.13 to the multi-supplicant operating mode, which requires that all networks users on the ports log on:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12,port1.0.13
awplus(config-if)# auth host-mode multi-supplicant
```

AUTH REAUTHENTICATION

Syntax

```
auth reauthentication
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to activate reauthentication on the authenticator ports. The supplicants must periodically reauthenticate according to the time interval set with "AUTH TIMEOUT REAUTH-PERIOD" on page 1129.

Confirmation Command

"SHOW AUTH-MAC INTERFACE" on page 1157 or "SHOW DOT1X INTERFACE" on page 1162

Example

This example activates reauthentication on ports 1.0.21 and 1.0.22:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.21,port1.0.22
awplus(config-if)# auth reauthentication
```

AUTH TIMEOUT QUIET-PERIOD

Syntax

```
auth timeout quiet-period value
```

Parameters

quiet-period
: Sets the number of seconds that an authenticator port remains in the quiet state following a failed authentication exchange with a supplicant. The range is 1 to 65,535 seconds. The default value is 60 seconds.

Mode

Port Interface mode

Description

Use this command to set the number of seconds that an authenticator port waits after a failed authentication with a supplicant before accepting authentication requests again.

Confirmation Command

“SHOW AUTH-MAC INTERFACE” on page 1157 or “SHOW DOT1X INTERFACE” on page 1162

Example

This example sets the quiet period to 20 seconds on authenticator port 1.0.19:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.19
awplus(config-if)# auth timeout quiet-period 20
```

AUTH TIMEOUT REAUTH-PERIOD

Syntax

```
auth timeout reauth-period value
```

Parameters

reauth-period
: Specifies the time interval that an authenticator port requires a supplicant to reauthenticate. The range is 1 to 65,535 seconds. The default value is 3600 seconds.

Mode

Port Interface mode

Description

Use this command to specify the time interval for reauthentication of supplicants on an authenticator port. Reauthentication must be enabled on an authenticator port for the timer to work. Reauthentication on a port is activated with "AUTH REAUTHENTICATION" on page 1127.

Confirmation Command

"SHOW AUTH-MAC INTERFACE" on page 1157 or "SHOW DOT1X INTERFACE" on page 1162

Example

This example activates reauthentication on port 1.0.16 and sets the reauthentication interval to 12 hours:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16
awplus(config-if)# auth reauthentication
awplus(config-if)# auth timeout reauth-period 43200
```

AUTH TIMEOUT SERVER-TIMEOUT

Syntax

```
auth timeout server-timeout value
```

Parameters

server-timeout
: Sets the timer used by the switch to determine authentication server timeout conditions. The range is 1 to 65535 seconds. The default value is 30 seconds.

Mode

Port Interface mode

Description

Use this command to set the amount of time the switch waits for a response from a RADIUS authentication server.

Confirmation Command

“SHOW AUTH-MAC INTERFACE” on page 1157 or “SHOW DOT1X INTERFACE” on page 1162

Example

This example sets the timer on port 1.0.21 to 15 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.21
awplus(config-if)# auth timeout server-timeout 15
```

AUTH TIMEOUT SUPP-TIMEOUT

Syntax

```
auth timeout supp-timeout value
```

Parameters

supp-timeout
: Sets the switch-to-supplicant retransmission time for EAP-request frames. The range is 1 to 65,535 seconds. The default value is 30 seconds.

Mode

Port Interface mode

Description

Use this command to set the retransmission time for EAP-request frames from authenticator ports.

Confirmation Command

"SHOW AUTH-MAC INTERFACE" on page 1157 or "SHOW DOT1X INTERFACE" on page 1162

Example

This example sets the retransmission time for EAP-request frames on authenticator ports 1.0.3 and 1.0.4 to 120 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.3,port1.0.4
awplus(config-if)# auth timeout supp-timeout 120
```

AUTH-MAC ENABLE

Syntax

```
auth-mac enable
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to activate MAC address-based authentication on authenticator ports. An authenticator port that uses this type of authentication extracts the source MAC address from the initial frames from a supplicant and automatically sends it as the supplicant's username and password to the authentication server. This authentication method does not require 802.1x client software on supplicant nodes.

Confirmation Command

"SHOW AUTH-MAC INTERFACE" on page 1157

"SHOW DOT1X INTERFACE" on page 1162

Example

This example activates MAC address-based authentication on ports 1.0.15 and 1.0.18:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15,port1.0.18
awplus(config-if)# auth-mac enable
```

AUTH-MAC REAUTH-RELEARNING

Syntax

```
auth-mac reauth-relearning
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to set the MAC address of the supplicant (client device) to re-learning for re-authentication on the interface specified in the INTERFACE command.

Example

This example sets the MAC address of the supplicant to re-learning for re-authentication on port 1.0.23:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.23
awplus(config-if)# auth-mac reauth-relearning
```

DOT1X CONTROL-DIRECTION

Syntax

```
dot1x control-direction in|both
```

Parameters

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 value.

Mode

Port Interface mode

Description

This command sets the direction of the filter for the unauthorized interface.

If the **in** parameter is specified with this command, packets entering the specified port are discarded. The **in** parameter discards the ingress packets received from the supplicant.

If the **both** parameter is specified with this command, 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.

Confirmation Command

“SHOW AUTH-MAC INTERFACE” on page 1157

“SHOW DOT1X INTERFACE” on page 1162

Examples

This example sets the port direction to the default (both) for port 1.0.2:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# dot1x control-direction both
```

This example sets the port direction to **in** for port 1.0.2:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# dot1x control-direction in
```

DOT1X EAP

Syntax

`dot1x eap` *`discard`*| *`forward`*| *`forward-untagged-vlan`*| *`forward-vlan`*

Parameters

discard
: Discards all ingress EAP packets on all ports.

forward
: Forwards ingress EAP packets across all VLANs and ports.

forward-untagged-vlan
: Forwards ingress EAP packets only to untagged ports in the same VLAN as the ingress port.

forward-vlan
: Forwards ingress EAP packets to tagged and untagged ports in the same VLAN as the ingress port.

Mode

Global Configuration mode

Description

Use this command to control the action of the switch to EAP packets when 802.1x authentication is disabled on the switch.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

This example configures the switch to forward all EAP packets when 802.1x authentication is disabled:

```
awplus> enable
awplus# configure terminal
awplus(config)# dot1x eap forward
```

This example configures the switch to discard all EAP packets when 802.1x authentication is disabled:

```
awplus> enable
awplus# configure terminal
awplus(config)# dot1x eap discard
```

This example configures the switch to forward EAP packets only to untagged ports in the VLANs of the ingress ports:

```
awplus> enable
awplus# configure terminal
awplus(config)# dot1x eap forward-untagged-vlan
```

DOT1X INITIALIZE INTERFACE

Syntax

```
dot1x initialize interface port
```

Parameters

port
Specifies a port. You can enter more than one port.

Mode

Privileged Exec mode

Description

Use this command to force authenticator ports into the unauthorized state. You might use this command to force supplicants on authenticator ports to reauthenticate themselves again by logging in with their usernames and passwords.

Example

This example forces authenticator ports 1.0.16 and 1.0.22 into the unauthorized state so that the supplicants must log on again:

```
awplus> enable
awplus# dot1x initialize interface port1.0.16,port1.0.22
```

DOT1X MAX-REAUTH-REQ

Syntax

```
dot1x max-reauth-req value
```

Parameters

max-reauth-req

Specifies the maximum number of times the switch retransmits EAP Request packets to a supplicant before it times out an authentication session. The range is 1 to 10 retransmissions. The default value is 2.

Mode

Port Interface mode

Description

Use this command to specify the maximum number of times the switch transmits EAP Request packets to a supplicant before it times out the authentication session.

Confirmation Command

"SHOW AUTH-MAC INTERFACE" on page 1157 or "SHOW DOT1X INTERFACE" on page 1162

Example

This example sets the maximum number of requests on ports 1.0.7 and 1.0.22 to 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.7,port1.0.22
awplus(config-if)# dot1x max-reauth-req 4
```

DOT1X PORT-CONTROL AUTO

Syntax

```
dot1x port-control auto
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to set the ports to the 802.1x port-based authenticator role. Ports begin in the unauthorized state, forwarding only EAPOL frames, until a supplicant has successfully logged on. For background information, refer to “Operational Settings for Authenticator Ports” on page 1093.

Confirmation Command

“SHOW AUTH-MAC INTERFACE” on page 1157 or “SHOW DOT1X INTERFACE” on page 1162

Example

This example sets ports 1.0.7 to 1.0.10 to the authenticator role:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.7-port1.0.10
awplus(config-if)# dot1x port-control auto
```

DOT1X PORT-CONTROL FORCE-AUTHORIZED

Syntax

```
dot1x port-control force-authorized
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to configure ports to the 802.1x authenticator role, in the force-authorized state. Ports that are set to the force-authorized state transition to the authorized state without any authentication exchanges required. The ports transmit and receive traffic normally without 802.1x based authentication of the supplicants. For background information, refer to "Operational Settings for Authenticator Ports" on page 1093.

Confirmation Command

"SHOW AUTH-MAC INTERFACE" on page 1157 or "SHOW DOT1X INTERFACE" on page 1162

Example

This example sets ports 1.0.1 and 1.0.4 to the authenticator role, in the force-authorized state:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1,port1.0.4
awplus(config-if)# dot1x port-control force-authorized
```

DOT1X PORT-CONTROL FORCE-UNAUTHORIZED

Syntax

```
dot1x port-control force-unauthorized
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to configure the ports to the 802.1x authenticator role, in the unauthorized state. Although the ports are in the authenticator role, the switch blocks all traffic on the ports. For background information, refer to “Operational Settings for Authenticator Ports” on page 1093.

Confirmation Command

“SHOW AUTH-MAC INTERFACE” on page 1157 or “SHOW DOT1X INTERFACE” on page 1162

Example

This example sets ports 1.0.7 and 1.0.24 to the authenticator role, in the force-unauthorized state:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.7,port1.0.24
awplus(config-if)# dot1x port-control force-unauthorized
```

DOT1X PORT-CONTROL SUPPLICANT

Syntax

```
dot1x port-control supplicant
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to set the ports to the 802.1x port-based supplicant role.

Before setting a port to the 802.1x port-based supplicant role, port-based network access control must first be enabled on the switch using the AAA AUTHENTICATION DOT1X DEFAULT GROUP RADIUS command. Refer to "AAA AUTHENTICATION DOT1X DEFAULT GROUP RADIUS" on page 1121.

Confirmation Command

"SHOW RUNNING-CONFIG INTERFACE" on page 242

Example

This example sets ports 1.0.11, 1.0.15, and 1.0.19 to the supplicant role:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11,port1.0.15,port1.0.19
awplus(config-if)# dot1x port-control supplicant
```

DOT1X SUPPLICANT-PARAMS AUTH-PERIOD

Syntax

```
dot1x supplicant-params auth-period value
```

Parameters

value

Specifies the authentication timeout period for supplicant ports. The range is 1 to 300 seconds. The default is 30 seconds.

Mode

Port Interface mode

Description

Use this command to specify the time period in seconds that supplicant ports wait for replies from authenticators after sending EAP-Response frames. The range is 1 to 300 seconds.

Confirmation Command

“SHOW RUNNING-CONFIG INTERFACE” on page 242

Example

This example sets the authentication timeout period on supplicant ports 1.0.4 and 1.0.5 to 80 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4,port1.0.5
awplus(config-if)# dot1x supplicant-params auth-period 80
```

DOT1X SUPPLICANT-PARAMS HELD-PERIOD

Syntax

```
dot1x supplicant-params held-period value
```

Parameters

value

Specifies the held timeout period in seconds for supplicant ports. The range is 0 to 65,535 seconds. The default value is 60 seconds.

Mode

Port Interface mode

Description

Specifies the amount of time in seconds a supplicant waits to re-authenticate after an authentication attempt has failed. A supplicant can attempt to log on again after the time period has expired.

Confirmation Command

"SHOW RUNNING-CONFIG INTERFACE" on page 242

Example

This example sets the held timeout period on supplicant ports 1.0.7 and 1.0.8 to 90 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.7,port1.0.8
awplus(config-if)# dot1x supplicant-params held-period 90
```

DOT1X SUPPLICANT-PARAMS MAX-START

Syntax

```
dot1x supplicant-params max-start value
```

Parameters

value
: Specifies the maximum number of tries by a supplicant to contact an authenticator. The range is 1 to 10. The default is 3.

Mode

Port Interface mode

Description

Use this command to specify the maximum number of times a supplicant sends EAPOL-Start frames before assuming that there is no authenticator present. The range is 1 to 10. The default is 3.

Confirmation Command

“SHOW RUNNING-CONFIG INTERFACE” on page 242

Example

This example sets the maximum number of attempts on supplicant port 1.0.12 to 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12
awplus(config-if)# dot1x supplicant-params max-start 4
```

DOT1X SUPPLICANT-PARAMS PASSWORD

Syntax

```
dot1x supplicant-params password value
```

Parameters

value

Assigns passwords to supplicant ports. A password can be from 1 to 16 alphanumeric characters (A to Z, a to z, 1 to 9). Do not use spaces or special characters, such as asterisks or exclamation points. The password is case-sensitive.

Mode

Port Interface mode

Description

Use this command to assign passwords to supplicant ports. A supplicant port sends its password to an authenticator for verification when it logs on to the network. You may assign the same password to more than one supplicant port.

The switch uses the EAP-MD5 authentication method when a port is configured as a supplicant.

Confirmation Command

"SHOW RUNNING-CONFIG INTERFACE" on page 242

Example

This example sets the password to "25tip98" on supplicant port 1.0.2:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# dot1x supplicant-params password 25tip98
```

DOT1X SUPPLICANT-PARAMS USERNAME

Syntax

```
dot1x supplicant-params username username
```

Parameters

username
: Assigns usernames to supplicant ports. A username can be from 1 to 16 alphanumeric characters (A to Z, a to z, 1 to 9). Do not use spaces or special characters, such as asterisks or exclamation points. The username is case-sensitive.

Mode

Port Interface mode

Description

Use this command to assign a username to a supplicant port. A supplicant port sends its username to an authenticator for verification when it logs on to the network. You may assign the same username to more than one supplicant port.

The switch uses the EAP-MD5 authentication method when a port is configured as a supplicant.

Confirmation Command

“SHOW RUNNING-CONFIG INTERFACE” on page 242

Example

This example assigns the username “JSmith12” to supplicant port 1.0.15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# dot1x supplicant-params username JSmith12
```

DOT1X TIMEOUT TX-PERIOD

Syntax

```
dot1x timeout tx-period value
```

Parameters

value

Sets the number of seconds an authenticator port waits for a response to an EAP-request/identity frame from a supplicant before retransmitting the request. The default value is 30 seconds. The range is 1 to 65,535 seconds.

Mode

Port Interface mode

Description

Use this command to set the amount of time that an authenticator port on the switch waits for a reply from a supplicant to an EAP-request/identity frame. If no reply is received, it retransmits the frame.

Confirmation Command

"SHOW AUTH-MAC INTERFACE" on page 1157 or "SHOW DOT1X INTERFACE" on page 1162

Example

This example sets the timeout period on authenticator ports 1.0.15 and 1.0.19 to 40 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15,port1.0.19
awplus(config-if)# dot1x timeout tx-period 40
```

NO AAA AUTHENTICATION DOT1X DEFAULT GROUP RADIUS

Syntax

```
no aaa authentication dot1x default group radius
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable 802.1x port-based network access control on the switch. All ports forward packets without any authentication. This is the default setting.

Confirmation Command

“SHOW DOT1X” on page 1161

Example

This example disables 802.1x port-based network access control on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no aaa authentication dot1x default group
radius
```

NO AUTH DYNAMIC-VLAN-CREATION

Syntax

```
no auth dynamic-vlan-creation
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to disable dynamic VLAN assignments of authentication ports. For background information, refer to "Supplicant and VLAN Associations" on page 1098.

Confirmation Command

"SHOW AUTH-MAC INTERFACE" on page 1157

"SHOW DOT1X INTERFACE" on page 1162

Example

This example disables dynamic VLAN assignment of authenticator port 1.0.15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# no auth dynamic-vlan-creation
```

NO AUTH GUEST-VLAN

Syntax

```
no auth guest-vlan
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to disable the Guest VLAN feature on an authenticator port.

Confirmation Command

“SHOW AUTH-MAC INTERFACE” on page 1157

“SHOW DOT1X INTERFACE” on page 1162

Example

This example removes the guest VLAN from ports 1.0.23 and 1.0.24:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.23,port1.0.24
awplus(config-if)# no auth guest-vlan
```

NO AUTH REAUTHENTICATION

Syntax

```
no auth reauthentication
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to remove reauthentication from authenticator ports so that supplicants do not have to periodically reauthenticate after the initial authentication. Reauthentication is still required if there is a change to the status of the link between a supplicant and the switch, or the switch is reset or power cycled.

Confirmation Command

"SHOW AUTH-MAC INTERFACE" on page 1157

"SHOW DOT1X INTERFACE" on page 1162

Example

This example deactivates reauthentication on port 1.0.2:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no auth reauthentication
```

NO AUTH-MAC ENABLE

Syntax

```
no auth-mac enable
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to deactivate MAC address-based authentication on authenticator ports.

Confirmation Command

“SHOW DOT1X SUPPLICANT INTERFACE” on page 1164

Example

This example removes MAC address-based authentication from port 1.0.23:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.23
awplus(config-if)# no auth-mac enable
```

NO DOT1X PORT-CONTROL

Syntax

```
no dot1x port-control
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to remove ports from the authenticator role so that they forward traffic without authentication.

Confirmation Command

"SHOW AUTH-MAC INTERFACE" on page 1157 or "SHOW DOT1X INTERFACE" on page 1162

Example

This example removes port 1.0.14 from the authenticator role:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.14
awplus(config-if)# no dot1x port-control
```

NO DOT1X PORT-CONTROL SUPPLICANT

Syntax

```
no dot1x port-control supplicant
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to remove ports from the 802.1x port-based supplicant role.

Confirmation Command

“SHOW RUNNING-CONFIG INTERFACE” on page 242

Example

This example removes ports 1.0.8 and 1.0.22 from the supplicant role:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.8,port1.0.22
awplus(config-if)# no dot1x port-control supplicant
```

SHOW AUTH-MAC INTERFACE

Syntax

```
show auth-mac interface port
```

Parameters

port

Specifies a port. You can display more than one port at a time.

Modes

Privileged Exec mode

Description

Use this command to display the parameter settings of the authenticator ports. This command is equivalent to "SHOW DOT1X INTERFACE" on page 1162. An example is shown in Figure 199.

```
Authentication Info for interface port1.0.2
   portEnabled: Enabled - portControl: Auto
   portStatus: UP
   reAuthenticate: Disabled
   reAuthPeriod: 3600
   PAE: quietPeriod: 60 - maxReauthReq: 2 - txPeriod: 30
   BE: suppTimeout: 30 - serverTimeout: 30
   CD: adminControlledDirections: both
   criticalVlan: Disabled
   guestVlan: Disabled
   dynamicVlanCreation: None
   hostMode: Single-Host
   dot1x: Enabled
   protocolVersion: 1
   authMac: Enabled
   reAuthRelearning: Disabled
```

Figure 199. SHOW AUTH-MAC INTERFACE Command

Example

This example displays the parameter settings of authenticator ports 1.0.1 through 1.0.4:

```
awplus# show auth-mac interface port1.0.1-port1.0.4
```

SHOW AUTH-MAC SESSIONSTATISTICS INTERFACE

Syntax

```
show auth-mac sessionstatistics interface port
```

Parameters

port
Specifies a port. You can enter more than one port.

Mode

Privileged Exec mode

Description

Use this command to display session statistics of the authenticator ports. An example is shown in Figure 200.

```
Authentication Session Statistics for interface port
   session user name: manager
      session authentication method: Remote server
      session time: 22045 secs
      session terminate cause: Not terminated yet
```

Figure 200. SHOW AUTH-MAC SESSIONSTATISTICS INTERFACE Command

Example

This example displays the session statistics of the authenticator port 1.0.17:

```
awplus# show auth-mac sessionstatistics interface port1.0.17
```

SHOW AUTH-MAC STATISTICS INTERFACE

Syntax

```
show auth-mac statistics interface port
```

Parameters

port

Specifies a port. You can enter more than one port.

Mode

Privileged Exec mode

Description

Use this command to display EAP packet statistics of authenticator ports. This command is equivalent to "SHOW DOT1X STATISTICS INTERFACE Command" on page 1163. An example is shown in Figure 201.

```
Authentication Statistics for interface port1.0.2
   EAPOL Frames Rx: 0 - EAPOL Frames Tx: 0
   EAPOL Start Frames Rx: 0 - EAPOL Logoff Frames Rx: 0
   EAP Rsp/Id Frames Rx: 0 - EAP Response Frames Rx: 0
   EAP Req/Id Frames Tx: 0 - EAP Request Frames Tx: 0
   Invalid EAPOL Frames Rx: 0 - EAP Length Error Frames Rx: 0
   EAPOL Last Frame Version Rx: 0 - EAPOL Last Frame Src: 0000.0000.0000
```

Figure 201. SHOW AUTH-MAC STATISTICS INTERFACE Command

Example

This example displays the EAP packet statistics of authenticator port 1.0.7:

```
awplus# show auth-mac statistics interface port1.0.7
```

SHOW AUTH-MAC SUPPLICANT INTERFACE

Syntax

```
show auth-mac supplicant interface port
```

Parameters

port
Specifies a port. You can enter more than one port.

Mode

Privileged Exec mode

Description

Use this command to display the supplicant state of the authentication mode set for the interface on authenticator ports. This command is equivalent to “SHOW DOT1X SUPPLICANT INTERFACE Command” on page 1164. An example is shown in Figure 202.

```
Interface port1.0.3
   authenticationMethod: dot1x
   totalSupplicantNum: 0
   authorizedSupplicantNum: 0
      macBasedAuthenticationSupplicantNum: 0
      dot1xAuthenticationSupplicantNum: 0
      webBasedAuthenticationSupplicantNum: 0
      otherAuthenticationSupplicantNum: 0
No supplicants
```

Figure 202. SHOW AUTH-MAC SUPPLICANT INTERFACE Command

Example

This example displays the supplicant state of the authentication mode on ports 1.0.21 and 1.0.23:

```
awplus# show auth-mac supplicant interface port1.0.21-
port1.0.23
```

SHOW DOT1X

Syntax

```
show dot1x
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display whether 802.1x port-based network access control is enabled or disabled on the switch and the IP addresses of the RADIUS servers. An example is shown in Figure 203.

```
802.1 Port-Based Authentication: Enabled
   RADIUS server address (auth): 149.32.146.78
```

Figure 203. SHOW DOT1X Command

Example

This example displays the status of the 802.1x port-based network access control feature and the IP addresses of the RADIUS servers:

```
awplus# show dot1x
```

SHOW DOT1X INTERFACE

Syntax

```
show dot1x interface port
```

Parameters

port
Specifies a port. You can display more than one port at a time.

Modes

Privileged Exec mode

Description

Use this command to display the parameter settings of authenticator ports. This command is equivalent to “SHOW AUTH-MAC INTERFACE” on page 1157.

Figure 204 displays an example of the information.

```
Authentication Info for interface port1.0.2
   portEnabled: Enabled - portControl: Auto
   portStatus: UP
   reAuthenticate: Enabled
   reAuthPeriod: 3600
   PAE: quietPeriod: 60 - maxReauthReq: 2 - txPeriod: 30
   BE: suppTimeout: 30 - serverTimeout: 30
   CD: adminControlledDirections: both
   guestVlan: Enabled
   DynamicVlanCreation: None
   hostMode: Single-Host
   dot1x: Enabled
   protocolVersion: 1
   authMac: Disabled
   reAuthRelearning: Disabled
```

Figure 204. SHOW DOT1X INTERFACE Command

Example

The example displays the authenticator parameter settings for ports 1.0.1 to 1.0.4:

```
awplus> enable
awplus# show dot1x interface port1.0.1-port1.0.4
```

SHOW DOT1X STATISTICS INTERFACE

Syntax

```
show dot1x statistics interface port
```

Parameters

port

Specifies a port. You can enter more than one port.

Mode

Privileged Exec mode

Description

Use this command to display EAP packet statistics of authenticator ports. This command is equivalent to "SHOW AUTH-MAC STATISTICS INTERFACE" on page 1159. An example is shown in Figure 205.

```
Authentication Statistics for interface port1.0.2
   EAPOL Frames Rx: 0 - EAPOL Frames Tx: 0
   EAPOL Start Frames Rx: 0 - EAPOL Logoff Frames Rx: 0
   EAP Rsp/Id Frames Rx: 0 - EAP Response Frames Rx: 0
   EAP Req/Id Frames Tx: 0 - EAP Request Frames Tx: 0
   Invalid EAPOL Frames Rx: 0 - EAP Length Error Frames Rx: 0
   EAPOL Last Frame Version Rx: 0 - EAPOL Last Frame Src: 0000.0000.0000
```

Figure 205. SHOW DOT1X STATISTICS INTERFACE Command

Example

This example displays the EAP packet statistics for authenticator port 1.0.7:

```
awplus> enable
awplus# show dot1x statistics interface port1.0.7
```

SHOW DOT1X SUPPLICANT INTERFACE

Syntax

```
show dot1x supplicant interface port [brief]
```

Parameters

port
Specifies a port. You can enter more than one port.

[brief]
Displays an abbreviated form of this window. This is an optional parameter.

Mode

Privileged Exec mode

Description

Use this command to display the supplicant state of the authentication mode set for the interface on authenticator ports. This command is equivalent to “SHOW AUTH-MAC SUPPLICANT INTERFACE Command” on page 1160. An example is shown in Figure 206.

```
Interface port1.0.3
  authenticationMethod: dot1x
  totalSupplicantNum: 2
  authorizedSupplicantNum: 2
    macBasedAuthenticationSupplicantNum: 0
    dot1xAuthenticationSupplicantNum: 2
    otherAuthenticationSupplicantNum: 0

  Supplicant name: user2
  Supplicant address: 680A.7583.0000
    authenticationMethod: dot1x
    portStatus: Authorized - currentId: 2
    abort:F fail:F start:F timeout:F success:T
    PAE: state: Authenticated - portMode: Auto
    PAE: reAuthCount: 0
    PAE: quietPeriod: 0 - maxReauthReq: 2
    BE: state: Idle - reqCount: 0
    CD: adminControlledDirections: both
```

Figure 206. SHOW DOT1X SUPPLICANT INTERFACE Command

Example

This example displays the supplicant state of the authentication mode on ports 1.0.21 to 1.0.23:

```
awplus> enable
awplus# show dot1x supplicant interface port1.0.21-
port1.0.23
```

Section X

Simple Network Management Protocols

This section contains the following chapters:

Chapter 75

SNMPv1 and SNMPv2c

This chapter contains the following topics:

Overview

The Simple Network Management Protocol (SNMP) is another way for you to monitor and configure the switch. This method lets you view and change the individual objects in the Management Information Base (MIB) in the management software on the switch, without having to use the command line commands.

The switch supports three versions of SNMP— SNMPv1, SNMPv2c, and SNMPv3. This chapter discusses SNMPv1 and SNMPv2c. For information on SNMPv3, refer to Chapter 77, ”SNMPv3 Commands” on page 1205.

Here are the main steps to using SNMP:

- Assign a management IP address to the switch. For instructions, refer to Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.
- Activate SNMP management on the switch. The default setting is disabled. For instructions, refer to Chapter 75, “Enabling SNMPv1 and SNMPv2c” on page 1172.
- Create one or more community strings. (You can use the default public and private strings.) For instructions, refer to “Creating Community Strings” on page 1173.
- Load the Allied Telesis MIBs for the switch onto your SNMP management workstation. The MIBs are available from the Allied Telesis web site at **www.alliedtelesis.com**.

A community string must be assigned an access level. The levels are Read and Read/Write. A community string that has an access level of Read can be used to view, but not change, the MIB objects on the switch. A community string that has a Read/Write access level can be used to both view the MIB objects and change them.

The switch can have up to eight community strings. The switch has two default community strings: public and private. The public string has an access level of Read, and the private string has an access mode of Read/Write. If you activate SNMP management on the switch, you should delete the private community string, which is a standard community string in the industry, to protect the switch from unauthorized changes.

The switch can send SNMP trap and inform messages to notify you about device events, such as changes in the states of port links. These messages are sent to receivers on your network. The difference between the messages is that the switch, when it sends inform messages, expects to receive acknowledgements from the receivers, whereas it does not expect acknowledgements when it sends traps.

To configure the switch to send trap or inform messages, you have to add to one or more of the community strings the IP addresses of the trap and inform receivers on your network. For trap messages, you must also specify the format in which the switch should send the messages. The format can be either SNMPv1 or SNMPv2c. For inform messages, the format is always SNMPv2c. For instructions, refer to "Adding or Removing IP Addresses of Trap or Inform Receivers" on page 1174.

You can configure SNMPv1 and SNMPv2c with the SNMPv3 Table commands described in Chapter 77, "SNMPv3 Commands" on page 1205. However, the SNMPv3 Table commands require a much more extensive configuration.

Enabling SNMPv1 and SNMPv2c

To enable SNMP on the switch, use the SNMP-SERVER command, found in the Global Configuration mode. The command has no parameters. The switch begins to send trap and inform messages to the receivers and permits remote management from SNMP workstations as soon as you enter the command. This assumes, of course, you have already created the community strings and added the IP addresses of trap and inform receivers. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server
```

Creating Community Strings

To create SNMPv1 and SNMPv2c community strings, use the SNMP-SERVER COMMUNITY command. This command is found in the Global Configuration mode. Here is the format of the command:

```
snmp-server community community rw|ro
```

You can create only one string at a time with the command. The COMMUNITY parameter is the name of the new string. It can be up to 15 alphanumeric characters and special characters, such as, !@#$%^&*?<>, and is case sensitive. Spaces are not allowed.

The RW and RO options define the access levels of new community strings. RW is read-write and RO is read-only.

This example creates the community string "plarnum" with read-write access:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server community plarnum rw
```

This example creates the community string "station5b2" with read-only access:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server community station5b2 ro
```

Adding or Removing IP Addresses of Trap or Inform Receivers

The command to add IP addresses of trap or inform receivers to community strings is the SNMP-SERVER HOST command. Here is the format:

```
snmp-server host ipaddress traps|informs version 1|2c
community
```

The IPADDRESS parameter is the IP address of a receiver. The COMMUNITY parameter is an existing community string to which you want to add the address. The community string is case sensitive.

The TRAPS and INFORMS parameters control whether or not the switch expects to receive acknowledgements from your SNMP applications after it sends the messages. Acknowledgements are expected for inform messages, but not for trap messages.

The 1 and 2C parameters define the format of the trap messages. The switch can send trap messages in either SNMPv1 or SNMPv2c format. Inform messages can only be sent in SNMPv2c format.

> **Note**
> SNMP must be activated on the switch for you to add trap or inform receivers to community strings. To activate SNMP, use the SNMP-SERVER command in the Global Configuration mode.

This example activates SNMP on the switch and assigns the IP address 121.12.142.8 as a trap receiver to the private community string. The messages are sent in SNMPv2c format:

```
awplus> enable
awplus# configure terminal
awplus# snmp-server
awplus(config)# snmp-server host 121.12.142.8 trap version
2c private
```

The rest of the examples assume that SNMP is already activated on the switch and so omit the SNMP-SERVER command.

This example assigns the IP address 121.14.154.11 as a trap receiver to the community string “Wanpam.” The messages are sent in SNMPv1 format:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server host 121.14.154.11 trap version
1 Wanpam
```

This example assigns the IP address 143.154.76.17 as an inform message receiver to the community string "st_bldg2." Inform messages must be sent in SNMPv2c format:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server host 143.154.76.17 informs
version 2c st_bldg2
```

To remove IP addresses of trap or inform receivers from community strings, use the NO form of the command. This example removes the IP address 121.12.142.8 of a trap receiver from the private community string:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server host 121.12.142.8 trap
version 2c private
```

Deleting Community Strings

To delete community strings, use the NO SNMP-SERVER COMMUNITY command. Here is the format:

```
no snmp-server community community
```

You can delete only one community string at a time with the command, which is found in the Global Configuration mode. The COMMUNITY parameter is case sensitive.

This example deletes the “ytnar12a” community string from the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server community ytnar12a
```

Disabling SNMPv1 and SNMPv2c

To disable SNMP on the switch, use the NO SNMP-SERVER command. You cannot remotely manage the switch with an SNMP application when SNMP is disabled. Furthermore, the switch stops transmitting trap and inform messages to your SNMP applications. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server
```

Displaying SNMPv1 and SNMPv2c

To learn whether SNMP is enabled or disabled on the switch, go to the Privileged Exec mode and issue the SHOW SNMP-SERVER command:

```
awplus# show snmp-server
```

Here is an example of what is displayed.

```
SNMP Server ....... Enabled
IP Protocol ....... IPv4
SNMPv3 Engine ID (Configured) ........ Not set
SNMPv3 Engine ID (actual) ............ 0x80001f8880241d7f08386d438e
```

Figure 207. SHOW SNMP-SERVER Command

The status of SNMP is displayed in the first field as either Enabled or Disabled. (The other fields in the window are not applicable to SNMPv1 and SNMPv2c.)

To view the community strings on the switch, use the SHOW SNMP-SERVER COMMUNITY command:

```
awplus# show snmp-server community
```

Here is an example of the information the command displays:

```
SNMP community information:
   Community Name ............. sw12eng1
      Access .................. Read-Write
      View .................... None
   Community Name ............. sw12eng1limit
      Access .................. Read-only
      View .................... None
   Community Name ............. westplnm7
      Access .................. Read-only
      View .................... None
   Community Name ............. site12pl4
      Access .................. Read-only
      View .................... None
```

Figure 208. SHOW SNMP-SERVER COMMUNITY Command

The information that the command provides for each community string includes the community name and the access level of read-write or read-only. There is also a view field which, for community strings created through the SNMPv1 and SNMPv2c commands, always has a value of None, indicating that the strings give an SNMP application access to the entire MIB tree of the switch. SNMPv1 and SNMPv2c community strings created with SNMPv3 can be configured so that they are restricted to particular parts of the MIB tree.

To view the trap and inform receivers assigned to the community strings, use the SHOW RUNNING-CONFIG SNMP command in the Privileged Exec mode:

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

Here is an example of command display:

```
snmp-server
no snmp-server enable trap auth
snmp-server community sw12eng1 rw
snmp-server community sw12eng1limit rw
snmp-server community westplnm7 ro
snmp-server community site12pl4 ro
snmp-server host 149.198.74.143 traps version 2c sw12eng1
snmp-server host 149.198.74.154 traps version 2c sw12eng1
snmp-server host 149.198.121.17 traps version 2c sw12eng1limit
snmp-server host 149.198.121.198 traps version 2c sw12eng1limit
```

Figure 209. SHOW RUNNING-CONFIG SNMP Command

Chapter 76
SNMPv1 and SNMPv2c Commands

The SNMPv1 and SNMPv2c commands are summarized in Table 115 and described in detail within the chapter.

Table 115. SNMPv1 and SNMPv2c Commands

Command	Mode	Description
“NO SNMP-SERVER” on page 1183	Global Configuration	Disables SNMPv1 and SNMPv2c on the switch.
“NO SNMP-SERVER COMMUNITY” on page 1184	Global Configuration	Deletes SNMPv1 and SNMPv2c community strings.
“NO SNMP-SERVER ENABLE TRAP” on page 1185	Global Configuration	Disables the transmission of all SNMP traps, except for link status and authentication traps, which are disabled separately.
“NO SNMP-SERVER ENABLE TRAP AUTH” on page 1186	Global Configuration	Disables the transmission of SNMP authentication traps.
“NO SNMP-SERVER HOST” on page 1187	Global Configuration	Removes the IP addresses of trap and inform receivers from the community strings.
“NO SNMP-SERVER VIEW” on page 1189	Global Configuration	Deletes SNMP views.
“NO SNMP TRAP LINK-STATUS” on page 1190	Port Interface	Disables the transmission of SNMP link status notifications when ports establish links or lose links to network devices.
“SHOW RUNNING-CONFIG SNMP” on page 1191	Privileged Exec	Displays the SNMPv1 and v2c community strings and the IP addresses of trap and inform receivers.
“SHOW SNMP-SERVER” on page 1192	Privileged Exec	Displays the current status of SNMP on the switch.
“SHOW SNMP-SERVER COMMUNITY” on page 1193	Privileged Exec	Displays the status of SNMPv1 and SNMPv2c and the community strings.

Table 115. SNMPv1 and SNMPv2c Commands (Continued)

Command	Mode	Description
“SHOW SNMP-SERVER VIEW” on page 1195	Privileged Exec	Displays the SNMP views.
“SNMP-SERVER” on page 1196	Global Configuration	Enables SNMPv1 and SNMPv2c on the switch.
“SNMP-SERVER COMMUNITY” on page 1197	Global Configuration	Creates new SNMPv1 and SNMPv2c community strings.
“SNMP-SERVER ENABLE TRAP” on page 1198	Global Configuration	Activates the transmission of all SNMP traps, except for link status and authentication traps, which are activated separately.
“SNMP-SERVER ENABLE TRAP AUTH” on page 1199	Global Configuration	Activates the transmission of SNMP authentication traps.
“SNMP-SERVER HOST” on page 1200	Global Configuration	Adds the IP addresses of trap and informs receivers to the community strings on the switch.
“SNMP-SERVER VIEW” on page 1202	Global Configuration	Creates SNMP views.
“SNMP TRAP LINK-STATUS” on page 1204	Port Interface	Configures SNMP to transmit link status notifications when ports establish links or lose links to network devices.

NO SNMP-SERVER

Syntax

```
no snmp-server
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable SNMPv1, SNMPv2c and SNMPv3 on the switch. The switch does not permit remote management from SNMP applications when SNMP is disabled. It also does not send SNMP trap or inform messages.

Confirmation Command

"SHOW SNMP-SERVER" on page 1192.

Example

This example disables SNMPv1, SNMPv2c, or SNMPv3 on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server
```

NO SNMP-SERVER COMMUNITY

Syntax

```
no snmp-server community community
```

Parameter

community
: Specifies an SNMP community string to be deleted from the switch. This parameter is case sensitive.

Mode

Global Configuration mode

Description

Use this command to delete SNMPv1 and SNMPv2c community strings from the switch. Deleting community strings with this command also deletes any IP addresses of SNMP trap or inform receivers assigned to the community strings. You can delete only one community string at a time with this command.

Confirmation Command

“SHOW SNMP-SERVER COMMUNITY” on page 1193

Example

This example deletes the “pla178ta” community string from the switch, as well as any IP addresses of trap or inform receivers that are assigned to it:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server community pla178ta
```

NO SNMP-SERVER ENABLE TRAP

Syntax

```
no snmp-server enable trap
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable the transmission of SNMP traps, except for the link status and authentication traps, which are disabled separately.

Confirmation Command

"SHOW RUNNING-CONFIG SNMP" on page 1191

Example

This example disables the transmission of all SNMP traps, except for the link status and authentication traps:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server enable trap
```

NO SNMP-SERVER ENABLE TRAP AUTH

Syntax

```
no snmp-server enable trap auth
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable the transmission of SNMP traps.

Confirmation Command

“SHOW RUNNING-CONFIG SNMP” on page 1191

Example

This example disables the transmission of SNMP traps:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server enable trap auth
```

NO SNMP-SERVER HOST

Syntax

```
no snmp-server host ipaddress traps|informs version 1|2c
community_string
```

Parameters

ipaddress
: Specifies the IPv4 or IPv6 address of a trap or inform receiver to be removed from a community string. You can specify only one IP address.

traps|informs
: Specifies the type of messages the switch is sending to the receiver.

1|2c
: Specifies the format of the messages that the switch is transmitting to the receiver. You can specify only 2c when you are deleting the IP address of an inform message receiver.

community_string
: Specifies the SNMP community string to which the IP address of the trap or inform receiver is assigned. This parameter is case sensitive.

Mode

Global Configuration mode

Description

Use this command to remove IP addresses of trap or inform receivers from the community strings on the switch. You can remove only one receiver at a time with this command. The switch does not send any further SNMP trap or inform messages to network devices after their IP addresses have been deleted from the community strings.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

This example removes the IPv4 address 115.124.187.4 of a trap receiver from the private community string:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server host 115.124.187.4 traps
version 1 private
```

This example removes the IPv4 address 171.42.182.102 of a trap receiver from the community string “station12a”:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server host 115.124.187.4 traps
version 2c station12a
```

This example removes the IPv6 address 124c:75:ae3::763:8b4 of an inform receiver from the community string “wadt27:”

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server host 124c:75:ae3::763:8b4
informs version 2c wadt27
```

NO SNMP-SERVER VIEW

Syntax

```
no snmp-server view viewname oid
```

Parameters

viewname
: Specifies the name of the view to be deleted. The name is case sensitive.

oid
: Specifies the OID of the view.

Mode

Global Configuration mode

Description

Use this command to delete SNMP views. You can delete just one view at a time with this command.

Confirmation Command

"SHOW SNMP-SERVER VIEW" on page 1195

Example

This example deletes the view AlliedTelesis with the OID 1.3.6.1.4.1.207:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server view AlliedTelesis
1.3.6.1.4.1.207
```

NO SNMP TRAP LINK-STATUS

Syntax

```
no snmp trap link-status
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to disable the transmission of SNMP link status notifications (traps) when ports establish links (linkUp) or lose links (linkDown) to network devices.

Confirmation Command

“SHOW INTERFACE” on page 231

Example

This example disables the transmission of link status notifications on ports 17 and 21:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17,port1.0.21
awplus(config-if)# no snmp trap link-status
```

SHOW RUNNING-CONFIG SNMP

Syntax

```
show running-config snmp
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the SNMPv1 and SNMPv2c community strings and the IP addresses of trap and inform receivers. An example is shown in Figure 210.

```
snmp-server
no snmp-server enable trap auth
snmp-server community sw12eng1 rw
snmp-server community sw12eng1limit rw
snmp-server community westplnm7 ro
snmp-server community site12pl4 ro
snmp-server host 149.198.74.143 traps version 2c sw12eng1
snmp-server host 149.198.74.154 traps version 2c sw12eng1
snmp-server host 149.198.121.17 traps version 2c sw12eng1limit
snmp-server host 149.198.121.198 traps version 2c sw12eng1limit
```

Figure 210. SHOW RUNNING-CONFIG SNMP Command

Example

This example displays the SNMPv1 and SNMPv2c community strings and the IP addresses of trap and inform receivers:

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

SHOW SNMP-SERVER

Syntax

```
show snmp-server
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the current status of SNMP on the switch. An example is shown in Figure 211. The first field displays whether SNMP is enabled or disabled on the switch. You can remotely manage the switch with SNMPv1 or v2c when the server is enabled. Remote management is not possible when the server is disabled. To activate or deactivate SNMP, refer to “SNMP-SERVER” on page 1196 and “NO SNMP-SERVER” on page 1183, respectively.

```
SNMP Server ....... Enabled
IP Protocol ....... IPv4
SNMPv3 Engine ID (Configured) ........ Not set
SNMPv3 Engine ID (actual) ............ 0x80001f8880241d7f08386d438e
```

Figure 211. SHOW SNMP-SERVER Command

Example

This example displays the current status of SNMP on the switch:

```
awplus# show snmp-server
```

SHOW SNMP-SERVER COMMUNITY

Syntax

```
show snmp-server community
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the SNMPv1 and SNMPv2c community strings on the switch. Here is an example of the display.

```
SNMP community information:
   Community Name ............. private
      Access ................. Read-Write
      View ................... None
   Community Name ............. public
      Access ................. Read-only
      View ................... None
```

Figure 212. SHOW SNMP-SERVER COMMUNITY Command

The fields in the entries are described in Table 116.

Table 116. SHOW SNMP-SERVER COMMUNITY Command

Parameter	Description
Community Name	The community string.
Access	The access level of the community string. The possible access levels are Read-Write and Read-Only.
View	The name of an SNMP view that defines a portion of the MIB tree that the community string is not permitted to access. Community strings that are not assigned views have a value of None, which means they have access to the entire MIB tree.

Example

This example displays the SNMPv1 and SNMPv2c community strings:

```
awplus# show snmp-server community
```

SHOW SNMP-SERVER VIEW

Syntax

```
show snmp-server view
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the SNMPv1 and SNMPv2c views on the switch. Here is an example of the display.

```
SNMP View information:
   View Name ............. system
      OID ................ 1.3.6.12.1.1
      Type ............... excluded
   View Name ............. AlliedTelesis
      OID ................ 1.3.6.1.4.1.207
      Type ............... excluded
```

Figure 213. SHOW SNMP-SERVER VIEW Command

The fields in the entries are described in Table 117.

Table 117. SHOW SNMP-SERVER VIEW Command

Parameter	Description
View Name	The view name.
OID	The OID to a section of the MIB tree.
Type	The view type, which is always excluded.

Example

This example displays the SNMPv1 and SNMPv2c views on the switch:

```
awplus# show snmp-server view
```

SNMP-SERVER

Syntax

```
snmp-server
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate SNMPv1, SNMPv2c and SNMPv3 on the switch. The switch permits remote management from SNMP applications when SNMP is enabled. The switch also sends SNMP messages to trap and inform receivers.

Confirmation Command

“SHOW SNMP-SERVER” on page 1192

Example

This example activates SNMPv1, SNMPv2c or SNMPv3 on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server
```

SNMP-SERVER COMMUNITY

Syntax

```
snmp-server community community rw|ro
```

Parameters

community
: Specifies a new community string. The maximum length is 40 alphanumeric and/or special characters, such as, !@#$%^&*?<>. The name is case sensitive. Spaces are not allowed.

rw|ro
: Specifies the access level of a new community string, of read-write (RW) or read-only (RO).

Mode

Global Configuration mode

Description

Use this command to create new SNMPv1 and SNMPv2c community strings on the switch. The switch can have up to eight community strings.

Confirmation Command

"SHOW SNMP-SERVER COMMUNITY" on page 1193

Example

This example creates the new community string "stea2a," with an access level of read-write:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server community stea2a rw
```

SNMP-SERVER ENABLE TRAP

Syntax

```
snmp-server enable trap
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate the transmission of all SNMP traps, except for power-inline, link status, and authentication traps, which are activated separately.

Confirmation Command

“SHOW RUNNING-CONFIG SNMP” on page 1191

Example

This example activates the transmission of all SNMP traps, except for power-inline, link status, and authentication traps:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server enable trap
```

SNMP-SERVER ENABLE TRAP AUTH

Syntax

```
snmp-server enable trap auth
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate the transmission of SNMP authentication failure traps.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example activates the transmission of SNMP authentication failure traps:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server enable trap auth
```

SNMP-SERVER HOST

Syntax

```
snmp-server host ipaddress traps|informs version 1|2c
community
```

Parameters

ipaddress
Specifies the IPv4 or IPv6 address of a network device to receive trap or inform messages from the switch.

traps|*informs*
Specifies the type of messages.

1|*2c*
Specifies the format of the traps sent by the switch. For trap messages, the format can be SNMPv1 (1) or SNMPv2c (2c). For inform messages, the format must be SNMPv2c (2c).

community
Specifies an SNMP community string. This parameter is case sensitive.

Mode

Global Configuration mode

Description

Use this command to specify IP addresses of network devices to receive trap and inform messages from the switch. A community string can have up to eight IP addresses of trap and inform receivers.

SNMP must be enabled on the switch for you to add trap and inform receivers to community strings. To enable SNMP, refer to “SHOW SNMP-SERVER VIEW” on page 1195

Confirmation Command

“SHOW RUNNING-CONFIG SNMP” on page 1191

Examples

This example assigns the IPv4 address 149.44.12.44 of a trap receiver to the private community string. The traps are sent in the SNMPv2c format:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server host 149.44.12.44 traps version
2c private
```

This example assigns the IPv4 address 152.34.32.18 as a trap receiver to the community string "tlpaac78". The traps are sent in the SNMPv1 format:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server host 152.34.32.18 traps version
1 tlpaac78
```

This example assigns the IPv6 address 45ac:be22:78::c45:8156 as an inform receiver to the community string "anstat172". Inform messages must be sent in the SNMPv2c format:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server host 45ac:be22:78::c45:8165
informs version 2c anstat172
```

SNMP-SERVER VIEW

Syntax

```
snmp-server view viewname oid excluded|included
```

Parameters

viewname
: Specifies the name of a new view. The maximum length is 64 alphanumeric and/or special characters. The string is case sensitive. Spaces are not allowed.

oid
: Specifies the OID of the view. The OID must be in decimal format.

excluded
: Denies access to the part of the MIB tree specified by the OID.

included
: Permits access to the part of the MIB tree specified by the OID.

Mode

Global Configuration mode

Description

Use this command to create SNMPv1 and SNMPv2c views on the switch. Views are used to restrict the MIB objects that network managers can access through the community strings. A view can have more than one OID, but each OID must be entered in a separate command.

Confirmation Command

“SHOW SNMP-SERVER VIEW” on page 1195

Examples

This example creates a view that excludes all MIB objects in the OID 1.3.6.1.2.1. The view is assigned the name “sw12_restrict_view:”

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server view sw12_restrict_view
1.3.6.1.2.1 excluded
```

This example creates the new view "AlliedTelesis" that limits the available MIB objects to those in the OID 1.3.6.1.4.1.207:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server view AlliedTelesis 1.3.6.1
excluded
awplus(config)# snmp-server view AlliedTelesis
1.3.6.1.4.1.207 included
```

SNMP TRAP LINK-STATUS

Syntax

```
snmp trap link-status
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to enable SNMP to transmit link status notifications (traps) when ports establish links (linkUp) or lose links (linkDown) to network devices.

Confirmation Command

“SHOW INTERFACE” on page 231

Example

This example configures the switch to transmit link status notifications whenever links are established or lost on ports 1 to 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1-port1.0.4
awplus(config-if)# snmp trap link-status
```

Chapter 77
SNMPv3 Commands

The SNMPv3 commands are summarized in Table 118 and described in detail within the chapter.

Table 118. SNMPv3 Commands

Command	Mode	Description
“NO SNMP-SERVER” on page 1207	Global Configuration	Disables SNMPv1, v2c and v3 on the switch.
“NO SNMP-SERVER ENGINEID LOCAL” on page 1208	Global Configuration	Returns the SNMP engine ID value to the default value:
“NO SNMP-SERVER GROUP” on page 1209	Global Configuration	Deletes SNMPv3 groups from the switch.
“NO SNMP-SERVER HOST” on page 1210	Global Configuration	Deletes SNMPv3 host entries.
“NO SNMP-SERVER USER” on page 1212	Global Configuration	Deletes SNMPv3 users from the switch.
“NO SNMP-SERVER VIEW” on page 1213	Global Configuration	Deletes SNMPv3 views from the switch.
“SHOW SNMP-SERVER” on page 1214	Privileged Exec	Displays the current status of SNMP on the switch.
“SHOW SNMP-SERVER GROUP” on page 1215	Privileged Exec	Displays the SNMPv3 groups.
“SHOW SNMP-SERVER HOST” on page 1216	Privileged Exec	Displays SNMPv3 host entries.
“SHOW SNMP-SERVER USER” on page 1217	Privileged Exec	Displays SNMPv3 users.
“SHOW SNMP-SERVER VIEW” on page 1218	Privileged Exec	Displays SNMPv3 views.
“SNMP-SERVER” on page 1219	Global Configuration	Activates SNMPv1, v2c and v3 on the switch.
“SNMP-SERVER ENGINEID LOCAL” on page 1220	Global Configuration	Configures the SNMPv3 engine ID.

Table 118. SNMPv3 Commands (Continued)

Command	Mode	Description
“SNMP-SERVER GROUP” on page 1221	Global Configuration	Creates SNMPv3 groups.
“SNMP-SERVER HOST” on page 1223	Global Configuration	Creates SNMPv3 host entries.
“SNMP-SERVER USER” on page 1225	Global Configuration	Creates SNMPv3 users.
“SNMP-SERVER VIEW” on page 1227	Global Configuration	Creates SNMPv3 views.

NO SNMP-SERVER

Syntax

```
no snmp-server
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable SNMPv1, SNMPv2c, and SNMPv3 on the switch. The switch does not permit remote management from SNMP applications when SNMP is disabled. It also does not send SNMP trap or inform messages.

Confirmation Command

"SHOW SNMP-SERVER" on page 1214.

Example

This example disables SNMPv1, SNMPv2c, or SNMPv3 on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server
```

NO SNMP-SERVER ENGINEID LOCAL

Syntax

```
no snmp-server engineid local
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to return the SNMP engine ID value to the default value.

Confirmation Command

“SHOW SNMP-SERVER” on page 1214

Example

This example returns the SNMP engine ID value to the default value:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server engineid local
```

NO SNMP-SERVER GROUP

Syntax

```
no snmp-server group name noauth|auth|priv
```

Parameters

name

Specifies the name of a group you want to delete from the switch. The name is case sensitive.

auth/noauth/priv

Specifies the minimum security level of the group to be deleted. The options are:

auth: Indicates authentication, but no privacy.

noauth: Indicates no authentication or privacy.

priv: Indicates authentication and privacy.

Mode

Global Configuration mode

Description

Use this command to delete SNMPv3 groups.

Confirmation Command

"SHOW SNMP-SERVER GROUP" on page 1215

Example

This example deletes the SNMPv3 group "campus1_mgmt" with authentication and privacy security:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server group campus1_mgmt priv
```

NO SNMP-SERVER HOST

Syntax

```
no snmp-server host ipaddress informs|traps v3
auth|noauth|priv username
```

Parameters

ipaddress
: Specifies the IP address of a trap receiver. The address can be IPv4 or IPv6. You can specify just one address.

informs/trap
: Specifies the type of message the switch sends. The options are:

  informs: Sends inform messages.

  trap: Sends trap messages.

noauth/auth/priv
: Specifies the minimum security level of the user associated with this entry. The options are:

  noauth: Indicates no authentication or privacy.

  auth: Indicates authentication, but no privacy.

  priv: Indicates authentication and privacy.

username
: Specifies an SNMPv3 user name.

Mode

Global Configuration mode

Description

Use this command to delete SNMPv3 host entries. Host entries define the IP addresses to receive SNMPv3 inform and trap messages.

Example

This example deletes the host entry with the IPv4 address 187.87.165.12. The user name associated with this entry is "jones:"

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server host 187.87.165.12 traps v3 auth
jones
```

NO SNMP-SERVER USER

Syntax

```
no snmp-server user user
```

Parameters

user

Specifies the name of a user you want to delete from the switch. The name is case sensitive.

Mode

Global Configuration mode

Description

Use this command to delete SNMPv3 users. You can delete just one user at a time with this command.

Confirmation Command

“SHOW SNMP-SERVER USER” on page 1217

Example

This example deletes the SNMPv3 user “tedwards”:

```
awplus> enable
awplus# configure terminal
awplus(config)# no snmp-server user tedwards
```

NO SNMP-SERVER VIEW

Syntax

```
no snmp-server view view OID
```

Parameters

view

Specifies the name of a view to be deleted from the switch. The name is case sensitive.

OID

Specifies the OID of the subtree of the view to be deleted.

Mode

Global Configuration mode

Description

Use this command to delete SNMPv3 views from the switch.

Confirmation Command

"SHOW SNMP-SERVER VIEW" on page 1218

Example

This example deletes the view All, which has the OID 1.3.6.1:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server view All subtree 1.3.6.1
```

SHOW SNMP-SERVER

Syntax

```
show snmp-server
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the current status of SNMP on the switch. An example is shown in Figure 214. The first field displays whether SNMP is enabled or disabled on the switch. You can remotely manage the switch with SNMPv1 or v2c when the server is enabled. Remote management is not possible when the server is disabled. To activate or deactivate SNMP, refer to “SNMP-SERVER” on page 1219 and“NO SNMP-SERVER” on page 1207, respectively.

```
SNMP Server ....... Enabled
IP Protocol ....... IPv4
SNMPv3 Engine ID (Configured) ........ Not set
SNMPv3 Engine ID (actual) ............ 0x80001f8880241d7f08386d438e
```

Figure 214. SHOW SNMP-SERVER Command

Example

This example displays the current status of SNMP on the switch:

```
awplus# show snmp-server
```

SHOW SNMP-SERVER GROUP

Syntax

```
show snmp-server group
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the SNMPv3 groups.

Example

This example displays the SNMPv3 groups:

```
awplus# show snmp-server group
```

SHOW SNMP-SERVER HOST

Syntax

```
show snmp-server host
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the SNMPv3 host entries.

Example

This example displays the SNMPv3 host entries:

```
awplus# show snmp-server host
```

SHOW SNMP-SERVER USER

Syntax

```
show snmp-server user
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the SNMPv3 users.

Example

This example displays the SNMPv3 users:

```
awplus# show snmp-server user
```

SHOW SNMP-SERVER VIEW

Syntax

```
show snmp-server view
```

Parameter

None

Mode

Privileged Exec mode

Description

Use this command to display the SNMPv3 views on the switch.

Example

This example displays the SNMPv3 views on the switch:

```
awplus# show snmp-server view
```

SNMP-SERVER

Syntax

```
snmp-server
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate SNMPv1, SNMPv2c, and SNMPv3 on the switch. The switch permits remote management from SNMP applications when SNMP is enabled. The switch also sends SNMP messages to trap and inform receivers.

Confirmation Command

"SHOW SNMP-SERVER" on page 1214

Example

The following example activates SNMPv1, SNMPv2c, and SNMPv3 on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server
```

SNMP-SERVER ENGINEID LOCAL

Syntax

```
snmp-server engineid local engine-id|default
```

Parameters

engine-id
: Specifies the SNMPv3 engine ID. The value can be up to 32 characters.

default
: Returns the SNMPv3 engine ID to the system-generated value.

Mode

Global Configuration mode

Description

Use this command to configure the SNMPv3 engine ID.

Note
Changing the SNMPv3 engine ID from its default value is not recommended because the SNMP server on the switch may fail to operate properly.

Confirmation Command

"SHOW SNMP-SERVER" on page 1214

Examples

This example sets the SNMPv3 engine ID to 89ab532d782:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server engineid local 89ab532d782
```

This example returns the SNMPv3 engine ID to the default setting:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server engineid local default
```

SNMP-SERVER GROUP

Syntax

```
snmp-server group name auth|noauth|priv read readview|
write writeview
```

Parameters

name

Specifies a name for a new group. A name can be up to 64 alphanumeric and/or special characters, such as, !@#$%^&*?<>, and is case sensitive.

auth/noauth/priv

Specifies the minimum security level that users must have to gain access to the switch through the group. The options are:

auth: Indicates authentication, but no privacy.

noauth: Indicates no authentication or privacy.

priv: Indicates authentication and privacy.

readview

Specifies the name of an existing SNMPv3 view that specifies the MIB objects the members of the group can view. If this parameter is omitted, the members cannot view any MIB objects using the group. The name is case sensitive.

writeview

Specifies the name of an existing SNMPv3 view that specifies the part of the MIB tree the members of the group can change. If this parameter is omitted, the members cannot change any MIB objects using the group. The name is case sensitive.

Mode

Global Configuration Mode

Description

Use this command to create SNMPv3 groups.

Examples

This example creates a group called “sta5west” with a minimum security level of privacy. The group has a read view named “internet” and a write view named “private”:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server group sta5west priv read
internet write private
```

This example creates a group called “swengineering” with a minimum security level of authentication and privacy. The group has the read view “internet” and the write view “ATI”:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server group swengineering priv read
internet write ATI
```

This example creates a group called “hwengineering” with a security level of no authentication or privacy.The group has the read view “internet,” but no write view.

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server group hwengineering noauth read
internet
```

SNMP-SERVER HOST

Syntax

```
snmp-server host ipaddress informs|traps version 3
auth|noauth|priv username
```

Parameters

ipaddress

Specifies the IP address of a trap receiver. The address can be IPv4 or IPv6. You can specify just one address.

informs/trap

Specifies the type of message the switch sends. The options are:

informs: Sends inform messages.

traps: Sends trap messages.

noauth/auth/priv

Specifies the minimum security level of the user associated with this entry. The options are:

noauth: Indicates no authentication or privacy.

auth: Indicates authentication, but no privacy.

priv: Indicates authentication and privacy.

username

Specifies an SNMPv3 user name.

Mode

Global Configuration mode

Description

Use this command to designate network devices to receive SNMPv3 inform and trap messages.

Example

This example configures SNMPv3 to send trap messages to an end node with the IPv4 address 149.157.192.12. The user name associated with this entry is “sthompson:”

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server host 149.157.192.12 traps
version 3 auth sthompson
```

SNMP-SERVER USER

Syntax

```
snmp-server user username groupname [auth sha|md5
auth_password] [priv des priv_password]
```

Parameters

username

Specifies a name for a new SNMPv3 user. A name can have up to 32 alphanumeric and/or special characters and is case sensitive. Spaces are not allowed.

groupname

Specifies a name of a group for a new user. A group name can have up to 32 alphanumeric and/or special characters and is case sensitive. Spaces are not allowed.

auth

Specifies an authentication protocol for a user. The options are:

md5: The MD5 Message Digest Algorithms authentication protocol.

sha: The SHA Secure Hash Algorithms authentication protocol.

auth_password

Specifies a password for authentication. A password can have up to 40 alphanumeric and/or special characters and is case sensitive. Spaces are not allowed.

priv_password

Specifies a password for privacy with the 3DES Data Encryption Standard. A password can have up to 40 alphanumeric and/or special characters and is case sensitive.

Mode

Global Configuration mode

Description

Use this command to create new SNMPv3 users. A new user can have a security level of no security, authentication only, or authentication and privacy. The security level is assigned in the following manner:

- To create a user that has neither authentication nor privacy, omit both the AUTH and PRIV keywords.

- To create a user that has authentication but not privacy, include the AUTH keyword but not the PRIV keyword.
- To create a user that has both authentication and privacy, include both the AUTH and PRIV keywords.

You cannot create a user that has privacy but not authentication.

Confirmation Command

“SHOW SNMP-SERVER USER” on page 1217

Examples

This example creates the user “dcraig”. The user is not given authentication or privacy:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server user dcraig
```

This example creates the user “bjones”. The user is assigned authentication using SHA and the authentication password “as11fir”. The account is not assigned privacy:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server user bjones auth sha as11fir
```

This example creates a user with the name “csmith”. The account is given both authentication and privacy. The authentication protocol is MD5, the authentication password “light224aq”, and the privacy password “pl567pe”:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server user csmith auth md5 light224aq
priv des pl567pe
```

SNMP-SERVER VIEW

Syntax

```
snmp-server view viewname oid excluded|included
```

Parameters

viewname
: Specifies the name of a new view. The maximum length is 64 alphanumeric and/or special characters. The string is case sensitive. Spaces are not allowed.

oid
: Specifies the OID of the view. The OID must be in decimal format. Each decimal equals 1 character, for example, 1.3.6.1.1 would be equivalent to 9 characters.

excluded
: Denies access to the part of the MIB tree specified by the OID.

included
: Permits access to the part of the MIB tree specified by the OID.

Mode

Global Configuration mode

Description

Use this command to create SNMPv3 views on the switch. Views are used to restrict the MIB objects that network managers can access through SNMPv3 groups. A view can have more than one OID, but each OID must be added in a separate command.

Confirmation Command

"SHOW SNMP-SERVER VIEW" on page 1218

Examples

This example creates a view that excludes all MIB objects in the OID 1.3.6.1.2.1. The view is assigned the name "sw12_restrict_view:"

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server view sw12_restrict_view
1.3.6.1.2.1 excluded
```

This example creates the new view “AlliedTelesis” that limits the available MIB objects to those in the OID 1.3.6.1.4.1.207:

```
awplus> enable
awplus# configure terminal
awplus(config)# snmp-server view AlliedTelesis 1.3.6.1
excluded
awplus(config)# snmp-server view AlliedTelesis
1.3.6.1.4.1.207 included
```

Section XI

Network Management

This section contains the following chapters:

Chapter 78

sFlow Agent

This chapter contains the following topics:

Overview

The sFlow agent allows the switch to gather data about the traffic on the ports and to send the data to an sFlow collector on your network for analysis. You can use the information to monitor the performance of your network or identify traffic bottlenecks.

The sFlow agent can gather two types of information about the traffic on the ports of the switch:

- Ingress packet samples
- Packet counters

Ingress Packet Samples

The sFlow agent can capture ingress packets on ports and send copies of the packets to an sFlow collector on your network for analysis. Depending on the capabilities of a collector, packets can be scrutinized for source and destination MAC or IP addresses, protocol type, length, and so forth.

Packet sampling is activated by specifying sampling rates on the ports. This value defines the average number of ingress packets from which the agent samples one packet. For example, a sampling rate of 1000 on a port prompts the agent to send one packet from an average of 1000 ingress packets to the designated sFlow collector. Different ports can have different rates.

Packet Counters

The agent can also gather and send data to a collector about overall information regarding the status and performance of the ports, such as speeds and status, and the statistics from the packet counters. The counters contain the number and types of ingress and egress packets handled by the ports since the switch or the counters were last reset. Here is the port status and counter information the agent can gather and send to a collector on your network:

- Port number
- Port type
- Speed
- Direction
- Status
- Number of ingress and egress octets
- Number of ingress and egress unicast packets
- Number of ingress and egress multicast packets
- Number of ingress and egress broadcast packets
- Number of ingress and egress discarded packets

- Number of ingress and egress packets with errors
- Number of ingress packets with unknown protocols

To configure the agent to forward these port statistics to a collector, you have to specify polling rates, which define the maximum amount of time permitted between successive queries of the counters of a port by the agent.

Different ports can have different polling rates. Ports to which critical network devices are connected may be assigned low polling rates, so that the information on the collector is kept up-to-date. Ports connected to less critical devices may be assigned higher polling rates.

To increase its efficiency, the agent may send port status and counter information before the polling interval of a port times out. For example, if you define a polling interval of five minutes for a port, the agent, depending on its internal dynamics, may send the information to the collector before five minutes have actually elapsed.

Guidelines

Here are the guidelines to the sFlow agent.

- You can specify just one sFlow collector.
- The switch must have a management IP address. For instructions, refer to Chapter 13, "IPv4 and IPv6 Management Addresses" on page 295.
- If the sFlow collector is not a member of the same subnet as the management IP address of the switch, the switch must be able to access the subnet in which the collector is located, through routers or other Layer 3 devices.
- If the sFlow collector is not a member of the same subnet as the management IP address of the switch, the switch must have a default gateway that specifies the first hop to reaching the collector's subnet. For instructions, refer to Chapter 13, "IPv4 and IPv6 Management Addresses" on page 295.
- This feature is not dependent on SNMP. You do not have to enable or configure SNMP on the switch to use it. Additionally, you cannot use an sFlow collector with SNMP to configure or manage this feature.

Configuring the sFlow Agent

The command for defining the IP address of the sFlow collector is the SFLOW COLLECTOR IP command. The command, which is located in the Global Configuration mode, has this format:

```
sflow collector ip ipaddress port udp_port
```

The IPADDRESS parameter specifies the IP address of the collector and the UDP_PORT parameter its UDP port. This example specifies the IP address of the sFlow collector as 154.122.11.24 and the UDP port as 6300:

```
awplus> enable
awplus# configure terminal
awplus(config)# sflow collector ip 154.122.11.24 port 6300
```

After configuring the agent, go to the next section to configure the ports whose performance data is to be sent to the collector.

Configuring the Ports

To configure the ports so that their performance data is collected by the sFlow agent, you have to define two variables, one of which is optional. The variables are listed here:

- Sampling rate (optional)
- Polling rate (required)

> **Note**
> If the sFlow agent is already enabled on the switch, it will be necessary to disable it while you set these parameters. For instructions, refer to "Disabling the sFlow Agent" on page 1238.

Configuring the Sampling Rate

If you want the sFlow agent to collect packet samples from the ports on the switch and to send the samples to the sFlow collector, you have to specify sampling rates. The sampling rates define the average number of ingress packets from which one packet is sampled. Each port can have just one sampling rate, but different ports can have different rates. The packet sampling rate is controlled with the SFLOW SAMPLING-RATE command in the Port Interface mode. Here is the format of the command:

```
sflow sampling-rate value
```

The VALUE parameter specifies the average number of ingress packets on a port from which one sample is taken by the agent and sent to the sFlow collector. The permitted values are 0 and 256 to 16441700 packets. For example, if you specify a sampling rate of 10000 packets on a port, the agent samples an average of one packet in 10,000 ingress packets. To disable packet sampling on a port, enter the value 0 for the sampling rate or use the NO form of the command.

This example sets the sampling rate on ports 2 and 3 to 1 packet in every 2000 ingress packets:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2,port1.0.3
awplus(config-if)# sflow sampling-rate 2000
```

This example disables packet sampling on port 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.8
awplus(config-if)# no sflow sampling-rate
```

Configuring the Polling Interval

The polling interval determines how frequently the agent queries the packet counters of the ports and sends the data to the collector. This is the maximum amount of time allowed between successive queries of the counters by the agent on the switch. The range is 0 to 16777215 seconds. For example, if you set the polling interval to 400 seconds on a port, the agent polls the counters of the designated port and sends the data to the collector at least once every 400 seconds.

Just as with the sampling rate, a port can have just one polling rate, but different ports can have different settings.

The command to set this value is the SFLOW POLLING-INTERVAL command in the Port Interface mode. Here is the format of the command:

```
sflow polling-interval value
```

This example of the command sets the polling interval to 100 seconds on ports 4, 9, and 11:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4,port1.0.9,port1.0.11
awplus(config-if)# sflow polling-interval 100
```

To disable the polling of the packet counters on a port, enter the value 0 for the polling interval or use the NO form of this command, as shown in this example, which disables packet counters polling on port 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.23
awplus(config-if)# no sflow polling-interval
```

Enabling the sFlow Agent

Use the SFLOW ENABLE command in the Global Configuration mode to activate the sFlow agent so that the switch begins to gather packet samples and packet counters and to transmit the data to the sFlow collector on your network. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# sflow enable
```

This command assumes that you have already performed these steps:

- Added the IP address of the collector to the sFlow agent with the SFLOW COLLECTOR IP command.
- Used the SFLOW SAMPLING-RATE and SFLOW POLLING-INTERVAL IP commands to configure those ports from which performance data is to be gathered.
- Assigned the switch a management IP address. For instructions, refer to Chapter 13, "IPv4 and IPv6 Management Addresses" on page 295.

The switch immediately begins transmitting the packet samples and packet counters to the collector as soon as you enter the command.

Disabling the sFlow Agent

To stop the sFlow agent from collecting performance data on the ports on the switch and from sending the data to the collector on your network, use the NO SFLOW ENABLE command in the Global Configuration mode. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# no sflow enable
```

Displaying the sFlow Agent

To view the IP addresses and UDP port settings of the collectors as defined in the sFlow agent on the switch, use the SHOW SFLOW command in the Global Configuration mode. Here is the command:

```
awplus(config)# show sflow
```

Here is an example of the display.

```
Number of Collectors: 1
Collector_address     UDP_port
==================    ========
149.122.78.12         6343

Number of Samplers/Pollers 4
Port    Sample-rate       Polling-interval
====    ===========       ================
1.0.4   1000              60
1.0.12  1000              60
1.0.13  50000             2400
1.0.14  50000             2400

   sFlow Status
   ============
   Enabled
```

Figure 215. SHOW SFLOW Command

The fields are described in Table 123 on page 1253.

Configuration Example

Here is an example of how to configure the sFlow agent. The IP address of the sFlow collector is 152.232.56.11. The ports from which performance data will be collected will be ports 3, 11, 12, and 21 to 23. Ports 3, 11,and 12 will have a polling rate of 120 seconds and sampling rate of 1 packet in an average of 10.000 packets. Ports 21 to 23 will have a polling rate of 1800 seconds and sampling rate of 1 packet in every 50.000 packets.

This first series of commands adds the IP address of the sFlow collector to the agent on the switch. You must add the IP address of the collector before configuring the polling and sampling rates of the ports.

Table 119. sFlow Agent Configuration Example - Add IP Address

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# sflow collector ip 152.232.56.11 port 6342`	Use the SFLOW COLLECTOR IP command to add the IP address of the sFlow collector to the sFlow agent on the switch.
`awplus(config)# show sflow`	Use the SHOW SFLOW command to confirm the IP address.

The next series of commands configures the sFlow settings of the ports.

Table 120. sFlow Agent Configuration Example - sFlow Port Settings

`awplus(config)# interface port1.0.3,port1.0.11, port1.0.12`	From the Global Configuration mode, use the INTERFACE PORT command to enter the Interface mode for ports 3, 11, and 12.
`awplus(config-if)# sflow sampling-rate 10000`	Use the SFLOW SAMPLING-RATE command to set the sampling rate of the ports to 1 packet for every 10000 packets.
`awplus(config-if)# sflow polling-interval 120`	Use the SFLOW POLLING-INTERVAL command to set the polling rate of the statistics counters of the ports to 120 seconds.

Table 120. sFlow Agent Configuration Example - sFlow Port Settings

`awplus(config)# interface port1.0.21-port1.0.23`	Use the INTERFACE PORT command to enter the Interface mode for ports 21 to 23.
`awplus(config-if)# sflow sampling-rate 50000`	Use the SFLOW SAMPLING-RATE command to set the sampling rate of the ports to 1 packet for every 50000 packets.
`awplus(config-if)# sflow polling-interval 1800`	Use the SFLOW POLLING-INTERVAL command to set the polling rate of the statistics counters of the ports to 1800 seconds.
`awplus(config-if)# exit`	Return to the Global Configuration mode.
`awplus(config)# show sflow`	Use the SHOW SFLOW command again to confirm the configuration of the ports.

This last command activates the sFlow agent on the switch.

Table 121. sFlow Agent Configuration Example - Activate sFlow Agent

`awplus(config)# sflow enable`	Activate the agent with the SFLOW ENABLE command.

Depending on the amount of traffic on the ports and the values of the sampling rates and polling intervals, there may be long periods of time in which the agent on the switch does not send any information to the collectors. For instance, if there is little or no traffic on port 23 in the example, the agent will wait about 30 minutes (1800 seconds) before sending performance data for that particular port.

Chapter 79
sFlow Agent Commands

The sFlow agent commands are summarized in Table 122 and described in detail within the chapter.

Table 122. sFlow Agent Commands

Command	Mode	Description
“NO SFLOW COLLECTOR IP” on page 1244	Global Configuration	Deletes the IP address of an sFlow collector from the switch.
“NO SFLOW ENABLE” on page 1245	Global Configuration	Disables the sFlow agent on the switch.
“SFLOW COLLECTOR IP” on page 1246	Global Configuration	Adds the IP addresses and UDP ports of sFlow collectors on your network to the sFlow agent on the switch.
“SFLOW ENABLE” on page 1247	Global Configuration	Activates the sFlow agent on the switch.
“SFLOW POLLING-INTERVAL” on page 1248	Port Interface	Sets the polling intervals that control the maximum amount of time permitted between successive pollings of the port packet counters by the sFlow agent.
“SFLOW SAMPLING-RATE” on page 1250	Port Interface	Sets the sampling rates that determine the number of ingress packets from which one sample is taken on a port.
“SHOW SFLOW” on page 1252	Global Configuration	Displays the IP addresses and the UDP ports of the sFlow collectors. Also displays the sampling and polling values for the individual ports.

NO SFLOW COLLECTOR IP

Syntax

```
no sflow collector ip ipaddress
```

Parameters

ipaddress
Specifies the IP address of an sFlow collector.

Mode

Global Configuration mode

Description

Use this command to delete the IP address of an sFlow collector from the switch.

Confirmation Command

“SHOW SFLOW” on page 1252

Example

This example deletes the IP address 152.42.175.22 as an sFlow collector from the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no sflow collector ip 152.42.175.22
```

NO SFLOW ENABLE

Syntax

```
no sflow enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable the sFlow agent to stop the switch from transmitting sample and counter data to the sFlow collector on your network.

Confirmation Command

"SHOW SFLOW" on page 1252

Example

This example disables the sFlow agent:

```
awplus> enable
awplus# configure terminal
awplus(config)# no sflow enable
```

SFLOW COLLECTOR IP

Syntax

```
sflow collector ip ipaddress [port udp_port]
```

Parameters

ipaddress
: Specifies the IP address of the sFlow collector on your network.

udp_port
: Specifies the UDP port number of the sFlow collector. The default is UDP port 6343.

Mode

Global Configuration mode

Description

Use this command to specify the IP address and UDP port of an sFlow collector on your network. The packet sampling data and the packet counters from the ports are sent by the switch to the specified collector. You can specify just one collector.

If the IP address of a collector has already been assigned to the switch, and you want to change it, you must first delete it using the NO version of this command.

Confirmation Command

“SHOW SFLOW” on page 1252

Example

This example enters the IP address of the collector as 149.112.14.152 and the UDP port as 5622:

```
awplus> enable
awplus# configure terminal
awplus(config)# sflow collector ip 149.112.14.152 port 5622
```

SFLOW ENABLE

Syntax

```
sflow enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate the sFlow agent on the switch. The switch uses the agent to gather packet sampling data and packet counters from the designated ports and to transmit the data to the sFlow collector on your network.

Confirmation Command

"SHOW SFLOW" on page 1252

Example

The following example actives the sFlow agent on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# sflow enable
```

SFLOW POLLING-INTERVAL

Syntax

```
sflow polling-interval polling-interval
```

Parameters

polling-interval
: Specifies the maximum amount of time permitted between successive pollings of the packet counters of a port by the agent. The range is 0 to 16777215 seconds.

Mode

Port Interface mode

Description

Use this command to set the polling intervals for the ports. This controls the maximum amount of time permitted between successive pollings of the packet counters on the ports by the sFlow agent. The ports can have different polling intervals.

To remove sFlow monitoring from a port, enter the NO form of this command, NO SFLOW POLLING-INTERVAL.

You must disable the sFlow agent to set or change the polling interval of a port. For instructions, refer to “NO SFLOW ENABLE” on page 1245.

Confirmation Commands

“SHOW SFLOW” on page 1252

Examples

This example sets the polling interval for ports 13 to 15 to 3600 seconds (one hour):

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.13-port1.0.15
awplus(config-if)# sflow polling-interval 3600
```

This example removes sFlow monitoring on port 21 using the NO form of the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.21
awplus(config-if)# no sflow polling-interval
```

SFLOW SAMPLING-RATE

Syntax

```
sflow sampling-rate sampling-rate
```

Parameters

sampling-rate
: Specifies the sampling rate on a port. The possible values are 0 and 256 to 16441700 packets. The value 0 means no sampling.

Mode

Port Interface mode

Description

Use this command to enable or disable packet sampling on the ports and to set the sampling rates. The sampling rate dictates the number of ingress packets from which one sample is taken on a port and sent by the agent to the sFlow collector. For example, a sample rate of 700 on a port means that one sample packet is taken for every 700 ingress packets. The ports can have different sampling rates.

To disable packet sampling on the ports, enter the value 0 for the sampling rate or use the NO form of this command, NO SFLOW SAMPLING-RATE.

You must disable the sFlow agent to set or change the sampling rate of a port. For instructions, refer to “NO SFLOW ENABLE” on page 1245.

Confirmation Commands

“SHOW SFLOW” on page 1252

Examples

This example configures ports 4 to 8 to sample 1 packet in every 350 ingress packets:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4-port1.0.8
awplus(config-if)# sflow sampling-rate 350
```

This example disables packet sampling on port 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.7
awplus(config-if)# no sflow sampling-rate
```

SHOW SFLOW

Syntax

```
show sflow [database]
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the settings of the sFlow agent on the switch. The command displays the same information with or without the DATABASE keyword. Here is an example of the information.

```
Number of Collectors: 1
Collector_address     UDP_port
==================    ========
149.122.78.12         6343

Number of Samplers/Pollers 4
Port    Sample-rate       Polling-interval
====    ===========       ================
1.0.4   1000              60
1.0.12  1000              60
1.0.13  50000             2400
1.0.14  50000             2400

   sFlow Status
   ============
   Enable
```

Figure 216. SHOW SFLOW Command

The fields are described in Table 123.

Table 123. SHOW SFLOW Command

Parameter	Description
Number of Collectors	Number of sFlow collectors that have been defined on the switch by having their IP addresses entered in the agent. The agent can contain up to four IP addresses of sFlow collectors.
Collector_address	The IP address of the sFlow collector on your network. To set this parameter, refer to "SFLOW COLLECTOR IP" on page 1246.
UDP_port	The UDP ports of the sFlow collectors. To set this parameter, refer to "SFLOW COLLECTOR IP" on page 1246.
Number of Samplers/ Pollers	Number of ports configured to be sampled or polled.
Port	The port number.
Sample-rate	The rate of ingress packet sampling on the port. For example, a rate of 500 means that one in every 500 packets is sent to the designated collector. A value of 0 means the agent is not sampling packets on the port. To set this value, refer to "SFLOW SAMPLING-RATE" on page 1250.
Polling-interval	The maximum amount of time (seconds) permitted between successive pollings of the packet counters of the port. To set this value, refer to "SFLOW POLLING-INTERVAL" on page 1248.
sFlow Status	The status of the sFlow agent. If the status is enabled, the switch is sending port performance data to the designated collector. If the status is disabled, the switch is not sending performance data. To enable or disable the agent, refer to "SFLOW ENABLE" on page 1247 and "NO SFLOW ENABLE" on page 1245.

Example

This example displays the settings of the sFlow agent:

```
awplus> enable
awplus# show sflow
```

Chapter 80

LLDP and LLDP-MED

This chapter contains the following topics

Overview

Link Layer Discovery Protocol (LLDP) and Link Layer Discovery Protocol for Media Endpoint Devices (LLDP-MED) allow Ethernet network devices, such as switches and routers, to receive and transmit device-related information to directly connected devices on the network that are also using the protocols, and to store the information that is learned about other devices. The data sent and received by LLDP and LLDP-MED are useful for many reasons. The switch can discover other devices directly connected to it. Neighboring devices can use LLDP to advertise some parts of their Layer 2 configuration to each other, enabling some kinds of misconfiguration to be more easily detected and corrected.

LLDP is a “one-hop” protocol; LLDP information can only be sent to and received by devices that are directly connected to each other, or connected via a hub or repeater. Devices that are directly connected to each other are called neighbors. Advertised information is not forwarded on to other devices on the network. LLDP is a one-way protocol. That is, 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 acknowledgements. LLDP cannot solicit any information from other devices. LLDP operates over physical ports only. For example, it can be configured on switch ports that belong to static port trunks or LACP trunks, but not on the trunks themselves. In addition, LLDP can be configured on switch ports that belong to VLANs, but not on the VLANs themselves.

Each port can be configured to transmit local information, receive neighbor information, or both. LLDP transmits information 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.

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 TLVs are grouped as follows

- ❒ “Mandatory LLDP TLVs” on page 1257
- ❒ “Optional LLDP TLVs” on page 1257
- ❒ “Optional LLDP-MED TLVs” on page 1259

Mandatory LLDP TLVs

Mandatory LLDP TLVs are sent by default on ports that send TLVs. The TLVs are defined in Table 124.

Table 124. Mandatory LLDP TLVs

TLV	Description
Chassis ID	The device's chassis ID number. For Allied Telesis devices, this is the MAC address of the switch.
Port ID	The number of the port that transmitted the advertisements.
Time to Live (TTL)	The length of time in seconds for which the information received in the advertisements remains valid. If the value is greater than zero, the information is stored in the switch's neighbor table. If the value is zero, the information is no longer valid and is removed from the table.

Optional LLDP TLVs

You can configure the switch to send optional LLDP TLVs along with the mandatory TLVs in the LLDPDUs. The following table describes the optional TLVs from the basic management set and the organizationally specific TLVs from the IEEE 802.1AB TLV set (Annex F).

Table 125. Optional LLDP TLVs

TLV	Description
Port description	A port's description. To add a port description, refer to "Adding Descriptions" on page 182 or "DESCRIPTION" on page 208.
System name	The name of the switch. To assign a name, refer to "Adding a Name to the Switch" on page 124 or "HOSTNAME" on page 155.
System description	A description of the device. This may include information about the device hardware and operating system. The AT-FS970M Switch sends its model name as its system description.

Table 125. Optional LLDP TLVs (Continued)

TLV	Description
System capabilities	The device's router and bridge functions, and whether or not these functions are currently enabled. The value for this TLV on the AT-FS970M Switch is Bridge, Router.
Management address	The address of the local LLDP agent. This can be used to obtain information related to the local device.
Port VLAN	The VID of the VLAN in which the transmitting port is an untagged member.
Port and protocol VLANs	Whether the device supports protocol VLANs and, if it does, the protocol VLAN identifiers.
VLAN names	The names of the VLANs in which the transmitting port is either an untagged or tagged member.
Protocol IDs	List of protocols that are accessible through the port, for instance: ❒ FS970M (Loopback) ❒ 0026424203000000 (STP, RSTP, or MSTP) ❒ 888e01 (802.1x) ❒ AAAA03 (EPSR) ❒ 88090101 (LACP) ❒ 00540000e302 (Loop protection) ❒ 0800 (IPv4) ❒ 0806 (ARP) ❒ 86dd (IPv6)
MC/PHY Configuration	The speed and duplex mode of the port and whether the port was configured with Auto-Negotiation.
Power management	The power via MDI capabilities of the port.
Link aggregation	Whether the port is capable of link aggregation and, if so, whether it is currently a member of an aggregator.

Table 125. Optional LLDP TLVs (Continued)

TLV	Description
Maximum frame size	The maximum frame size the port can forward.

The switch does not verify whether a device connected to a port is LLDP-compatible prior to sending mandatory and optional LLDPs.

Optional LLDP-MED TLVs

LLDP-MED is an extension of LLDP that is used between LAN network connectivity devices, such as this switch, and media endpoint devices connected to them, such as IP phones.

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.

LLDP-MED TLVs, unlike the other TLVs, are only sent if the switch detects that an LLDP-MED activated device is connected to a port. Otherwise, LLDP-MED TLVs are not transmitted.

Note
The switch is not an LLDP-MED activated device. The switch, while capable of transmitting LLDP-MED TLVs to other devices, cannot provide LLDP-MED information about itself.

The LLDP-MED TLVs are listed in Table 126.

Table 126. Optional LLDP-MED TLVs

TLV	Description
Capabilities	The LLDP-MED TLVs that are supported and enabled on the switch, and the device type, which for this switch is Network Connectivity Device.
Network policy	The 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 Class of Service (CoS) priority ❒ Voice VLAN Diffserv Code Point (DSCP)

Table 126. Optional LLDP-MED TLVs (Continued)

TLV	Description
Location	Location information configured for the port, in one or more of the following formats: ❒ Civic location ❒ Coordinate location ❒ Emergency Location Identification Number (ELIN)
Extended power management	The following PoE information: ❒ 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.
Inventory management	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

Enabling LLDP and LLDP-MED on the Switch

To enable LLDP and LLDP-MED on the switch, use the LLDP RUN command in the Global Configuration mode. The switch begins to transmit advertisements from those ports that are configured to send TLVs, and begins to populate its neighbor information table as advertisements from the neighbors arrive on the ports. The command does not support any parameters. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# lldp run
```

To deactivate LLDP and LLDP-MED, refer to "Disabling LLDP and LLDP-MED on the Switch" on page 1281.

Configuring Ports to Only Receive LLDP and LLDP-MED TLVs

This is the first in a series of examples that show how to configure the ports for LLDP and LLDP-MED. In this first example, ports 4 and 18 are configured to accept advertisements from their neighbors, but not to send any advertisements.

Table 127. Configuring LLDP and LLDP-MED Ports Example 1

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# interface port1.0.4,port1.0.18`	Enter the Port Interface mode for ports 4 and 18.
`awplus(config-if)# lldp receive`	Configure the ports to accept TLVs from their neighbors.
`awplus(config-if)# no lldp transmit`	Configure the ports not to send any TLVs.
`awplus(config-if)# end`	Return to the Privileged Exec Mode.
`awplus# show lldp interface port1.0.4,port1.0.18`	Use the SHOW LLDP INTERFACE command to confirm the configuration.

If LLDP is active on the switch, the switch begins to populate the neighbor table as TLVs arrive on ports 4 and 18. The neighbors on those ports do not receive any advertisements from the switch because the ports do not send any TLVs.

Configuring Ports to Send Only Mandatory LLDP TLVs

This example illustrates how to configure the ports to receive and send only the mandatory LLDP TLVs. Since the default is for ports to send all mandatory and optional TLVs, you must remove the optional TLVs. This example configures port 16 to 20:

Table 128. Configuring LLDP and LLDP-MED Ports Example 2

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# interface port1.0.16-port1.0.20`	Enter the Port Interface mode for ports 16 to 20.
`awplus(config-if)# lldp transmit receive`	Configure the ports to accept and send TLVs to their neighbors.
`awplus(config-if)# no lldp tlv-select all`	Remove all optional LLDP TLVs with the NO LLDP TLV-SELECT command.
`awplus(config-if)# no lldp med-tlv-select all`	Remove all optional LLDP-MED TLVs with the NO LLDP MED-TLV-SELECT command.
`awplus(config-if)# end`	Return to the Privileged Exec mode.
`awplus# show lldp interface port1.0.16-port1.0.20`	Use the SHOW LLDP INTERFACE command to confirm the configuration.

The ports send only the mandatory LLDP TLVs because no optional TLVs are specified.

Configuring Ports to Send Optional LLDP TLVs

This example illustrates how to configure the ports to send optional LLDP TLVs along with the mandatory TLVs, to their neighbors. Refer to Table 129 for the list of optional LLDP TLVs with brief descriptions. For full descriptions, refer to Table 125 on page 1257.

Table 129. Optional LLDP TLVs - Summary

TLV Designator	Description
port-description	Port description
system-name	System name
system-description	System description
system-capabilities	System capabilities
management-address	Management IP address
port-vlan	Port VLAN
port-and-protocol-vlan	Port and Protocol VLANs
vlan-names	Names of VLANs in which the port is a member.
protocol-ids	Protocol IDs
mac-phy-config	Speed and duplex mode
power-management	Power via MDI capabilities
link-aggregation	Link aggregation status
max-frame-size	The maximum supported frame size of the port.

This example configures ports 18 and 24 to send these optional TLVs, along with the mandatory TLVs:

- port-description
- link-aggregation
- mac-phy-config

Here are the commands to configure the ports to send the TLVs:

Table 130. Configuring Ports to Send TLVs

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# interface port1.0.18,port1.0.24`	Enter the Port Interface mode for ports 18 and 24.
`awplus(config-if)# lldp transmit receive`	Configure the ports to accept and send TLVs to and from their neighbors.
`awplus(config-if)# no lldp tlv-select all`	Remove all optional LLDP TLVs from the ports with the NO LLDP TLV-SELECT command.
`awplus(config-if)# no lldp med-tlv-select all`	Remove all optional LLDP-MED TLVs from the ports with the NO LLDP MED-TLV-SELECT command.

`awplus(config-if)# lldp tlv-select port-description`
`awplus(config-if)# lldp tlv-select link-aggregation`
`awplus(config-if)# lldp tlv-select mac-phy-config`
	Add the optional TLVs you want the ports to transmit, with the LLDP TLV-SELECT command.

`awplus(config-if)# end`	Return to the Privileged Exec Mode.
`awplus# show lldp interface port1.0.18,port1.0.24`	Use the SHOW LLDP INTERFACE command to confirm the configuration.

Configuring Ports to Send Optional LLDP-MED TLVs

This section explains how to configure the ports to send these optional LLDP-MED TLVs:

- Capabilities
- Network-policy

For instructions on how to create LLDP-MED civic, coordinate, and ELIN location entries, refer to the following sections.

The command to configure ports to send the capabilities, network-policy, and inventory-management TLVs is the LLD MED-TLV-SELECT command, which has this format:

`lldp med-tlv-select all|`*`tlv`*

In this example of the command, ports 3 and 4 are configured to send the capabilities and network-policy TLVs:

Table 131. Configuring Ports to Send Optional LLDP-MED TLVs

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# interface port1.0.3,port1.0.4`	Enter the Port Interface mode for ports 3 and 4.
`awplus(config-if)# lldp transmit receive`	Configure the ports to accept and send TLVs to and from their neighbors.
`awplus(config-if)# no lldp tlv-select all`	Remove all optional LLDP TLVs from the ports with the NO LLDP TLV-SELECT command.
`awplus(config-if)# no lldp med-tlv-select all`	Remove all optional LLDP-MED TLVs from the ports with the NO LLDP MED-TLV-SELECT command.
`awplus(config-if)# lldp med-tlv-select capabilities` `awplus(config-if)# lldp tlv-select network-policy`	Configure the ports to transmit the capabilities and network-policy TLVs, with the LLDP MED-TLV-SELECT command.

Table 131. Configuring Ports to Send Optional LLDP-MED TLVs

`awplus(config-if)# end`	Return to the Privileged Exec Mode.
`awplus# show lldp interface port1.0.3,port1.0.4`	Use the SHOW LLDP INTERFACE command to confirm the configuration.

Configuring Ports to Send LLDP-MED Civic Location TLVs

Civic location TLVs specify the physical addresses of network devices. Country, state, street, and building number are only a few examples of the various types of information civic location TLVs can include.

Unlike some of the other LLDP-MED TLVs, such as the capabilities and network policy TLVs, which have pre-set values that you cannot change, a civic location TLV has to be configured before a port will send it. You have to create an entry with the relevant location information, apply it to one or more ports on the switch, and then configure the ports to send it as their civic location TLV.

Here are the main steps to creating civic location TLVs:

1. Starting in the Global Configuration mode, use the LOCATION CIVIC-LOCATION command to assign an ID number to the new Civic Location entry. The command moves you to the Civic mode.

2. Use the parameters in the Civic mode to configure the settings of the entry. An abbreviated list of the parameters is shown in Table 132. For the complete list, refer to Table 142 on page 1313.

Table 132. Abbreviated List of LLDP-MED Civic Location Entry Parameters

Parameter	Example
building	102
city	San-Jose
country	US
county	Santa-Clara
division	North-Brookview
floor	4
house-number	401
house-number-suffix	C
name	J-Smith
post-office-box	102
postal-code	95134
primary-road-name	Eastwood
room	402

Table 132. Abbreviated List of LLDP-MED Civic Location Entry Parameters (Continued)

Parameter	Example
seat	cube-411a
state	CA
street-suffix	Blvd
unit	A11

3. Move to the Port Interface mode of the ports to which the entry is to be assigned. (A civic location entry can be applied to more than one port.)
4. Use the LLDP LOCATION command in the Port Interface mode to attach the location entry to the port.
5. Use the LLDP MED-TLV-SELECT command in the Port Interface mode to configure the ports to send the TLV in their advertisements.

This example creates a civic location entry for port 14. The address information of the entry, which is assigned the ID number 8, is listed here:

1020 North Hacienda Avenue
San Jose, CA 95132

This first series of commands creates the location entry.

Table 133. Commands to Create Location Entry

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# location civic-location identifier 8`	Use the LOCATION CIVIC-LOCATION command to assign an ID number in the range of 1 to 256 to the entry and to enter the Civic mode. This example assigns the entry the ID number 8.

Table 133. Commands to Create Location Entry

awplus(config_civic)# country US awplus(config_civic)# state CA awplus(config_civic)# city San-Jose awplus(config_civic)# building 1020 awplus(config_civic)# primary-road-name North-Hacienda awplus(config_civic)# street-suffix Avenue awplus(config_civic)# postal-code 95132	Use the appropriate parameter commands to define the entry.
awplus(config_civic)# exit	Return to the Global Configuration mode.
awplus(config)# exit	Return to the Privileged Exec mode.
awplus# show location civic-location identifier 8	Use the SHOW LOCATION command to verify the configuration of the new location entry.

This series of commands adds the new location entry to port 14 and configures the port to include the location TLV in its advertisements:

Table 134. Commands to Add New Location

awplus# configure terminal	Enter the Global Configuration mode.
awplus(config)# interface port1.0.14	Enter the Port Interface mode for port 14.
awplus(config-if)# lldp transmit receive	Configure the port to send and receive LLDP advertisements.
awplus(config-if)# lldp location civic-location-id 8	Use the LLDP LOCATION command to add the civic location entry, ID number 8, to the port.
awplus(config-if)# lldp med-tlv-select location	Use the LLDP MED-TLV-SELECT command to configure the port to send the location TLV in its advertisements.
awplus(config-if)# end	Return to the Privileged Exec Mode.
awplus# show location civic-location interface port1.0.14	Use the SHOW LOCATION command to confirm the assignment of the civic location entry to the port.

Table 134. Commands to Add New Location

`awplus# show lldp interface port1.0.14`	Use the SHOW LLDP INTERFACE command to confirm the port is configured to send the location entry.

Configuring Ports to Send LLDP-MED Coordinate Location TLVs

Coordinate location TLVs specify the locations of network devices by their latitudes and longitudes. Here are the main steps to creating coordinate location TLVs:

1. Starting from the Global Configuration mode, use the LOCATION COORD-LOCATION command to assign the new entry an ID number. The command automatically takes you to the Coordinate mode.

2. Use the parameter commands in the Coordinate mode to configure the new entry. The parameters are listed in Table 135.

Table 135. LLDP-MED Coordinate Location Entry Parameters

Parameter	Value
latitude	Latitude value in decimal degrees. The range is -90.0º to 90.0º. The parameter accepts up to eight digits to the right of the decimal point.
lat-resolution	Latitude resolution as the number of valid bits. The range is 0 to 34.
longitude	Longitude value in decimal degrees. The range is -180.0º to 180.0º. The parameter accepts up to eight digits to the right of the decimal point.
long-resolution	Longitude resolution as number of valid bits. The range is 0 to 34 bits.
altitude floors	Altitude in number of floors. The range is -2097151.0 to 2097151.0. The value for this parameter must be specified between the two keywords, as shown here: altitude *n* floors
altitude meters	Altitude in meters. The range is -2097151.0 to 2097151.0. The parameter accepts up to eight digits to the right of the decimal point. The value for this parameter must be specified between the two keywords, as shown here: altitude *n* meters

Table 135. LLDP-MED Coordinate Location Entry Parameters

Parameter	Value
alt-resolution	Altitude resolution as number of valid bits. The range is 0 to 30 bits.
datum nad83-mllw|nad83-navd| wgs84	The geodetic system (or datum) of the coordinates. The selections are: ❒ nad83-mllw - Mean lower low water datum 1983 ❒ nad83-navd - North American vertical datum 1983 ❒ wgs84 - World Geodetic System 1984

3. Move to the Port Interface mode of the ports to which the entry is to be assigned. (A coordinate location entry can be applied to more than one port.)

4. Use the LLDP LOCATION command in the Port Interface mode to attach the location entry to the ports.

5. Use the LLDP MED-TLV-SELECT command in the Port Interface mode to configure the ports to send the TLV in their advertisements.

Here is an example of how to create a coordinate location entry and apply it to a port. The specifications of the entry are:

ID number: 16
Latitude: 37.29153547
Longitude: --121.91528320
Datum: nad83-navd
Altitude: 10.25 meters

The example is assigned to port 15.

The first series of commands creates the coordinate location entry.

Table 136. Commands to Create the Coordinate Location Entry

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.

Table 136. Commands to Create the Coordinate Location Entry

`awplus(config)# location coord-location identifier 16`	Use the LOCATION COORD-LOCATION command to assign an ID number in the range of 1 to 256 to the new location entry, and to enter the Coordinate mode. The entry in this example is assigned the ID number 16.

`awplus(config_coord)# latitude 37.29153547`
`awplus(config-coord)# lat-resolution 12`
`awplus(config_coord)# longitude -121.91528320`
`awplus(config-coord)# long-resolution 33`
`awplus(config_coord)# datum nad83-navd`
`awplus(config_coord)# altitude 10.25 meters`
`awplus(config-coord)# alt-resolution 23`
	Use the parameter commands to define the entry.

`awplus(config_coord)# exit`	Return to the Global Configuration mode.
`awplus(config) exit`	Return to the Privileged Exec mode.
`awplus# show location coord-location identifier 16`	Confirm the configuration of the new coordinate location entry with the SHOW LOCATION command.

This series of commands adds the entry to port 15 and configures the port to include the TLV in its advertisements:

Table 137. Commands to Configure Port to Include TLV with Advertisements

`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# interface port1.0.15`	Enter the Port Interface mode for port 15.
`awplus(config-if)# lldp transmit receive`	Configure the port to send and receive LLDP advertisements.
`awplus(config-if)# lldp location coord-location-id 16`	Use the LLDP LOCATION command to add the coordinate location entry, ID number 16, to the port.
`awplus(config-if)# lldp med-tlv-select location`	Use the LLDP MED-TLV-SELECT command to configure the port to send the location entry in its advertisements.

Table 137. Commands to Configure Port to Include TLV with Advertisements

`awplus(config-if)# end`	Return to the Privileged Exec mode.

`awplus# show location coord-location interface port1.0.15`
 	
`ID Element Type Element Value`
`----------`
`16 Latitude Resolution 12 bits`
`Latitude 37.29153547 degrees`
`Longitude Resolution 33 bits`
`Longitude 121.9152832 degrees`
`Altitude Resolution 23 bits`
`Altitude 10.25000000 meters`
`Map Datum NAD83-NAVD`
	Use the SHOW LOCATION command to confirm the configuration.

`awplus# show lldp interface port1.0.15`	Use the SHOW LLDP INTERFACE command to confirm the port is configured to send the location entry.

Configuring Ports to Send LLDP-MED ELIN Location TLVs

This type of TLV specifies the location of a network device by its ELIN (emergency location identifier number). Here are the main steps to creating ELIN location TLVs:

1. Starting from the Global Configuration mode, use the LOCATION ELIN-LOCATION command to create the new entry.

2. In the Port Interface mode, use the LLDP LOCATION command to add the entry to the appropriate ports. (An ELI location entry can be applied to more than one port.)

3. In the Port Interface mode, use the LLDP MED-TLV-SELECT command to configure the ports to send the TLV in their advertisements.

Here is an example of how to create an ELIN location entry and apply it to a port. The specifications of the entry are:

ID number: 3
ELIN: 1234567890

The example is assigned to port 5.

The first series of commands creates the coordinate location entry.

Table 138. Commands to Create the Coordinate Location Entry

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# location elin-location 1234567890 identifier 3`	Use the LOCATION ELIN-LOCATION command to create the entry.
`awplus(config) exit`	Return to the Privileged Exec mode.
`awplus# show location elin-location identifier 3`	Confirm the configuration of the new ELIN location entry with the SHOW LOCATION command.

This series of commands adds the entry to port 5 and configures the port to include the TLV in its advertisements:

Table 139. Commands to Configure Port to Include TLV with Advertisements

`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# interface port1.0.5`	Enter the Port Interface mode for port 5.
`awplus(config-if)# lldp transmit receive`	Configure the port to send and receive LLDP advertisements.
`awplus(config-if)# lldp location elin-location-id 3`	Use the LLDP LOCATION command to add the ELIN location entry, ID number 3, to the port.
`awplus(config-if)# lldp med-tlv-select location`	Use the LLDP MED-TLV-SELECT command to configure the port to send the location entry in its advertisements.
`awplus(config-if)# end`	Return to the Privileged Exec mode.
`awplus# show location elin-location interface port1.0.5`	Use the SHOW LOCATION command to confirm the configuration.
`awplus# show lldp interface port1.0.5`	Use the SHOW LLDP INTERFACE command to confirm the port is configured to send the location entry.

Removing LLDP TLVs from Ports

To stop ports from sending optional LLDP TLVs, use this command:

```
no lldp tlv-select all|tlv
```

The command is located in the Port Interface mode. You can specify only one TLV at a time in the command. This example stops ports 4 and 5 from including the system capabilities and the management address TLVs in their advertisements:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.4,port1.0.5
awplus(config-if)# no lldp tlv-select system-capabilities
awplus(config-if)# no lldp tlv-select management-address
```

This example stops port 8 from transmitting all optional LLDP TLVs:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.8
awplus(config-if)# no lldp tlv-select all
```

Removing LLDP-MED TLVs from Ports

To remove optional LLDP-MED TLVs from ports, use the NO LLDP MED-TLV-SELECT command:

```
no lldp med-tlv-select capabilities|network-
policy|location|power-management-ext|inventory-
management|all
```

You can specify only one TLV at a time in the command, which is located in the Port Interface mode. This example stops ports 6 and 11 from sending the location and inventory management TLVs in their advertisements:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.6,port1.0.11
awplus(config-if)# no lldp med-tlv-select location
awplus(config-if)# no lldp med-tlv-select inventory-
management
```

This example stops port 15 from transmitting all optional LLDP-MED TLVs:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# no lldp med-tlv-select all
```

Deleting LLDP-MED Location Entries

The command for deleting LLDP-MED location entries from the switch is:

```
no location civic-location|coord-location|elin-location
identifier id_number
```

The command, which is located in the Global Configuration mode, can delete only one entry at a time and must include both the type and the ID number of the location entry to be deleted.

This example deletes the civic location ID 22:

```
awplus> enable
awplus# configure terminal
awplus(config)# no location civic-location-id 22
```

This example deletes the coordinate location ID 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# no location coord-location-id 8
```

This example deletes the ELIN location ID 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# no location elin-location-id 3
```

Disabling LLDP and LLDP-MED on the Switch

To disable LLDP and LLDP-MED on the switch, use the NO LLDP RUN command in the Global Configuration mode. The command has no parameters. After the protocols are disabled, the switch neither sends advertisements to nor collects information from its neighbors. The switch retains its LLDP settings. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# no lldp run
```

Displaying General LLDP Settings

To view the timers and other general LLDP and LLDP-MED settings, use the SHOW LLDP command in the User Exec mode or the Privileged Exec mode. Here is the command:

```
awplus# show lldp
```

Here is an example of the information.

```
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]
Fast Start Count........... 3 [3]

LLDP Global Status:
Total Neighbor Count ...... 47
Neighbors table last updated 0 hrs 0 mins 43 secs ago
```

Figure 217. SHOW LLDP Command

The fields are defined in Table 144 on page 1329.

Displaying Port Settings

To view the LLDP and LLDP-MED settings of the individual ports on the switch, use the SHOW LLDP INTERFACE command. The command has this format:

```
show lldp interface [port]
```

If you omit the PORT variable, as in this example, the command displays the settings for all the ports.

```
awplus# show lldp interface
```

This example displays the settings for ports 17 and 19:

```
show lldp interface port1.0.17,port1.0.19
```

Here is an example of the information.

```
LLDP Port Status and Configuration:
  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    Rx Tx  -- --  0.0.0.0         PdSmSdSc-- Pv--VnPi MpPoLaMf McNpLo--In
2    Rx Tx  -- --  0.0.0.0         PdSmSdSc-- Pv--VnPi MpPoLaMf McNpLo--In
3    Rx --  -- --  0.0.0.0         ---------- -------- -------- ----------
4    Rx Tx  -- --  149.124.36.15   PdSmSdScMa Pv--VnPi MpPoLaMf McNpLo--In
5    Rx Tx  -- --  149.124.36.15   PdSmSdScMa Pv--VnPi MpPoLaMf McNpLo--In
```

Figure 218. SHOW LLDP INTERFACE Command

Displaying or Clearing Neighbor Information

There are two commands for displaying the information the switch has collected from the LLDP and LLDP-MED-compatible neighbors connected to its ports. To view a summary of the information, use the SHOW LLDP NEIGHBORS command in the User Exec mode or the Privileged Exec mode. The command has this format:

```
show lldp neighbors [interface port]
```

This example displays summary information for all the neighbors on the switch:

```
awplus# show lldp neighbors
```

This example displays summary information for the neighbors connected to ports 2 and 3:

```
awplus# show lldp neighbors interface port1.0.2,port1.0.3
```

Here is an example of the summary information:

The fields are defined in Table 146 on page 1340.

To view all the neighbor information, use the SHOW LLDP NEIGHBORS DETAIL command. The command has this format:

```
show lldp neighbors detail [interface port]
```

This example displays detailed information about all the neighbors:

```
awplus# show lldp neighbors detail
```

This example displays detailed information about the neighbor connected to port 23:

```
awplus# show lldp neighbors detail interface 23
```

An example of the information is provided in Figure 145 on page 1336 and Figure 146 on page 1340. The fields are defined in Table 145 on page 1336.

When the TTL value for a neighbor's information expires, the switch automatically deletes the information from the table so that the table contains only the most recent information. But if you need to, you can delete information manually with the CLEAR LLDP TABLE command:

```
clear lldp table [interface port]
```

This example clears the information the switch has received from all the neighbors:

```
awplus> enable
awplus# clear lldp table
```

This example clears the information the switch has received from the neighbor connected to port 11:

```
awplus> enable
awplus# clear lldp table interface port1.0.11
```

Displaying Port TLVs

To view the TLVs of the individual ports on the switch, use the SHOW LLDP LOCAL-INFO INTERFACE command in the User Exec mode or the Privileged Exec mode. This command is useful whenever you want to confirm the TLVs on the ports, such as after you have configured the ports or if you believe that ports are not sending the correct information.

The command has this format:

```
show lldp local-info [interface port]
```

To view the TLVs on all the ports, enter this command:

```
awplus# show lldp local-info
```

This example displays the TLVs currently configured on port 2:

```
awplus# show lldp local-info interface port1.0.2
```

Refer to Figure 222 on page 1333 and Figure 223 on page 1334 for an example of the information. The fields are defined in Table 145 on page 1336.

Displaying and Clearing Statistics

The switch maintains LLDP and LLDP-MED performance statistics for the the individual ports and the entire unit. The command to display the statistics for the entire switch is the SHOW LLDP STATISTICS command in the Privileged Exec mode. (The LLDP and LLDP-MED SHOW commands, unlike the SHOW commands for the other features, are not available in the User Exec mode.) Here is the command:

```
awplus# show lldp statistics
```

Here is an example of the information the command displays. The fields are defined in Table 147 on page 1342.

```
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
```

Figure 219. SHOW LLDP STATISTICS Command

To view the same statistics for individual ports, use this command:

```
show lldp statistics interface port
```

You can view the statistics of more than one port at a time, as demonstrated in this example, which displays the LLDP statistics for ports 2 and 3:

```
awplus# show lldp statistics interface port1.0.2,port1.0.3
```

To clear the statistics on the ports, use this command, which, as with the SHOW command, is found in the Privileged Exec mode:

```
clear lldp statistics [interface port]
```

This example clears the statistics for all the ports on the switch:

```
awplus# clear lldp statistics
```

This example clears the statistics for ports 9 and 10:

```
awplus# clear lldp statistics interface port1.0.9,port1.0.10
```

Chapter 81
LLDP and LLDP-MED Commands

The Link Layer Discovery Protocol commands are summarized in Table 140 and described in detail within the chapter.

Table 140. LLDP and LLDP-MED Commands

Command	Mode	Description
“CLEAR LLDP STATISTICS” on page 1292	Privileged Exec	Clears the LLDP statistics (packet and event counters) on the ports.
“CLEAR LLDP TABLE” on page 1293	Privileged Exec	Clears the LLDP information the switch has received from its neighbors.
“LLDP HOLDTIME-MULTIPLIER” on page 1294	Global Configuration	Sets the holdtime multiplier value, which the switch uses to calculate the Time To Live (TTL) that it advertises to the neighbors.
“LLDP LOCATION” on page 1295	Port Interface	Adds LLDP-MED location information to the ports on the switch.
“LLDP MANAGEMENT-ADDRESS” on page 1297	Port Interface	Replaces the default management IP address TLV on the ports.
“LLDP MED-NOTIFICATIONS” on page 1299	Port Interface	Configures the switch to send LLDP-MED topology change notifications when devices are connected to, or disconnected from, the specified ports.
“LLDP MED-TLV-SELECT” on page 1300	Port Interface	Specifies the LLDP-MED TLVs the ports are to transmit to their neighbors.
“LLDP NON-STRICT-MED-TLV-ORDER-CHECK” on page 1302	Global Configuration	Configures the switch to either accept or discard LLDP-MED advertisements if the TLVs are not in standard order.
“LLDP NOTIFICATIONS” on page 1303	Port Interface	Configures ports to send LLDP SNMP notifications (traps).

Table 140. LLDP and LLDP-MED Commands (Continued)

Command	Mode	Description
“LLDP NOTIFICATION-INTERVAL” on page 1304	Global Configuration	Sets the notification interval, which is the minimum interval between LLDP SNMP notifications (traps).
“LLDP REINIT” on page 1305	Global Configuration	Sets the re-initialization delay, which is the number of seconds that must elapse after LLDP is disabled on a port before it can be re-initialized.
“LLDP RUN” on page 1306	Global Configuration	Activates LLDP on the switch.
“LLDP TIMER” on page 1307	Global Configuration	Sets the transmit interval, which is the interval between regular transmissions of LLDP advertisements.
“LLDP TLV-SELECT” on page 1308	Port Interface	Specifies the optional LLDP TLVs that the ports transmit to their neighbors.
“LLDP TRANSMIT RECEIVE” on page 1311	Port Interface	Configures ports to transmit to and/or accept LLDP and LLDP-MED advertisements from their neighbors.
“LLDP TX-DELAY” on page 1312	Global Configuration	Sets the value of the transmission delay timer, which is the minimum time interval between transmissions of LLDP advertisements due to a change in LLDP local information.
“LOCATION CIVIC-LOCATION” on page 1313	Global Configuration	Creates new LLDP-MED civic location entries and removes parameter values from existing entries.
“LOCATION COORD-LOCATION” on page 1316	Global Configuration	Creates new LLDP-MED coordinate location entries and removes parameter values from existing entries.
“LOCATION ELIN-LOCATION” on page 1319	Global Configuration	Creates new LLDP-MED ELIN location entries and removes parameter values from existing entries.
“NO LLDP MED-NOTIFICATIONS” on page 1320	Port Interface	Configures the switch not to send LLDP-MED topology change notifications when devices are connected to or disconnected from the specified ports.

Table 140. LLDP and LLDP-MED Commands (Continued)

Command	Mode	Description
"NO LLDP MED-TLV-SELECT" on page 1321	Port Interface	Stops ports from transmitting specified LLDP-MED TLVs.
"NO LLDP NOTIFICATIONS" on page 1323	Port Interface	Prevents ports from sending LLDP SNMP notifications (traps).
"NO LLDP RUN" on page 1324	Global Configuration	Disables LLDP on the switch.
"NO LLDP TLV-SELECT" on page 1325	Port Interface	Stops ports from sending optional LLDP TLVs to their neighbors.
"NO LLDP TRANSMIT RECEIVE" on page 1326	Port Interface	Stop ports from transmitting and/or accepting LLDP advertisements.
"NO LOCATION" on page 1327	Port Interface	Removes LLDP-MED location information from the ports on the switch.
"SHOW LLDP" on page 1329	Privileged Exec	Displays general LLDP settings.
"SHOW LLDP INTERFACE" on page 1331	Privileged Exec	Displays the LLDP port settings.
"SHOW LLDP LOCAL-INFO INTERFACE" on page 1333	Privileged Exec	Displays the current configurations of the LLDP advertisements that the ports on the switch can transmit to LLDP-compatible neighbors.
"SHOW LLDP NEIGHBORS DETAIL" on page 1335	Privileged Exec	Displays detailed information the switch has collected from its LLDP-compatible neighbors.
"SHOW LLDP NEIGHBORS INTERFACE" on page 1340	Privileged Exec	Displays a summary of the information gathered by the switch from its LLDP-compatible neighbors.
"SHOW LLDP STATISTICS" on page 1342	Privileged Exec	Displays the LLDP statistics for the entire switch.
"SHOW LLDP STATISTICS INTERFACE" on page 1344	Privileged Exec	Displays the LLDP statistics for the individual ports.
"SHOW LOCATION" on page 1346	Privileged Exec	Displays the civic, coordinate, and ELIN location entries on the switch.

CLEAR LLDP STATISTICS

Syntax

```
clear lldp statistics [interface port]
```

Parameters

port

Specifies a port. You can specify more than one port at a time in this command. Omitting this parameter. specifies all the ports.

Mode

Privileged Exec mode

Description

Use this command to clear the LLDP statistics (packet and event counters) on the ports. You can delete the statistics from all ports or from selected ports.

Examples

This example clears the statistics of all ports:

```
awplus> enable
awplus# clear lldp statistics
```

This example clears the statistics for ports 1 to 3:

```
awplus> enable
awplus# clear lldp statistics port1.0.1-port1.0.3
```

CLEAR LLDP TABLE

Syntax

```
clear lldp table [interface port]
```

Parameters

port

Specifies a port. You can specify more than one port at a time in this command. Omitting this parameter specifies all the ports.

Mode

Privileged Exec mode

Description

Use this command to clear the LLDP and LLDP-MED information the switch has received from its neighbors. You can delete all the information the switch has amassed or only the information from neighbors on selected ports.

Examples

This example clears the information the switch has received from all neighbors:

```
awplus> enable
awplus# clear lldp table
```

This example clears the information the switch has received from the neighbors connected to ports 6 and 8:

```
awplus> enable
awplus# clear lldp table interface port1.0.6,port1.0.8
```

LLDP HOLDTIME-MULTIPLIER

Syntax

```
lldp holdtime-multiplier holdtime-multiplier
```

Parameters

holdtime-multiplier
Specifies the holdtime multiplier value. The range is 2 to 10.

Mode

Global Configuration mode

Description

Use this command to set the holdtime multiplier value. The transmit interval is multiplied by the holdtime multiplier to give the Time To Live (TTL) the switch advertises to the neighbors. The transmit interval is set with “LLDP TIMER” on page 1307.

Confirmation Command

“SHOW LLDP” on page 1329.

Example

This example sets the holdtime multiplier to 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# lldp holdtime-multiplier 7
```

LLDP LOCATION

Syntax

```
lldp location civic-location-id|coord-location-id|elin-
location-id location_id
```

Parameters

civic-location-id
Adds a civic location to the ports.

coord-location-id
Adds a coordinate location to the ports.

elin-location-idA
dds an ELIN location to the ports.

location-id
Specifies the ID number of the location information to be added to the ports. You can add only one location at a time.

Mode

Port Interface mode

Description

Use this command to add LLDP-MED location information to the ports on the switch. The same command is used to add civic, coordinate and ELIN locations. The specified location entry must already exist.

To remove LLDP-MED location information from the ports, use the NO form of this command. You do not have to specify ID numbers when removing location entries from the ports.

Confirmation Command

"SHOW LOCATION" on page 1346.

Examples

This example adds the civic location ID 5 to ports 3 and 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.3,port1.0.4
awplus(config_if)# lldp location civic-location-id 5
```

This example adds the coordinate location ID 11 to port 2:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config_if)# lldp location coord-location-id 11
```

This example adds the ELIN location ID 27 to port 21:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.21
awplus(config_if)# lldp location elin-location-id 27
```

This example removes the civic location from port 25:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.25
awplus(config_if)# no lldp location civic-location-id
```

LLDP MANAGEMENT-ADDRESS

Syntax

```
lldp management-address ipaddress
```

Parameters

ipaddress
Specifies an IP address.

Mode

Port Interface mode

Description

Use this command to replace the default management IP address TLV of a port. The management IP address TLV is optional. A port must be configured to transmit it.

A port can have one of two possible default values for the management IP address TLV. The default value depends on whether a port is a member of the same VLAN as the management IP address, if present. Here are the possible default values for a port:

- A port that belongs to the same VLAN as the management IP address uses the address as its TLV default value.
- A port that belongs to a VLAN that does not have a management IP address, either because no address has been assigned to the switch or it is assigned to a different VLAN, uses the MAC address of the switch as its default value for this TLV.
- A port that belongs to more than one VLAN uses the management IP address as its default value if the address is assigned to its lowest numbered VLAN. Otherwise, it uses the switch's MAC address.

To return a port's management IP address TLV to the default value, use the NO form of this command.

Confirmation Command

"SHOW LLDP INTERFACE" on page 1331

Examples

This example configures port 2 to transmit the IP address 149.122.54.2 as its management IP address TLV:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# lldp management-address 149.122.54.2
```

This example returns the management IP address TLV on port 18 to its default value:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface 18
awplus(config-if)# no lldp management-address
```

LLDP MED-NOTIFICATIONS

Syntax

```
lldp med-notifications
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to configure the switch to send LLDP-MED topology change notifications when devices are connected to, or disconnected from, the specified ports. To prevent the switch from transmitting topology change notifications, refer to "NO LLDP NOTIFICATIONS" on page 1323.

Confirmation Command

"SHOW LLDP INTERFACE" on page 1331

Example

This example configures the switch to send LLDP-MED topology change notifications whenever devices are connected to, or removed from, ports 11 and 17:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11,port1.0.17
awplus(config-if)# lldp med-notifications
```

LLDP MED-TLV-SELECT

Syntax

```
lldp med-tlv-select capabilities|network-
policy|location|power-management-ext|inventory-
management|all
```

Parameters

capabilities
Specifies the capabilities TLV.

network-policy
Specifies the network policy TLV.

location
Specifies the location identification TLV.

power-management-ext
Specifies the extended power-via-MDI TLV.

inventory-management
Specifies the inventory management TLV.

all
Configures a port to send all LLDP-MED TLVs.

Mode

Port Interface mode

Description

Use this command to specify the LLDP-MED TLVs the ports are to transmit to their neighbors. The default setting is for the ports to send all the LLDP-MED TLVs, except for the inventory TLV. You can specify only one TLV per command. To remove LLDP-MED TLVs from the ports, refer to “NO LLDP MED-TLV-SELECT” on page 1321.

Confirmation Command

“SHOW LLDP INTERFACE” on page 1331

Examples

This example configures ports 3 to 8 to send the inventory management TLV to their neighbors:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.3-port1.0.8
awplus(config-if)# lldp med-tlv-select inventory-management
```

This example configures port 2 to send the capabilities and the location TLVs to its neighbor:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# lldp med-tlv-select capabilities
awplus(config-if)# lldp med-tlv-select location
```

LLDP NON-STRICT-MED-TLV-ORDER-CHECK

Syntax

```
lldp non-strict-med-tlv-order-check
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to configure the switch to accept LLDP-MED advertisements even if the TLVs are not in the standard order, as specified in ANSI/TIA-1057. This configuration is useful if the switch is connected to devices that send LLDP-MED advertisements in which the TLVs are not in the standard order.

Use the NO form of this command to configure the switch to accept only advertisements with TLVs that adhere to the correct order. Advertisements in which the TLVs are not in the standard order are discarded by the switch.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

This example configures the switch to accept LLDP-MED advertisements in which the TLVs are not in standard order:

```
awplus> enable
awplus# configure terminal
awplus(config)# lldp non-strict-med-tlv-order-check
```

This example configures the switch to discard LLDP-MED advertisements in which the TLVs are not in standard order:

```
awplus> enable
awplus# configure terminal
awplus(config)# no lldp non-strict-med-tlv-order-check
```

LLDP NOTIFICATIONS

Syntax

```
lldp notifications
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to configure ports to send LLDP SNMP notifications (traps). To prevent ports from transmitting LLDP SNMP notifications, refer to "NO LLDP NOTIFICATIONS" on page 1323.

Confirmation Command

"SHOW LLDP INTERFACE" on page 1331

Example

This example configures ports 2 and 3 to transmit SNMP notifications:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2,port1.0.3
awplus(config-if)# lldp notifications
```

LLDP NOTIFICATION-INTERVAL

Syntax

```
lldp notification-interval interval
```

Parameters

interval
Specifies the notification interval. The range is 5 to 3600 seconds.

Mode

Global Configuration mode

Description

Use this command to set the notification interval. This is the minimum interval between LLDP SNMP notifications (traps).

Confirmation Command

“SHOW LLDP” on page 1329

Example

This example sets the notification interval to 35 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# lldp notification-interval 35
```

LLDP REINIT

Syntax

```
lldp reinit delay
```

Parameters

delay
: Specifies the re-initialization delay value. The range is 1 to 10 seconds.

Mode

Global Configuration mode

Description

Use this command to set the re-initialization delay. This is the number of seconds that must elapse after LLDP is disabled on a port before it can be re-initialized.

Confirmation Command

"SHOW LLDP" on page 1329.

Example

This example set the re-initialization delay to 8 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# lldp reinit 8
```

LLDP RUN

Syntax

```
lldp run
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate LLDP on the switch. Once you have activated LLDP, the switch begins to transmit and accept advertisements on its ports. To deactivate LLDP, refer to “NO LLDP RUN” on page 1324.

Confirmation Command

“SHOW LLDP” on page 1329.

Example

```
awplus> enable
awplus# configure terminal
awplus(config)# lldp run
```

LLDP TIMER

Syntax

```
lldp timer interval
```

Parameters

interval
Specifies the transmit interval. The range is 5 to 32768 seconds.

Mode

Global Configuration mode

Description

Use this command to set the transmit interval. This is the interval between regular transmissions of LLDP advertisements. The transmit interval must be at least four times the transmission delay timer, set with "LLDP TX-DELAY" on page 1312.

Confirmation Command

"SHOW LLDP" on page 1329

Example

This example sets the transmit interval to 60 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# lldp timer 60
```

LLDP TLV-SELECT

Syntax

```
lldp tlv-select all/tlv
```

Parameters

all

Configures a port to send all optional TLVs.

tlv

Specifies an optional TLV that a port should transmit to its neighbor. You can specify only one TLV per command.

Mode

Port Interface mode

Description

Use this command to specify the optional LLDP TLVs that ports are to transmit to their neighbors. You can specify only one TLV in a command. To select all the TLVs, use the ALL option. The optional TLVs are listed in Table 141.

Table 141. Optional TLVs

TLV	Description
all	Sends all optional TLVs.
link-aggregation	Advertises link-aggregation values.
mac-phy-config	Identifies MAC and PHY configuration status.
management-address	Sends the management IP address of the port. To set this TLV, refer to “LLDP MANAGEMENT-ADDRESS” on page 1297.
max-frame-size	Sends the maximum supported frame size of the port. This is not adjustable on the switch.
port-and-protocol-vlan	Transmits whether port and protocol VLANs are supported and enabled on the port, and the list of port and protocol VLAN identifiers.

Table 141. Optional TLVs (Continued)

TLV	Description
port-description	Sends a port's description. To configure a port's description, refer to "Adding Descriptions" on page 182 or "DESCRIPTION" on page 208.
port-vlan	Sends the ID number (VID) of the port-based or tagged VLAN where the port is an untagged member.
power-management	Transmits Power over Ethernet (PoE) information.
protocol-ids	Transmits the protocols that are accessible through the port.
system-capabilities	The device's functions, and whether or not these functions are currently enabled.
system-description	Sends the model name of the switch.
system-name	Sends the name of the switch. To assign a name to the switch, refer to "Adding a Name to the Switch" on page 124 or "HOSTNAME" on page 155.
vlan-names	Sends the names of the port-based and tagged VLANs where the port is a member.

To remove optional TLVs from ports, refer to "NO LLDP TLV-SELECT" on page 1325.

Confirmation Command

"SHOW LLDP INTERFACE" on page 1331

Examples

This example configures ports 3 to 5 to transmit all the optional LLDP TLVs:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.3-port1.0.5
awplus(config-if)# lldp tlv-select all
```

This example configures ports 14 and 22 to transmit the optional LLDP port-description, port-vlan, and system-description TLVs:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.14,port1.0.22
awplus(config-if)# lldp tlv-select port-description
awplus(config-if)# lldp tlv-select port-vlan
awplus(config-if)# lldp tlv-select system-description
```

LLDP TRANSMIT RECEIVE

Syntax

```
lldp transmit receive|transmit
```

Parameters

transmit
: Configures ports to send LLDP advertisements.

receive
: Configures ports to accept LLDP advertisements.

Mode

Port Interface mode

Description

Use this command to configure ports to transmit and/or accept LLDP advertisements. Ports configured to transmit LLDP advertisements send the mandatory TLVs and any optional LLDP TLVs they have been configured to send. Ports configured to receive LLDP advertisements accept all advertisements from their neighbors.

Confirmation Command

"SHOW LLDP INTERFACE" on page 1331.

Examples

This example configures ports 14 and 22 to both transmit and receive LLDP advertisements:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.14,port1.0.22
awplus(config-if)# lldp transmit receive
```

This example configures ports 16 to 22 to only receive LLDP advertisements:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16-port1.0.22
awplus(config-if)# lldp receive
```

LLDP TX-DELAY

Syntax

```
lldp tx-delay tx-delay
```

Parameters

tx-delay
: Specifies the transmission delay timer in seconds. The range is 1 to 8192 seconds.

Mode

Global Configuration mode

Description

Use this command to set the value of the transmission delay timer. This is the minimum time interval between transmissions of LLDP advertisements due to a change in LLDP local information. The transmission delay timer cannot be greater than a quarter of the transmit interface, set with “LLDP TIMER” on page 1307. To view the current value, refer to “SHOW LLDP” on page 1329.

Confirmation Command

“SHOW LLDP” on page 1329

Example

This example sets the transmission delay timer to 120 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# lldp tx-delay 120
```

LOCATION CIVIC-LOCATION

Syntax

```
location civic-location identifier id_number
```

Parameters

id_number

Specifies an ID number for an LLDP-MED civic location entry on the switch. The range is 1 to 256. (This range is separate from the ID number ranges for coordinate and ELIN location entries.) You can specify only one ID number.

Mode

Global Configuration mode

Description

Use this command to create or modify LLDP-MED civic location entries on the switch. This command moves you to the Civic Location mode which contains the parameters you use to define or modify an entry. The parameters are listed in Table 142.

Table 142. LLDP-MED Civic Location Entry Parameters

Parameter	Example
additional-code	12345
additional-information	Updated-Aug-2010
branch-road-name	Slate-Lane
building	102
city	San-Jose
country	US
county	Santa-Clara
division	North-Brookview
floor	4
house-number	401
house-number-suffix	C
landmark	city-library

Table 142. LLDP-MED Civic Location Entry Parameters (Continued)

Parameter	Example
leading-street-direction	West
name	J-Smith
neighborhood	Cliffside
place-type	Business-district
post-office-box	102
postal-code	95134
postal-community-name	Lyton
primary-road-name	Eastwood
road-section	North
room	402
seat	cube-411a
state	CA
street-group	Addison
street-name-post-modifier	Div.
street-name-pre-modifier	West
street-suffix	Blvd
sub-branch-road-name	Boulder-Creek-Avenue
trailing-street-suffix	Avenue
unit	A11

Here are the guidelines to using the location parameters:

- The country parameter must be two uppercase characters (for example, US).
- The other parameters accept uppercase and lowercase characters and have a maximum character length of fifty characters.
- Each parameter can have only one value.
- The values cannot contain spaces.
- You can use as few or as many of the parameters as needed.
- You can combine any of the parameters in a single location entry.
- To remove parameters from a location entry, use the NO forms of the parameter commands (for example, NO UNIT).

After you create a location entry, use "LLDP LOCATION" on page 1295 to assign the location entry to a port, or ports, on the switch.

To remove a civic location entry, use "NO LOCATION" on page 1327.

Confirmation Command

"SHOW LOCATION" on page 1346

Examples

This example creates a new civic location entry that has the following specifications:

ID number: 5
Address: 100 New Adams Way
Floor 2, wiring closet 214
San Jose, CA 95134

```
awplus> enable
awplus# configure terminal
awplus(config)# location civic-location identifier 5
awplus(config_civic)# country US
awplus(config_civic)# city San-Jose
awplus(config_civic)# state CA
awplus(config_civic)# building 100
awplus(config_civic)# primary-road-name New-Adams
awplus(config_civic)# street-suffix Way
awplus(config_civic)# postal-code 95134
awplus(config_civic)# floor 2
awplus(config_civic)# room 214
awplus(config_civic)# exit
awplus(config)#
```

This example removes the defined values for the neighborhood and street-group parameters from LLDP-MED civic location ID 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# location civic-location identifier 3
awplus(config_civic)# no neighborhood
awplus(config_civic)# no street-group
awplus(config_civic)# exit
awplus(config)#
```

LOCATION COORD-LOCATION

Syntax

```
location coordinate-location identifier id_number
```

Parameters

id_number

Specifies an ID number for an LLDP-MED coordinate location entry. The range is 1 to 256. (This range is independent from the ID number ranges for civic and ELIN location entries.) You can specify only one ID number.

Mode

Global Configuration mode

Description

Use this command to create or modify LLDP-MED coordinate location entries on the switch. This command moves you to the Coordinate Location mode which contains the parameters you use to define the entries. The parameters are listed in Table 143.

Table 143. LLDP-MED Coordinate Location Entry Parameters

Parameter	Value
latitude	Latitude value in decimal degrees The range is -90.0º to 90.0º. The parameter accepts up to eight digits to the right of the decimal point.
lat-resolution	Latitude resolution as the number of valid bits. The range is 0 to 34 bits.
longitude	Longitude value in decimal degrees. The range is -180.0º to 180.0º. The parameter accepts up to eight digits to the right of the decimal point.
long-resolution	Longitude resolution as the number of valid bits. The range is 0 to 34 bits.

Table 143. LLDP-MED Coordinate Location Entry Parameters (Continued)

Parameter	Value
altitude floors	Altitude in number of floors. The range is -2097151.0 to 2097151.0. The value for this parameter must be specified between the two keywords, as shown here: altitude *n* floors
altitude meters	Altitude in meters. The range is -2097151.0 to 2097151.0 meters. The parameter accepts up to eight digits to the right of the decimal point. The value for this parameter must be specified between the two keywords, as shown here: altitude *n* meters
alt-resolution	Altitude resolution as the number of valid bits. The range is 0 to 30 bits.
datum nad83-mllw|nad83-navd|wgs84	The geodetic system (or datum) of the coordinates. The selections are: ❒ nad83-mllw - Mean lower low water datum 1983 ❒ nad83-navd - North American vertical datum 1983 ❒ wgs84 - World Geodetic System 1984

This command is also used to remove parameter values from existing LLDP-MED coordinate location entries. To remove parameters, use the NO forms of the parameters listed in Table 143.

To assign coordinate location entries to ports, refer to "LLDP LOCATION" on page 1295.

To remove a coordinate location entry, use "NO LOCATION" on page 1327.

Confirmation Command

"SHOW LOCATION" on page 1346

Examples

This example creates a new coordinate location entry with these specifications.

ID number: 16
Latitude: 37.29153547
Longitude: --121.91528320
Datum: nad83-navd
Altitude: 10.25 meters

```
awplus> enable
awplus# configure terminal
awplus(config)# location coord-location identifier 16
awplus(config_coord)# latitude 37.29153547
awplus(config_coord)# longitude -121.91528320
awplus(config_coord)# datum nad83-navd
awplus(config_coord)# altitude 10.25 meters
awplus(config_coord)# exit
```

This example removes the datum and altitude values without assigning new values from LLDP-MED civic location ID 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# location coord-location identifier 3
awplus(config_coord)# no datum
awplus(config_coord)# no altitude
awplus(config_coord)# exit
```

LOCATION ELIN-LOCATION

Syntax

```
location elin-location elin_id identifier id_number
```

Parameters

elin_id
: Specifies the ELIN (Emergency Location Identification Number) of 10 to 25 digits.

id_number
: Specifies an ID number for an LLDP-MED coordinate location entry on the switch. The range is 1 to 256. (This range is separate from the ranges for civic and coordinate entries.) You can specify only one ID number.

Mode

Global Configuration mode

Description

Use this command to create or modify LLDP-MED ELIN location entries on the switch. To create a new ELIN TLV, specify an unused ID number. To modify an existing ELIN TLV, enter its ID number.

To assign ELIN location entries to ports on the switch, use "LLDP LOCATION" on page 1295.

To remove an ELIN location entry, use "NO LOCATION" on page 1327.

Confirmation Command

"SHOW LOCATION" on page 1346

Example

This example creates a new location entry for ELIN 1234567890, with the ID number 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# location elin-location 1234567890 identifier
15
```

NO LLDP MED-NOTIFICATIONS

Syntax

```
no lldp med-notifications
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to configure the switch not to send LLDP-MED topology change notifications when devices are connected to or disconnected from the specified ports.

Confirmation Command

“SHOW LLDP INTERFACE” on page 1331

Example

This example configures the switch not to send LLDP-MED topology change notifications when devices are connected to or removed from port 19:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.19
awplus(config-if)# no lldp med-notifications
```

NO LLDP MED-TLV-SELECT

Syntax

`no lldp med-tlv-select` *capabilities*|*network-policy*|*location*|*power-management-ext*|*inventory-management*|*all*

Parameters

capabilities
Specifies the capabilities TLV.

network-policy
Specifies the network policy TLV.

location
Specifies the location identification TLV.

power-management-ext
Specifies the extended power-via-MDI TLV.

inventory-management
Specifies the inventory management TLV.

all
Configures a port to stop sending all LLDP-MED TLVs.

Mode

Port Interface mode

Description

Use this command to stop ports from transmitting LLDP-MED TLVs. You can specify only one TLV per command. The default setting is for ports to send all optional LLDP-MED TLVs, except for the inventory TLV.

Confirmation Command

"SHOW LLDP INTERFACE" on page 1331

Examples

This example stops port 8 from transmitting all LLDP-MED TLVs:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.8
awplus(config-if)# no lldp med-tlv-select all
```

This example stops ports 2 and 16 from transmitting the LLDP-MED capabilities and network policy TLVs:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2,port1.0.16
awplus(config-if)# no lldp med-tlv-select capabilities
awplus(config-if)# no lldp med-tlv-select network-policy
```

NO LLDP NOTIFICATIONS

Syntax

```
no lldp notifications
```

Parameters

None

Mode

Port Interface mode

Description

Use this command to prevent ports from sending LLDP SNMP notifications (traps).

Confirmation Command

"SHOW LLDP INTERFACE" on page 1331

Example

This example prevents port 14 from transmitting SNMP notifications:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.14
awplus(config-if)# no lldp notifications
```

NO LLDP RUN

Syntax

```
no lldp run
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable LLDP and LLDP-MED on the switch. The switch, when LLDP and LLDP-MED are disabled, neither sends advertisements to nor collects information from its neighbors. The LLDP settings are retained by the switch.

Confirmation Command

“SHOW LLDP” on page 1329

Example

This example disables LLDP and LLDP-MED on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no lldp run
```

NO LLDP TLV-SELECT

Syntax

```
no lldp tlv-select all/tlv
```

Parameters

all
: Removes all optional LLDP TLVs from a port.

tlv
: Removes an optional TLV from a port. You can specify only one TLV. To remove more than one TLV from a port, repeat the command as many times as needed.

Mode

Port Interface mode

Description

Use this command to stop ports from sending optional LLDP TLVs to their neighbors. The optional TLVs are listed in Table 141 on page 1308.

To stop ports from transmitting LLDP-MED TLVs, refer to "NO LLDP MED-TLV-SELECT" on page 1321.

Confirmation Command

"SHOW LLDP INTERFACE" on page 1331

Examples

This example configures ports 21 and 22 to stop transmitting all optional LLDP TLVs:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.21,port1.0.22
awplus(config-if)# no lldp tlv-select all
```

This example stops the transmission of the management-address and system-capabilities TLVs on port 11:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11
awplus(config-if)# no lldp tlv-select management-address
awplus(config-if)# no lldp tlv-select system-capabilities
```

NO LLDP TRANSMIT RECEIVE

Syntax

```
no lldp transmit/receive
```

Parameters

transmit
: Stops ports from sending LLDP and LLDP-MED advertisements.

receive
: Stops ports from accepting LLDP and LLDP-MED advertisements.

Mode

Port Interface mode

Description

Use this command to stop ports from transmitting and/or accepting LLDP and LLDP-MED advertisements to or from their neighbors.

Confirmation Command

“SHOW LLDP INTERFACE” on page 1331

Examples

This example stops port 12 from transmitting or receiving LLDP advertisements:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12
awplus(config-if)# no lldp transmit receive
```

This example configures ports 3 and 4 to stop receiving LLDP advertisements:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.3-port1.0.4
awplus(config-if)# no lldp receive
```

NO LOCATION

Syntax

```
no location civic-location|coord-location|elin-location
identifier id_number
```

Parameters

civic-location
Deletes a civic location from the switch.

coord-location
Deletes a coordinate location.

elin-location
Deletes an ELIN location.

id_number
Specifies the ID number of the location information to be deleted from the switch. You can specify only one location entry at a time.

Mode

Global Configuration mode

Description

Use this command to delete LLDP-MED location entries from the switch. The same command is used to remove civic locations, coordinate locations and ELIN locations. You can delete only one entry at a time.

Confirmation Command

"SHOW LOCATION" on page 1346

Examples

This example deletes the civic location ID 17:

```
awplus> enable
awplus# configure terminal
awplus(config)# no location civic-location-id 17
```

This example removes the coordinate location IDs 6 and 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# no location coord-location-id 6
awplus(config)# no location coord-location-id 8
```

This example removes the ELIN location IDs 3 and 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# no location elin-location-id 3
awplus(config)# no location elin-location-id 4
```

SHOW LLDP

Syntax

```
show lldp
```

Parameters

None.

Mode

Privileged Exec mode

Description

Use this command to display general LLDP settings. Here is an example of the information.

```
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]
Fast Start Count .......... 3            [3]

LLDP Global Status:
Total Neighbor Count ...... 47
Neighbors table last updated 1 hrs 7 mins 6 secs ago
```

Figure 220. SHOW LLDP Command

The fields are defined in Table 144.

Table 144. SHOW LLDP Command

Field	Description
LLDP Status	Whether LLDP is enabled or disabled on the switch.
Notification Interval	Minimum interval between LLDP notifications.
Tx Timer Interval	Transmit interval between regular transmissions of LLDP advertisements.

Table 144. SHOW LLDP Command (Continued)

Field	Description
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 re-initialization delay. This is the minimum time that must elapse after LLDP has been disabled before it can be initialized again.
Tx Delay	The transmission delay. This is the minimum time interval between transmissions of advertisements due to changes in LLDP local information.
Total Neighbor Count	Number of LLDP neighbors the switch has discovered on all its ports.
Neighbors table last updated	The time since the LLDP neighbor table was last updated.

Example

The following example displays general LLDP settings:

```
awplus# show lldp
```

SHOW LLDP INTERFACE

Syntax

```
show lldp interface [port]
```

Parameters

port

Specifies a port, You can specify more than one port at a time with this command. Omitting this variable displays the LLDP settings for all ports.

Mode

Privileged Exec mode

Description

Use this command to display the LLDP port settings. Here is an example of the information.

```
LLDP Port Status and Configuration:
  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    Rx Tx  -- --  0.0.0.0         PdSmSdSc-- Pv--VnPi MpPoLaMf McNpLo--In
2    Rx Tx  -- --  0.0.0.0         PdSmSdSc-- Pv--VnPi MpPoLaMf McNpLo--In
3    Rx --  -- --  0.0.0.0         ---------- -------- -------- ----------
4    Rx Tx  -- --  149.124.36.15   PdSmSdScMa Pv--VnPi MpPoLaMf McNpLo--In
5    Rx Tx  -- --  149.124.36.15   PdSmSdScMa Pv--VnPi MpPoLaMf McNpLo--In
```

Figure 221. SHOW LLDP INTERFACE Command

Examples

This example displays the LLDP settings for all the ports on the switch:

```
awplus# show lldp interface
```

This example displays the LLDP settings for ports 5, 6 and 11:

```
awplus# show lldp interface port1.0.5,port1.0.6,port1.0.11
```

SHOW LLDP LOCAL-INFO INTERFACE

Syntax

```
show lldp local-info [interface port]
```

Parameters

port

Specifies a port, You can specify more than one port at a time with this command. Omitting this parameter displays the LLDP information for all the ports.

Mode

Privileged Exec mode

Description

Use this command to display the LLDP and LLDP-MED TLVs that the local ports are actively transmitting to their LLDP-compatible neighbors. Ports that have not been activated with "LLDP TRANSMIT RECEIVE" on page 1311 or that have not established links with their LLDP counterparts cannot be displayed with this command. See Figure 222 and Figure 223 on page 1334.

```
LLDP Local Information:
   Chassis ID Type ................. MAC address
   Chassis ID ...................... 0015.77d8.4360
   Port ID Type .................... Port component
   Port ID ......................... 25
   TTL ............................. 120 (secs)
   Port Description ................ Port_25
   System Name ..................... [zero length]
   System Description .............. AT-FS970M/24C
   System Capabilities   - Supported .. Bridge, Router
                         - Enabled .... Bridge, Router
   Management Addresses ............ 0.0.0.0
   Port VLAN ID (PVID) ............. 1
   Port & Protocol VLAN  - Supported . No
                         - Enabled ... No
                         - VIDs ...... 0
   VLAN Names ...................... Default_VLAN
   Protocol IDs .....................
   MAC/PHY Auto-negotiation ......... Supported / Enabled
         Advertised Capability ....... 1000BaseTFD, 100BaseTXFD, 100BaseTX,
                                       10BaseTFD, 10BaseT
         Operational MAU Type ........ 30 (1000BaseTFD)
```

Figure 222. SHOW LLDP LOCAL-INFO INTERFACE Command

```
Power Via MDI (PoE) ..............  Not Supported
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, Inventory
Network Policy ...................  1
      Application Type ...........  Voice
      Frame Format ...............  Untagged
      VLAN ID ....................  1
      Layer 2 Priority ...........  0
      DSCP Value .................  0
Location Identifier ..............  [not advertised]
Extended Power Via MDI (PoE) .....  Not Supported
Inventory Information:
      Hardware Revision ..........  A
      Firmware Revision ..........  v1.0.0
      Software Revision ..........  v1.0.0
      Serial Number ..............  A04161H09020007
      Manufacturer Name ..........  ATI
      Model Name .................  AT-FS970M/24C
      Asset ID ...................  [not advertised]
```

Figure 223. SHOW LLDP LOCAL-INFO INTERFACE Command (continued)

The fields are defined in Table 145 on page 1336.

Examples

This example displays all ports that are actively transmitting TLVs:

```
awplus# show lldp local-info interface
```

This example displays the TLVs being actively transmitted by ports 18 and 23:

```
awplus# show lldp local-info interface port1.0.18,port1.0.23
```

SHOW LLDP NEIGHBORS DETAIL

Syntax

```
show lldp neighbors detail [interface port]
```

Parameters

port

Specifies a port. You can specify more than one port.

Mode

Privileged Exec mode

Description

Use this command to display the information the switch has gathered from its LLDP and LLDP-MED neighbors. To display the information for all the neighbors, do not include the INTERFACE parameter. See Figure 224 and Figure 225 on page 1336.

```
LLDP Detailed Neighbor Information:
   Neighbors table last updated 0 hrs 0 mins 20 secs ago
   Chassis ID Type ................. MAC address
   Chassis ID ...................... 0015.77d8.4360
   Port ID Type .................... Port component
   Port ID ......................... port1.0.25
   TTL ............................. 120 (secs)
   Port Description ................ Port 25
   System Name ..................... [zero length]
   System Description .............. AT-FS970M/24C
   System Capabilities   - Supported .. Bridge, Router
                         - Enabled .... Bridge, Router
   Management Addresses ............ 0.0.0.0
   Port VLAN ID (PVID) ............. 1
   Port & Protocol VLAN  - Supported . No
                         - Enabled ... No
                         - VIDs ...... 0
   VLAN Names ...................... Default_VLAN
   Protocol IDs .....................
   MAC/PHY Auto-negotiation ......... Supported / Enabled
         Advertised Capability ....... 1000BaseTFD, 100BaseTXFD, 100BaseTX,
                                       10BaseTFD, 10BaseT
         Operational MAU Type ........ 30 (1000BaseTFD)
   Power Via MDI (PoE) ............. Not Supported
   Link Aggregation ................ Supported / Disabled
   Maximum Frame Size .............. 1522 (Octets)
```

Figure 224. SHOW LLDP NEIGHBORS DETAIL Command

```
LLDP-MED Device Type ............. Network Connectivity
LLDP-MED Capabilities ............ LLDP-MED Capabilities,
                                    Network Policy,
                                    Location Identification, Inventory
Network Policy ................... 1
      Application Type ........... Voice
      Frame Format ............... Untagged
      VLAN ID .................... 1
      Layer 2 Priority ........... 0
      DSCP Value ................. 0
Location Identifier .............. [not advertised]
Extended Power Via MDI (PoE) ..... Not Supported
Inventory Information:
      Hardware Revision ........... A
      Firmware Revision ........... v1.0.0
      Software Revision ........... v1.0.0
      Serial Number ............... A04161H09020007
      Manufacturer Name ........... ATI
      Model Name .................. AT-FS970M/24C
      Asset ID .................... [not advertised]
```

Figure 225. SHOW LLDP NEIGHBORS DETAIL Command (continued)

The information is explained in Table 145.

Table 145. 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.
System Description	A description of the switch, such as the product name.
System Capabilities (Supported)	The device's functions supported by the switch.

Table 145. SHOW LLDP NEIGHBORS DETAIL Command (Continued)

Parameter	Description
System Capabilities (Enabled)	The device's functions, and whether or not these functions are currently enabled.
Management Address	The IP address of the neighbor.
Port VLAN ID (PVID)	The VLAN ID of the port.
Port & Protocol VLAN (Supported)	The protocol VLANs supported by the switch.
Port & Protocol VLAN (Enabled)	The protocol VLANs enabled on the switch.
Port & Protocol VLAN (VIDs)	The VLAN IDs of the protocol VLANs supported on the switch.
VLAN Names	The names of the port-based and tagged VLANs in which the neighbor port is a member.
Protocol IDs	List of protocols that are accessible through the neighbor's port.
MAC/PHY Auto-negotiation	The speed and duplex mode of the port and whether the port was configured with Auto-Negotiation.
Advertised Capability	The auto-negotiation port capabilities, including 1000BaseTDF, 100BaseTXFD, 100BaseTX, 10BaseTFD, 10BaseT.
Operational MAU Type	The Operational MAU (Medium Attachment Unit) type is the attached device's medium speed such as twisted pair, fiber, or link speed.
Power via MDI (PoE)	The power via MDI capabilities of the port.
Link Aggregation	The link aggregation status.
Maximum Frame Size	The maximum frame size the port can forward.
LLDP-MED Device Type	The LLDP-MED device types are Class I, Class II, Class III, Network Connectivity, Local, and Unknown.
LLDP-MED Capabilities	The LLDP-MED TLVs that are supported and enabled on the switch, and the device type, which for this switch is Network Connectivity Device.

Table 145. SHOW LLDP NEIGHBORS DETAIL Command (Continued)

Parameter	Description
Network Policy	The 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 Class of Service (CoS) priority Voice VLAN Diffserv Code Point (DSCP)
Application Type	The switch supports Application Type 1: Voice.
Frame Format	The frame format specifies the port type connected to a VLAN as tagged or untagged.
VLAN ID	The Virtual Local Area Network ID (VID).
Layer 2 Priority	Layer 2 user priority is in the range of 0 to 7.
DSCP Value	Indicates a DSCP priority level. The range is 0 to 63. A level of 0 is the lowest priority, and a level of 63 is the highest priority.
Location Identifier	Specifies an ID number for an LLDP-MED civic location entry on the switch. The range is 1 to 256.
Extended Power via MDI (PoE)	The extended power via MDI capabilities of the port.
Inventory Information	
Hardware Revision	The hardware revision number of the chassis.
Firmware Revision	The revision number of the bootloader on the chassis.
Software Revision	The revision number of the management software on the chassis.
Serial Number	The serial number of the device.

Table 145. SHOW LLDP NEIGHBORS DETAIL Command (Continued)

Parameter	Description
Manufacturer Name	The name of the company that manufactured the device.
Model Name	The model name.
Asset ID	The asset ID number.

Examples

This example displays the information from all of the neighbors on the switch:

```
awplus# show lldp neighbors
```

This example displays the information from all of the neighbors that are connected to ports 1 and 4:

```
awplus# show lldp neighbors interface port1.0.1,port1.0.4
```

SHOW LLDP NEIGHBORS INTERFACE

Syntax

```
show lldp neighbors interface [port]
```

Parameters

port

Specifies a port. You can specify more than one port at a time with this command.

Mode

Privileged Exec mode

Description

Use this command to view a summary of the information gathered by the switch from its LLDP and LLDP-MED neighbors. To display the information from all the neighbors, do not include a port number.

```
Total number of neighbors on these ports .... 1

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 Class 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 Name  Sys Name                  Cap.        Cl Pwr
--------------------------------------------------------------------------------
1.0.2   0015.77cc.e242     1.0.12                               --B-R---
1.0.3   c286.11bc.a7a4     1.0.16                               --B-R---
```

Figure 226. SHOW LLDP NEIGHBORS INTERFACE Command

The information is explained in Table 146.

Table 146. SHOW LLDP NEIGHBORS INTERFACE Command

Parameter	Description
Local Port	The local port that received the information from the neighbor.
Neighbor Chassis ID	The ID number of the neighbor’s chassis.

Table 146. SHOW LLDP NEIGHBORS INTERFACE Command

Parameter	Description
Neighbor Port Name	The number of the neighbor's port that sent the information.
Neighbor System Name	The neighbor's system name.
Neighbor Capability	Capabilities that are supported and enabled on the neighbor.

Examples

This example displays a summary of the information from all the neighbors connected to the switch:

```
awplus# show lldp neighbors interface
```

This example displays a summary of the information from the neighbors connected to ports 1 and 4:

```
awplus# show lldp neighbors interface port1.0.1,port1.0.4
```

SHOW LLDP STATISTICS

Syntax

```
show lldp statistics
```

Parameters

None

Mode

User Exec mode and Privileged Exec mode

Description

Use this command to display the LLDP statistics for the switch. Here is an example of the information.

```
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
```

Figure 227. SHOW LLDP STATISTICS Command

The information the command displays is explained in Table 147.

Table 147. SHOW LLDP STATISTICS Command

Statistic	Description
Frame Out	Number of LLDPDU frames transmitted.
Frame In	Number of LLDPDU frames received.
Frame In Errored	Number of invalid LLDPDU frames received.
Frame In Dropped	Number of LLDPDU frames received and discarded.

Table 147. SHOW LLDP STATISTICS Command (Continued)

Statistic	Description
TLVs Unrecognized	Number of LLDP TLVs received that were not recognized, but the TLV types were in the range of reserved TLV types
TLVs Discarded	Number of discarded TLVs.
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.

Example

The following example displays LLDP statistics for the switch:

```
awplus# show lldp statistics
```

SHOW LLDP STATISTICS INTERFACE

Syntax

```
show lldp statistics interface [port]
```

Parameters

port
Specifies a port. You can specify more than one port.

Mode

User Exec mode and Privileged Exec mode

Description

Use this command to display the LLDP statistics for the individual ports. Here is an example of the information.

```
LLDP Packet and Event counters:

Port 2.0.2
   Frames:      Out ................... 15
                In ..................... 12
                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
```

Figure 228. SHOW LLDP STATISTICS INTERFACE Command

The information the command displays is explained in Table 148.

Table 148. SHOW LLDP STATISTICS INTERFACE Command

Statistic	Description
Frame Out	Number of LLDPDU frames transmitted by the port.
Frame In	Number of LLDPDU frames received by the port.
Frame In Errored	Number of invalid LLDPDU frames received by the port.

Table 148. SHOW LLDP STATISTICS INTERFACE Command

Statistic	Description
Frame In Dropped	Number of LLDPDU frames the port received and discarded.
TLVs Unrecognized	Number of LLDP TLVs received that were not recognized, but the TLV types were in the range of reserved TLV types
TLVs Discarded	Number of TLVs discarded by the port.
Neighbors New Entries	Number of times the information advertised by the neighbor on the port has been inserted into the neighbor table.
Neighbors Deleted Entries	Number of times the information advertised by the neighbor on the port has been removed from the neighbor table.
Neighbors Dropped Entries	Number of times the information advertised by the neighbor on the port could not be entered into the neighbor table because of insufficient resources.
Neighbors Entry Age-outs Entries	Number of times the information advertised by the neighbor on the port has been removed from the neighbor table because the information TTL interval has expired.

Examples

This example displays the statistics for all the ports:

```
awplus# show lldp statistics interface
```

This example displays the statistics for ports 2, 6 and 18:

```
awplus# show lldp statistics interface
port1.0.2,port1.0.6,port1.0.18
```

SHOW LOCATION

Syntax

```
show location civic-location|coord-location|elin-location
[identifier id-number|interface port]
```

Parameters

id-number
Specifies an ID number of a location entry.

port
Specifies a port. You can specify more than one port.

Mode

User Exec mode and Privileged Exec mode

Description

Use this command to display the civic, coordinate or ELIN location entries on the switch. Here is an example of a civic location entry.

```
ID     Element Type          Element Value
-----------------------------------------------
8      Country               US
       State                 CA
       City                  San-Jose
       Street Suffix         Avenue
       Postal Code           95132
       Building              1020
       Primary Road Name     Pineapple
```

Figure 229. SHOW LOCATION Command for a Civic Location

The information the command displays is explained in Table 149.

Table 149. SHOW LLDP STATISTICS INTERFACE Command

Column	Description
ID	The ID number of the entry.
Element Type	A parameter of the entry.
Element Value	The current value of a parameter.

Examples

The following example displays all the civic location entries on the switch:

```
awplus# show location civic-location
```

The following example displays only civic location entry 8:

```
awplus# show location civic-location identifier 8
```

The following example displays the civic location entry assigned to port 13:

```
awplus# show location civic-location interface port1.0.13
```

The following example displays all the coordinate location entries:

```
awplus# show location coord-location
```

The following example displays only coordinate location entry 16:

```
awplus# show location coord-location identifier 16
```

The following example displays the coordinate location assigned to port 21:

```
awplus# show location coord-location interface port1.0.21
```

The following example displays all the ELIN location entries:

```
awplus# show location elin-location
```

The following example displays only ELIN location entry 3:

```
awplus# show location elin-location identifier 3
```

The following example displays the ELIN location entry assigned to port 23:

```
awplus# show location elin-location interface port1.0.23
```

Chapter 82

Address Resolution Protocol (ARP)

This chapter contains the following topics:

Overview

The Address Resolution Protocol (ARP) is used to associate an IPv4 address with a MAC address used by network nodes. ARP gathers information about mapping between an IPv4 address and a MAC address and stores them in the ARP cache. The ARP cache is located in the RAM of a node. When the node receives a packet from the Network layer, then the node encapsulates the packet into a frame. The node looks up the ARP cache to find out the MAC address of the destination node.

ARP on the Switch

The software supports the following settings:

- Dynamic ARP entries timeout in 300 seconds
- Up to 1024 static ARP entries

Dynamic ARP Entries

ARP entries that are gathered dynamically populate the ARP table in the cache. These are called dynamic ARP entries. Dynamic ARP entries are updated in two ways:

- During regular operations

  When a node receives frames from the media, it records the source IP and MAC addresses.

- Using ARP broadcast requests

  When a node creates a frame and does not find an entry of the destination IPv4 address in the ARP cache, ARP broadcasts a request, including the IP address of the destination host, to all the devices on the LAN. Only the node assigned to the IP address replies to the sender. Based on the reply, the original node makes an ARP entry into the ARP table in the ARP cache.

On the AT-FS970M switches, the dynamic ARP entries are time-stamped and set to time out in 300 seconds.

Static ARP Entries

A manually entered ARP entry is called a static ARP entry. Static ARP entries never expire. You must remove them manually as needed.

The software can support up to 1024 static ARP entries.

Adding Static ARP Entries

In most cases, the ARP table can be populated dynamically; however, the switch allows you to add an ARP entry to the ARP cache manually because there are cases in which you want to add static ARP entries.

One case is when a node connected to the switch does not support ARP. The node does not reply to the ARP request that the switch broadcasts, and an ARP entry for the node cannot be created dynamically. Another case is when routes are fixed and not subject to change. Dynamic ARP entries time out, and ARP re-broadcasts ARP requests even when no change occurs in the network topology. By creating fixed routes statically, you can reduce ARP broadcasting requests.

To add a static ARP entry, use the ARP command in the Global Configuration mode. Here is the format of the command:

`arp` *`ipaddress macaddress port_number`*

You must include both the IP address and the MAC address of the destination node. The MAC address must be entered in one of the following formats:

- xx:xx:xx:xx:xx:xx
- zzzz.zzzz.zzzz

Note
The switch must have a management IP address to support static ARP entries. The IP addresses of the ARP entries must be members of the same subnet as the management IP address. For instructions, refer to Chapter 13, "IPv4 and IPv6 Management Addresses" on page 295.

The following example creates an ARP entry for the IP address 192.168.0.16 and the MAC address 2b:56:c2:78:62:a3 on port 16:

```
awplus> enable
awplus# configure terminal
awplus(config)# arp 192.168.0.16 00:02:c2:78:62:a3
port1.0.16
```

Deleting Static and Dynamic ARP Entries

The ARP cache contains two types of ARP entries: dynamic and static. These types of ARP entries are deleted using different commands shown in Table 150.

Table 150. Deleting ARP Entries

To Do This Task	Use This Command
Delete dynamic ARP entries.	CLEAR ARP-CACHE
Delete static ARP entries.	NO ARP (IP ADDRESS)

The CLEAR ARP-CACHE command deletes all dynamic ARP entries at once.

The following example deletes all of the dynamic ARP entries in the ARP cache:

```
awplus> enable
awplus# clear arp-cache
```

You can delete one static ARP entry with the NO ARP (IP ADDRESS) command. The following example deletes the static ARP entry for the IP address 192.168.1.12:

```
awplus> enable
awplus# configure terminal
awplus(config)# no arp 192.168.1.12
```

Displaying the ARP Table

To display the ARP table on the switch, use the SHOW ARP command in the User Exec mode or the Privileged Exec mode. Here is the format of the command:

```
awplus# show arp
```

An example is shown in Figure 230.

```
IP ARP

ARP Cache Timeout ......... 300 seconds

Total ARP Entries ......... 215

IP Address       MAC Address       Interface   Port         Type
-------------------------------------------------------------------
149.122.34.4     0006.5bb2.4421    vlan2       port1.0.2    Dynamic
149.122.34.12    00a0.d218.eea1    vlan2       port1.0.3    Dynamic
149.122.34.21    00a0.c357.3214    vlan2       port1.0.4    Dynamic
149.122.35.1     00a0.64b1.76a5    vlan8       port1.0.7    Dynamic
```

Figure 230. SHOW ARP Command

The fields are described in Table 152 on page 1360.

Chapter 83

Address Resolution Protocol (ARP) Commands

The ARP commands are summarized in Table 151 and described in detail within the chapter.

Table 151. ARP Commands

Command	Mode	Description
“ARP” on page 1356	Global Configuration	Adds static ARP entries to the ARP cache.
“CLEAR ARP-CACHE” on page 1358	User Exec and Privileged Exec	Deletes all dynamic ARP entries from the ARP cache.
“NO ARP (IP ADDRESS)” on page 1359	Global Configuration	Deletes a static ARP entry from the ARP cache.
“SHOW ARP” on page 1360	User Exec and Privileged Exec	Displays the static and dynamic ARP entries in the ARP cache.

ARP

Syntax

```
arp ipaddress macaddress port_number
```

Parameters

ipaddress
Specifies the IP address of the host.

macaddress
Specifies the MAC address of the host. The MAC address must be entered in one of the following formats:

xx:xx:xx:xx:xx:xx
or
zzzz.zzzz.zzzz

port_number
Specifies the port number associated with the IP address.

Mode

Global Configuration mode

Description

Use this command to add the static ARP entry of a host to the ARP cache. The ARP entry must not already exist in the ARP cache. The switch can support up to 1024 static ARP entries.

Note
The switch must have a management IP address to support static ARP entries. The IP addresses of the ARP entries must be members of the same subnet as the management IP address. To assign an management IP address to the switch, refer to Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.

Confirmation Command

“SHOW ARP” on page 1360

Example

The following example creates an ARP entry for the IP address 192.168.1.3 and the MAC address 7a:54:2b:11:65:72 on port 25:

```
awplus> enable
awplus# configure terminal
awplus(config)# arp 192.168.1.3 7a:54:2b:11:65:72 port1.0.25
```

CLEAR ARP-CACHE

Syntax

```
clear arp-cache
```

Parameters

None

Modes

User Exec mode and Privileged Exec mode

Description

Use this command to delete all dynamic ARP entries from the ARP cache on the switch.

Confirmation Command

“SHOW ARP” on page 1360

Example

The following example deletes all of the ARP entries dynamically added to the ARP cache:

```
awplus> enable
awplus# clear arp-cache
```

NO ARP (IP ADDRESS)

Syntax

```
no arp ipaddress
```

Parameters

ipaddress
Specifies the IP address of a static ARP entry.

Mode

Global Configuration mode

Description

Use this command to delete a static ARP entry from the ARP cache. Static ARP entries do not expire, and you must remove them manually. This command can delete only one ARP entry at a time.

Confirmation Command

"SHOW ARP" on page 1360

Example

The following example deletes the static ARP entry of the IP address 192.168.1.2:

```
awplus> enable
awplus# configure terminal
awplus(config)# no arp 192.168.1.2
```

SHOW ARP

Syntax

```
show arp
```

Parameters

None

Modes

User Exec mode and Privileged Exec mode

Description

Use this command to display the ARP entries in the ARP cache. Figure 231 is an example of the information displayed by this command.

```
IP ARP

ARP Cache Timeout ......... 300 seconds

Total ARP Entries ......... 2

IP Address    MAC Address          Interface    Port         Type
-------------------------------------------------------------------
10.0.0.1      eccd.6d41.9e57       vlan1        port1.0.10   Dynamic
10.0.0.150    000c.2957.96db       vlan1        port1.0.10   Dynamic
10.0.0.75     0000.1a2a.f8bb       vlan1        port1.0.1    Static
```

Figure 231. SHOW ARP Command

The columns of the ARP table are described in Table 152.

Table 152. SHOW ARP Command

Parameter	Description
IP Address	Indicates the IP address of the host.
MAC Address	Indicates the MAC address of the host.
Interface	Indicates the VLAN where the host is a member.
Port	Indicates the port number where the host is connected.

Table 152. SHOW ARP Command (Continued)

Parameter	Description
Type	Indicates the type of entry. The type is one of the following: ❒ Static: Static entry added with the ARP (IP ADDRESS MAC ADDRESS) command. ❒ Dynamic: Dynamic entry learned from ARP request/reply exchanges. ❒ Invalid: Possible nonexistent entry. ❒ Other: Entry automatically generated by the system.

Example

The following example displays the ARP entries in the ARP cache on the switch:

```
awplus# show arp
```

Chapter 84
RMON

This chapter contains the following topics:

Overview

The RMON (Remote MONitoring) MIB is used with SNMP applications to monitor the operations of network devices. The switch supports the four RMON MIB groups listed here:

- Statistic group. This group is used to view port statistics remotely with SNMP programs. For instructions, refer to “RMON Port Statistics” on page 1365.
- History group. This group is used to collect histories of port statistics to identify traffic trends or patterns. For instructions, refer to “RMON Histories” on page 1367.
- Alarm group. This group is used to create alarms that trigger event log messages or SNMP traps when statistics thresholds are exceeded. For instructions, refer to “RMON Alarms” on page 1370.
- Event group. This group is used with alarms to define the actions of the switch when packet statistic thresholds are crossed. For instructions, refer to “RMON Alarms” on page 1370.

For instructions on how to configure SNMP on the switch, refer to Chapter 75, “SNMPv1 and SNMPv2c” on page 1169 or Chapter 76, “SNMPv1 and SNMPv2c Commands” on page 1181.

RMON Port Statistics

To view port statistics using an SNMP program and the RMON section in the MIB, you must configure the switch to reserve areas of memory in which to store the statistics for remote viewing with your SNMP program. These areas of memory are referred to as statistics groups. The switch can have up to eight statistics groups, and each group can store the statistics of a single port. Thus, you can remotely monitor up to eight ports at a time with an SNMP program. (To view the statistics of all the ports, use "SHOW PLATFORM TABLE PORT COUNTERS" on page 239.)

The following sections explain the commands for managing statistics groups:

- "Adding Statistics Groups" next
- "Viewing Statistics Groups" on page 1366
- "Deleting Statistics Groups" on page 1366

Adding Statistics Groups

The command to create statistics groups is the RMON COLLECTION STATS command in the Port Interface mode. Here is the format of the command:

```
rmon collection stats stats_id [owner owner]
```

The STATS_ID parameter is the ID number of the new group. The range is 1 to 65535. The groups will be easier to identify if their ID numbers are the same as the port numbers. For instance, a group assigned to port 16 should be assigned the ID number 16. You will find this particularly useful when you view the statistics with your SNMP program, because they are identified by the statistics group ID numbers and not by the port numbers. If the two numbers are different, you might have difficulty determining which port statistics you are viewing.

The OWNER parameter, used to identify the person who created an entry, is primarily intended for switches that are managed by more than one person, and is optional.

This example of the command assigns RMON statistics groups to ports 5, 16 and 20. The groups are assigned ID numbers that match the port numbers:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# rmon collection stats 5
awplus(config-if)# exit
awplus(config)# interface port1.0.16
```

```
awplus(config-if)# rmon collection stats 16
awplus(config-if)# exit
awplus(config)# interface port1.0.20
awplus(config-if)# rmon collection stats 20
```

You can now use your SNMP program and the RMON section of the MIB tree to view the RMON statistics of the ports. This assumes, of course, that SNMP is activated and configured on the switch.

Viewing Statistics Groups

To confirm the configuration, use the SHOW RMON STATISTICS command in the Privilege Exec mode:

```
awplus# show rmon statistics
```

Here is an example of the information.

```
Stats Index = 5
   Data source ifindex = 5
   Owner Agent

Stats Index = 16
   Data source ifindex = 16
   Owner Agent

Stats Index = 20
   Data source ifindex = 20
   Owner Agent
```

Figure 232. SHOW RMON STATISTICS Command

The fields are described in Table 166 on page 1404.

Deleting Statistics Groups

To delete RMON statistics groups from the ports on the switch, use the NO RMON COLLECTION STATS command in the Port Interface mode. This example of the command removes the group from port 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# no rmon collection stats 5
```

RMON Histories

RMON histories are snapshots of port statistics. They are taken by the switch at predefined intervals and can be used to identify trends or patterns in the numbers or types of ingress packets on the ports on the switch. The snapshots can be viewed with your SNMP program, in the history group of the RMON portion of the MIB tree. (Port histories cannot be viewed through the command line interface.)

The switch stores the snapshots in areas of memory called history groups. There can be up to eight history groups on the switch and each group is capable of storing the snapshots of one port. Consequently, the switch can maintain the histories of up to eight ports at a time.

A history group is further divided into what are called buckets. Each bucket stores one snapshot of statistics of a port. A group can have from 1 to 50 buckets. The more buckets in a group, the more snapshots it can store.

The following sections explain how to manage RMON histories:

- "Adding History Groups" next
- "Displaying History Groups" on page 1368
- "Deleting History Groups" on page 1369

Adding History Groups

The command for creating history groups is the RMON COLLECTION HISTORY command. This command is in the Port Interface mode because history groups are applied on a per-port basis. Here is the format of the command:

```
rmon collection history history_id [buckets buckets]
[interval interval] [owner owner]
```

You can apply a history group to only one port.

The HISTORY_ID number is a history group's ID number. The range is 1 to 65535. As with statistics groups, which are explained earlier in this chapter, history groups are easier to identify when you view them with your SNMP program if their ID numbers are the same as the port numbers. This is because the SNMP program identifies the histories by the group numbers and not by the port numbers.

The BUCKETS variable defines the number of snapshots the switch is to store of the statistics of a port. Each bucket can store one snapshot of RMON statistics. Different ports can have different numbers of buckets. The range is 1 to 50 buckets.

The INTERVAL parameter, which is entered in seconds, specifies how frequently the switch is to take snapshots of the statistics. The range is 1 to 3600 seconds (1 hour). For example, if you want the switch to take one

snapshot every minute for five minutes on a port, you specify five buckets (one bucket for each minute) and an interval of sixty seconds.

After you enter the command, the switch checks its memory to determine whether it has sufficient memory resources to create the history group. If its memory resources are insufficient, it reduces the number of buckets to an amount that can be accommodated by the resources. If there are no available resources, the switch cancels the history group.

The switch takes the first snapshot at the end of the first interval. A history group that has an interval of 1800 seconds, for example, does not take its first snapshot for 30 minutes. Once all the buckets of a group are full, the switch continues storing snapshots by deleting the oldest snapshots as it adds new snapshots. For instance, for a history group of three buckets, the switch deletes the first bucket when it adds the fourth bucket.

To stop a history from gathering any more statistics, you must delete it.

This example configures the switch to take a snapshot of the statistics of port 23 once every hour for fifteen hours:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.23
awplus(config-if)# rmon collection history 23 buckets 15
interval 3600
```

This example of the command configures the switch to take a snapshot of the statistics of port 7 once every thirty minutes for four hours. Eight buckets are required because there are eight thirty minute periods in four hours:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.7
awplus(config-if)# rmon collection history 7 buckets 8
interval 1800
```

Displaying History Groups

You should always check the configuration of a new history entry, just to be sure the switch had adequate memory resources. The command for displaying the entries is the SHOW RMON HISTORY command in the Privileged Exec mode:

```
awplus# show rmon history
```

Here is an example of the information.

```
History Index = 7
   Data source ifindex = 7
   Buckets requested = 8
   Buckets granted = 8
   Interval = 1800
   Owner Agent

History Index = 23
   Data source ifindex = 23
   Buckets requested = 15
   Buckets granted = 15
   Interval = 3600
   Owner Agent
```

Figure 233. SHOW RMON HISTORY Command

The fields are defined in Table 165 on page 1402.

Deleting History Groups

Use the NO RMON COLLECTION HISTORY command in the Port Interface mode to delete history groups from the switch. The switch stops collecting port statistic histories as soon as you enter the command. This example of the command deletes the history group with the ID 2 on port 2:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.2
awplus(config-if)# no rmon collection history 2
```

RMON Alarms

RMON alarms are used to generate alert messages when packet activity on designated ports rises above or falls below specified threshold values. The alert messages can take the form of messages that are entered in the event log on the switch or traps that are sent to SNMP programs.

The switch supports up to eight alarms. Each RMON alarm can monitor one port and one RMON statistic.

RMON alarms consist of two thresholds. There is a rising threshold and a falling threshold. The alarm is triggered if the value of the monitored RMON statistic of the designated port exceeds the rising threshold. The response of the switch is to enter a message in the event log, send an SNMP trap, or both. The alarm is reset if the value of the monitored statistic drops below the falling threshold.

The frequency with which the switch tests the thresholds in an alarm against the actual RMON statistic is controlled by the time interval, a setting you can adjust for each alarm.

Here are the three components that comprise RMON alarms:

- RMON statistics group: A port must have an RMON statistics group if it is to have an alarm. When you create an alarm, you specify the port to which it is to be assigned not by the port number, but rather by the ID number of the port's statistics group. (As explained in "RMON Port Statistics" on page 1365, statistics groups are also used to remotely view port statistics in the RMON portion of the MIB tree.)
- RMON event: An event specifies the action of the switch when the ingress packet activity on a port crosses a statistic threshold defined in an alarm. The choices are to log a message in the event log of the switch, send an SNMP trap to an SNMP workstation, or both. You can create up to eight events. Since there are only three possible actions, and since events can be used with more than one alarm, you probably will not create more than three events.
- Alarm: The last component is the alarm itself. It defines the port statistic to be monitored and the rising and falling thresholds that trigger the switch to perform an event. The thresholds of an alarm can have the same event or different events. The switch supports up to eight alarms.

The following sections explain how to create and manage the various elements of an alarm:

Creating RMON Statistics Groups

The port of an alarm must have an RMON statistics group. Statistics groups are created with the RMON COLLECTION STATS command, described in "RMON Port Statistics" on page 1365. Refer there for instructions on how to create the groups.

Creating RMON Events

The event of an alarm defines the action of the switch when a threshold is crossed. There are three commands for creating RMON events, one command for each action. Here is the command that creates events that enter messages in the event log when statistic thresholds are crossed:

```
rmon event event_id log description description [owner
owner]
```

Here is the command to create events that send SNMP traps:

```
rmon event event_id trap community_string [description
description] [owner owner]
```

This command creates events that both send SNMP traps and enter messages in the event log:

```
rmon event event_id log trap community_string [description
description] [owner owner]
```

The EVENT_ID parameter is a value from 1 to 65535 that uniquely identifies the event.

The COMMUNITY_STRING parameter in the two commands that send SNMP traps identifies an SNMP community string on the switch. The designated community string should have host IP addresses of SNMP workstations that are to receive traps from the alarm. This parameter is case sensitive, and the community string must already exist on the switch. You can specify only one community string.

Using the DESCRIPTION parameter to describe the event makes the event easier to identify. The description can be up to 20 alphanumeric characters. Spaces and special characters are not allowed. This parameter is optional on the two commands that create events that send SNMP traps, but is required in the command that creates an event that only enters a log message.

The owner parameter is useful in situations where more than one person is managing the switch. You can use it to identify who created the event. This parameter is optional in all three commands.

Creating RMON Alarms

After you have added a statistics group to a port and created the event, you are ready to create the alarm with the RMON ALARM command, located in the Global Configuration mode. Here is the format of the command:

```
rmon alarm alarm_id oid.stats_id interval interval
delta|absolute rising-threshold rising-threshold event
rising_event_id falling-threshold falling-threshold event
falling_event_id [owner owner]
```

The ALARM_ID parameter is a value from 1 to 65535 that uniquely identifies the alarm. (Remember, the switch is limited to eight alarms at one time.)

The OID.STATS_ID parameter has two parts. The first part specifies the OID of the RMON statistic the alarm is to monitor. You have to specify the statistic by its OID. For example, the OID for etherStatsOctets is 1.3.6.1.2.1.16.1.1.1.4.

Table 153 is a partial list of the MIB object names and numbers for use in the OID portion of the variable. For the complete list, refer to Table 162 on page 1388.

Table 153. Abbreviated List of MIB Object Names and OID Numbers

MIB Name	OID Number
etherStatsDropEvents	1.3.6.1.2.1.16.1.1.1.3.*stats_id*
etherStatsOctets	1.3.6.1.2.1.16.1.1.1.4.*stats_id*
etherStatsPkts	1.3.6.1.2.1.16.1.1.1.5.*stats_id*
etherStatsBroadcastPkts.*stats_id*	1.3.6.1.2.1.16.1.1.1.6.*stats_id*
etherStatsMulticastPkts.*stats_id*	1.3.6.1.2.1.16.1.1.1.7.*stats_id*

The second part of the OID.STATS_ID variable is the ID number of the statistics group on the port the alarm is to monitor. The port is specified indirectly in the command, by the ID number of the statistics group. For example, if the alarm is to monitor port 4, use the STATS_ID variable to enter the ID number of the statistics group on port 4. If you follow the advice given earlier in this chapter, of always numbering statistics groups the same as the port numbers, the port numbers and the ID numbers of the statistics group should always be the same, thus lessening the chance of an alarm being assigned to the wrong port.

The INTERVAL parameter specifies how frequently the switch is to poll

the statistics group to determine whether a threshold has been crossed. The range is 1 to 65535 seconds.

The DELTA and ABSOLUTE parameters define the type of change that has to occur for the monitored statistic to trigger the alarm. The DELTA setting compares a threshold against the difference between the current and previous values of the statistic, while the ABSOLUTE setting compares a threshold against the current value of the statistic.

The raising and falling thresholds are the values which, when crossed, cause the switch to perform the specified events. The range for both thresholds is 1 to 65535.

The OWNER parameter is used to indicate who created the alarm. This parameter is optional.

Creating an Alarm - Example 1

This example creates an alarm that monitors the change per minute in the number of all ingress packets for port 22. The RMON statistic is etherStatsPkts, and its OID is 1.3.6.1.2.1.16.1.1.1.5. The alarm is assigned the ID number 1 and triggers event 3, which enters a message in the event log if the ingress traffic on the port exceeds 20000 packets per minute or falls below 1000 packets.

The first sequence of steps adds an RMON statistics group to port 22. The alarm will not work unless the switch is gathering statistics from the port to use with RMON. (You can skip this phase if the port already has a statistics group.)

Table 154. Add RMON Statistics Group to Port

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# interface port1.0.22`	Enter the Port Interface mode for port 22.
`awplus(config-if)# rmon collection stats 22`	Add a statistics group to the port with the RMON COLLECTION STATS command. The entries are easier to remember if their ID numbers are the same as the port numbers to which they are assigned.
`awplus(config-if)# end`	Return to the Privileged Exec mode.

Table 154. Add RMON Statistics Group to Port

`awplus# show rmon statistics`	Use the SHOW RMON STATISTICS command to verify the configuration of the new group.

The next series of steps creates the event, which enters a message in the event log whenever the thresholds are crossed:

Table 155. Create an RMON Event

`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# rmon event 3 log description Enter_log_message`	Create the event with the RMON EVENT LOG command.
`awplus(config)# exit`	Return to the Privileged Exec mode.
`awplus# show rmon event`	Use the SHOW RMON EVENT command to verify the configuration of the new event.

Here are the specifications of the alarm:

- Alarm ID number 1
- Monitored statistic: etherStatsPkts - OID 1.3.6.1.2.1.16.1.1.1.5 (all ingress packets)
- Statistics group ID number: 22
- Interval: 60 seconds
- Rising threshold: 20000 packets
- Rising threshold event: 3
- Falling threshold: 1000 packets
- Falling threshold event: 3

Here are the steps to creating the alarm:

Table 156. Creating an RMON Alarm

`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# rmon alarm 1 1.3.6.1.2.1.16.1.1.1.5.22 interval 60 delta rising-threshold 20000 event 3 falling-threshold 1000 event 3`	Create the alarm with the RMON ALARM command.
`awplus(config)# exit`	Return to the Privileged Exec mode.
`awplus# show rmon alarm`	Use the SHOW RMON ALARM command to verify the configuration of the new alarm.

Creating an Alarm - Example 2

This example creates an alarm that monitors the ingress broadcast traffic on port 20. The RMON statistic is etherStatsBroadcastPkts, and its OID is 1.3.6.1.2.1.16.1.1.1.6. The alarm triggers an event if the traffic exceeds 10,000 packets or falls below 1,000 packets per minute. Both thresholds have the same event, which logs a message in the event log and sends an SNMP trap when either threshold is crossed.

Phase 1: Creating the SNMP Community String and Activating SNMP

This example requires a community string because the event sends traps. The community string will be called “Station12ap” and will have the host ID addresses 149.211.243.12 and 149.211.243.75. Here are the steps to create the community string, assign it the IP addresses of the host nodes and activate SNMP on the switch.

Table 157. Creating the SNMP Community String and Activating SNMP

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# snmp-server`	Activate SNMP on the switch with the SNMP-SERVER command.
`awplus(config)# snmp-server enable trap`	Activate the transmission of traps with the SNMP-SERVER ENABLE TRAP command.

Table 157. Creating the SNMP Community String and Activating SNMP

awplus(config)# snmp-server community Station12ap rw	Create the community string with the SNMP-SERVER COMMUNITY command.
awplus(config)# snmp-server host 149.211.243.12 traps version 2c Station12ap awplus(config)# snmp-server host 149.211.243.75 traps version 2c Station12ap	Add the IP addresses of the trap receivers to the community string with the SNMP-SERVER HOST command.
awplus(config)# exit	Return to the Privileged Exec mode.
awplus# show snmp-server	Verify that SNMP is enabled on the switch with the SHOW SNMP-SERVER command.
awplus# show snmp-server community	Verify the new community string with the SHOW SNMP-SERVER COMMUNITY command.
awplus# show running-config	Verify the host IP addresses of the community string with the SHOW RUNNING-CONFIG command.

Phase 2: Adding the RMON Statistics Group to the Port

The steps here add a statistics group to port 20 so that the port statistics are collected by the switch for use with RMON.

Table 158. Adding the RMON Statistics Group to the Port

awplus# configure terminal	Enter the Global Configuration mode.
awplus(config)# interface port1.0.20	Enter the Port Interface mode for port 20.
awplus(config-if)# rmon collection stats 20	Add a statistics group to the port with the RMON COLLECTION STATS command. The groups are easier to remember when their ID numbers are the same as the port numbers.
awplus(config-if)# end	Return to the Privileged Exec mode.
awplus# show rmon statistics	Use the SHOW RMON STATISTICS command to verify the configuration of the new group.

Phase 3: Creating the Event

The event in this example is to send an SNMP trap and to log a message in the event log. The event is assigned the ID number 2.

Table 159. Creating the Event

`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# rmon event 2 log trap Station12ap description trap_and_log_event`	Create the event with the RMON EVENT LOG TRAP command. It is important to remember that the community string is case sensitive.
`awplus(config)# exit`	Return to the Privileged Exec mode.
`awplus# show rmon event`	Use the SHOW RMON EVENT command to verify the configuration of the new event.

Phase 4: Creating the Alarm

Here are the specifications of the alarm:

- Alarm ID number 2
- Monitored statistic: etherStatsBroadcastPkts - OID 1.3.6.1.2.1.16.1.1.1.6 (broadcast packets)
- Statistics group ID number: 20
- Interval: 60 seconds
- Rising threshold: 10000 packets
- Rising threshold event: 2
- Falling threshold: 1000 packets
- Falling threshold event: 2

Here are the steps to creating the alarm.

Table 160. Creating the Alarm

`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# rmon alarm 2 1.3.6.1.2.1.16.1.1.1.6.20 interval 60 delta rising-threshold 10000 event 2 falling-threshold 1000 event 2`	Create the alarm with the RMON ALARM command.

Table 160. Creating the Alarm

`awplus(config)# exit`	Return to the Privileged Exec mode.
`awplus# show rmon alarm`	Use the SHOW RMON ALARM command to verify the new alarm.

Chapter 85
RMON Commands

The RMON commands are summarized in Table 161 and described in detail within the chapter.

Table 161. RMON Commands

Command	Mode	Description
“NO RMON ALARM” on page 1383	Global Configuration	Deletes alarms from the switch.
“NO RMON COLLECTION HISTORY” on page 1384	Port Interface	Deletes history groups from the ports on the switch.
“NO RMON COLLECTION STATS” on page 1385	Port Interface	Deletes statistics groups from the ports on the switch.
“NO RMON EVENT” on page 1386	Global Configuration	Deletes events from the switch.
“RMON ALARM” on page 1387	Global Configuration	Creates alarms to monitor RMON statistics on the ports.
“RMON COLLECTION HISTORY” on page 1390	Port Interface	Creates history groups on the ports.
“RMON COLLECTION STATS” on page 1392	Port Interface	Creates statistics groups on the ports.
“RMON EVENT LOG” on page 1393	Global Configuration	Creates alarm events that enter entries in the event log.
“RMON EVENT LOG TRAP” on page 1394	Global Configuration	Creates alarm events that enter entries in the event log and send SNMP traps.
“RMON EVENT TRAP” on page 1396	Global Configuration	Creates alarm events that send SNMP traps.
“SHOW RMON ALARM” on page 1398	Privileged Exec	Displays the RMON alarms on the switch.
“SHOW RMON EVENT” on page 1400	Privileged Exec	Displays the RMON events on the switch.

Table 161. RMON Commands (Continued)

Command	Mode	Description
“SHOW RMON HISTORY” on page 1402	Privileged Exec	Displays the RMON history groups that are assigned to the ports on the switch.
“SHOW RMON STATISTICS” on page 1404	Privileged Exec	Displays the statistics groups that are assigned to the ports.

NO RMON ALARM

Syntax

```
no rmon alarm alarm_id
```

Parameters

alarm_id
: Specifies the ID number of the alarm you want to delete. You can delete only one alarm at a time. The range is 1 to 65535.

Mode

Global Configuration mode

Description

Use this command to delete alarms from the switch.

Confirmation Command

"SHOW RMON ALARM" on page 1398

Example

This example deletes the alarm with ID 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# no rmon event 3
```

NO RMON COLLECTION HISTORY

Syntax

```
no rmon collection history collection_id
```

Parameters

collection_id
: Specifies the ID number of the history group you want to delete. You can delete only one group at a time. The range is 1 to 65535.

Mode

Port Interface mode

Description

Use this command to delete history groups from ports on the switch.

Confirmation Command

“SHOW RMON HISTORY” on page 1402

Example

This example deletes the history group that has the ID number 17 from port 17:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17
awplus(config-if)# no rmon collection history 17
```

NO RMON COLLECTION STATS

Syntax

```
no rmon collection stats stats_id
```

Parameters

stats_id
: Specifies the ID number of the statistics group you want to delete. The range is 1 to 65535.

Mode

Port Interface mode

Description

Use this command to delete statistics groups from ports on the switch.

Confirmation Command

"SHOW RMON STATISTICS" on page 1404

Example

This example deletes the statistics group with ID 11 from port 11:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.11
awplus(config-if)# no rmon collection stats 11
```

NO RMON EVENT

Syntax

```
no rmon event event_id
```

Parameters

event_id
: Specifies the ID number of the event you want to delete from the switch. You can delete only one event at a time. The range is 1 to 65535.

Mode

Global Configuration mode

Description

Use this command to delete events from the switch.

Confirmation Command

“SHOW RMON EVENT” on page 1400

Example

This example delete the event with ID 2:

```
awplus> enable
awplus# configure terminal
awplus(config)# no rmon event 2
```

RMON ALARM

Syntax

```
rmon alarm alarm_id oid.stats_id interval interval
delta|absolute rising-threshold rising-threshold event
rising_event_id falling-threshold falling-threshold event
falling_event_id [owner owner]
```

Parameters

alarm_id

Specifies the ID number of a new alarm. The range is 1 to 65535.

oid

Specifies the OID of the RMON statistic the alarm should monitor. You can specify just one statistic.

stats_id

Specifies the ID number of the statistics group that is assigned to the port the alarm is to monitor. You can specify just one statistics group, and the group must already exist.

For more information on the OID and STATS_ID variables, refer to "Creating RMON Alarms" on page 1372.

interval

Specifies the polling interval in seconds. The range is 1 to 65535 seconds.

delta

Specifies that the alarm is based on the difference between the current value and preceding value of the designated statistic.

absolute

Specifies that the alarm is based on the current value of the designated RMON statistic.

rising_threshold

Specifies the rising threshold which, when crossed, causes the switch to perform the specified event. The range is 1 to 65535.

rising_event_id

Specifies the ID number of the event the switch is to perform when the rising threshold is crossed. The event must already exist.

falling_threshold

Specifies the falling threshold which, when crossed, causes the switch to perform the specified event. The range is 1 to 65535.

rising_event_id
Specifies the ID number of the event the switch is to perform when the falling threshold is crossed. The event must already exist.

owner
Specifies the owner of the alarm.

Mode

Global Configuration mode

Description

Use this command to create RMON alarms. RMON alarms monitor the values of SNMP objects and trigger events when the values of the monitored objects cross specified thresholds. Here are the guidelines to this command:

- The switch supports up to eight alarms.
- An alarm can designate just one RMON statistic.
- An alarm can belong to just one port at a time.
- The port of an alarm must have an RMON statistics group. You must create the group before the alarm. For instructions, refer to “Adding Statistics Groups” on page 1365 or “RMON COLLECTION STATS” on page 1392.
- The port of an alarm is specified indirectly in the command. You use the STATS_ID parameter to specify the ID number of the RMON statistics group you added to the port.
- The command must include both rising and falling thresholds.
- The rising and falling thresholds can have different events or the same event. The events must already exist.

The OID parameter in the command specifies the OID of the MIB statistic the alarm is to monitor. The MIB object must be specified by its OID number. An alarm can have just one MIB object. Table 162 lists the possible object names and OID numbers. (The STATS_ID variable is the ID number of a statistics group through which the alarm monitors a port.)

Table 162. MIB Object Names and ID Numbers

MIB Name	OID Number
etherStatsDropEvents	1.3.6.1.2.1.16.1.1.1.3.*stats_id*
etherStatsOctets	1.3.6.1.2.1.16.1.1.1.4.*stats_id*
etherStatsPkts	1.3.6.1.2.1.16.1.1.1.5.*stats_id*
etherStatsBroadcastPkts	1.3.6.1.2.1.16.1.1.1.6.*stats_id*

Table 162. MIB Object Names and ID Numbers (Continued)

MIB Name	OID Number
etherStatsMulticastPkts	1.3.6.1.2.1.16.1.1.1.7.*stats_id*
etherStatsCRCAlignErrors	1.3.6.1.2.1.16.1.1.1.8.*stats_id*
etherStatsUndersizePkts	1.3.6.1.2.1.16.1.1.1.9.*stats_id*
etherStatsOversizePkts	1.3.6.1.2.1.16.1.1.1.10.*stats_id*
etherStatsFragments	1.3.6.1.2.1.16.1.1.1.11.*stats_id*
etherStatsJabbers	1.3.6.1.2.1.16.1.1.1.12.*stats_id*
etherStatsCollisions	1.3.6.1.2.1.16.1.1.1.13.*stats_id*
etherStatsPkts64Octets	1.3.6.1.2.1.16.1.1.1.14.*stats_id*
etherStatsPkts65to127Octets	1.3.6.1.2.1.16.1.1.1.15.*stats_id*
etherStatsPkts128to255Octets	1.3.6.1.2.1.16.1.1.1.16.*stats_id*
etherStatsPkts256to511Octets	1.3.6.1.2.1.16.1.1.1.17.*stats_id*
etherStatsPkts512to1023Octets	1.3.6.1.2.1.16.1.1.1.18.*stats_id*
etherStatsPkts1024to1518Octets	1.3.6.1.2.1.16.1.1.1.19.*stats_id*

Confirmation Command

"SHOW RMON ALARM" on page 1398

Example

This example creates an RMON alarm that monitors ingress multicast packets (OID 1.3.6.1.2.1.16.1.1.1.7) on a port assigned a statistics group with the ID number 5. The alarm triggers event ID number 1 if the number of multicast packets exceeds 10,000 packets per minute or falls below 1,000 packets:

```
awplus> enable
awplus# configure terminal
awplus(config)# rmon alarm 1 1.3.6.1.2.1.16.1.1.1.7.5
interval 60 delta rising-threshold 10000 event 1 falling-
threshold 1000 event 1
```

Note
For examples that illustrate how to create all of the components of RMON alarms, refer to "RMON Alarms" on page 1370.

RMON COLLECTION HISTORY

Syntax

```
rmon collection history history_id [buckets buckets]
[interval interval] [owner owner]
```

Parameters

history_id
Specifies the ID number of a new history group. The range is 1 to 65535.

buckets
Specifies the number of requested buckets to store snapshots. The range is 1 to 50 buckets.

interval
Specifies the polling interval in seconds. The range is 1 to 3600 seconds.

owner
Specifies an owner of up to 20 alphanumeric characters for the event. Spaces and special characters are not allowed.

Mode

Port Interface mode

Description

Use this command to add RMON history groups to the ports on the switch. History groups enable the switch to capture snapshots of the RMON statistics of the ports over time. You can view the snapshots with an SNMP program to look for trends or patterns in the numbers or types of ingress packets on the ports.

A history group can be applied to just one port, and the switch can support up to eight entries at a time. Thus, you can collect statistics histories on up to eight ports at a time.

The BUCKETS variable defines the number of snapshots the switch is to take of the RMON statistics of a port. Different ports can have different numbers of buckets. The INTERVAL parameter, which is entered in seconds, specifies how frequently the switch is to take the snapshots of the statistics. For example, if you want the switch to take one snapshot every minute for five minutes on a port, you would specify five buckets (one bucket for each minute) and an interval of sixty seconds.

RMON statistics histories are only viewable from an SNMP application program. There are no commands in the command line interface for viewing histories.

Confirmation Command

"SHOW RMON HISTORY" on page 1402

Examples

This example creates a history group that takes a snapshot of the RMON statistics on port 14 every fifteen minutes (900 seconds) for two hours. The group requires eight buckets because there are eight fifteen-minute intervals in two hours. The group is assigned the ID number 1:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.14
awplus(config-if)# rmon collection history 1 buckets 8
interval 900
```

This example creates a history group that takes a snapshot of the RMON statistics on port 7 every hour (3600 seconds) for twelve hours. The group, which is assigned the ID number 5, requires 12 buckets, one for each hour:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.7
awplus(config-if)# rmon collection history 5 buckets 12
interval 3600
```

RMON COLLECTION STATS

Syntax

```
rmon collection stats stats_id [owner owner]
```

Parameters

stats_id
: Specifies the ID number of a new statistics group. The range is 1 to 65535.

owner
: Specifies an owner of up to 20 alphanumeric characters for the group. Spaces and special characters are not allowed.

Mode

Port Interface mode

Description

Use this command to create RMON statistics groups on the ports of the switch. The groups are used to view RMON port statistics from SNMP workstations on your network and to create RMON alarms.

A port can have only one RMON statistics group, and a group can be assigned to just one port at a time. The switch supports up to eight groups, allowing you to monitor up to eight ports at one time.

Confirmation Command

“SHOW RMON STATISTICS” on page 1404

Example

This example adds a statistics group to port 16 and assigns it the ID number 16:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16
awplus(config-if)# rmon collection stats 16
```

RMON EVENT LOG

Syntax

```
rmon event event_id log description description [owner
owner]
```

Parameters

event_id
Specifies the ID number of a new event. The range is 1 to 65535.

description
Specifies a description of up to 20 alphanumeric characters for the event. Spaces and special characters are not allowed.

owner
Specifies an owner of up to 20 alphanumeric characters for the event. Spaces and special characters are not allowed.

Mode

Global Configuration mode

Description

Use this command to create events for RMON alarms. This type of event enters a message in the event log when a rising or falling threshold of an alarm is crossed. The same event can be assigned to multiple alarms.

Confirmation Command

"SHOW RMON EVENT" on page 1400.

Example

The following example creates an event with an ID of 2, with a description of "port5_traffic," and an owner named "John" for RMON alarms:

```
awplus> enable
awplus# configure terminal
awplus(config)# rmon event 2 log description port5_traffic
owner John
```

RMON EVENT LOG TRAP

Syntax

```
rmon event event_id log trap community_string [description
description] [owner owner]
```

Parameters

event_id
Specifies the ID number of a new event. The range is 1 to 65535.

community_string
Specifies the community string assigned the IP addresses of the network devices that are to receive the trap. You can specify just one community string. The community string is case sensitive and must already exist on the switch.

description
Specifies a description of up to 20 alphanumeric characters for the event. Spaces and special characters are not allowed.

owner
Specifies an owner of up to 20 alphanumeric characters for the event. Spaces and special characters are not allowed. You must enter a description to include an owner.

Mode

Global Configuration mode

Description

Use this command to create events for RMON alarms. This type of event enters a message in the event log and sends an SNMP trap when a rising or falling threshold of an alarm is crossed. The same event can be assigned to multiple alarms.

Confirmation Command

“SHOW RMON EVENT” on page 1400.

Example

This example creates an event for RMON alarms with an ID of 2, a community string of "station43a," a description of "broadcast_packets," and an owner named, "jones:"

```
awplus> enable
awplus# configure terminal
awplus(config)# rmon event 2 log trap station43a description
broadcast_packets owner jones
```

RMON EVENT TRAP

Syntax

```
rmon event event_id trap community_string [description
description] [owner owner]
```

Parameters

event_id
Specifies the ID number of a new event. The range is 1 to 65535.

community_string
Specifies the community string assigned the IP addresses of the network devices that are to receive the trap. You can specify just one community string. The community string is case sensitive and must already exist on the switch.

description
Specifies a description of up to 20 alphanumeric characters for the event. Spaces and special characters are not allowed.

owner
Specifies an owner of up to 20 alphanumeric characters for the event. Spaces and special characters are not allowed. You must enter a description to include an owner.

Mode

Global Configuration mode

Description

Use this command to create events for RMON alarms. This type of event sends an SNMP trap when a rising or falling threshold of an alarm is crossed. The same event can be assigned to multiple alarms.

Confirmation Command

“SHOW RMON EVENT” on page 1400.

Example

The following example creates an event with an ID of 4, a community string of "st_west8," and a description of "router_north:"

```
awplus> enable
awplus# configure terminal
awplus(config)# rmon event 4 trap st_west8 description
router_north
```

SHOW RMON ALARM

Syntax

```
show rmon alarm
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the RMON alarms on the switch. Here is an example of the information.

```
Alarm Index = 2
   Variable etherStatsBroadcastPkts.2
   Interval 80
   Alarm Type rising and falling
   Rising Threshold = 1000
   Event Index = 5
   Falling Threshold = 100
   Event Index = 5
   Owner Agent

Alarm Index =  5
   Variable etherStatsBroadcastPkts.4
   Interval 5
   Alarm Type rising and falling
   Rising Threshold = 5000
   Event Index = 1
   Falling Threshold = 500
   Event Index = 1
   Owner Agent
```

Figure 234. SHOW RMON ALARM Command

The fields are described in Table 163.

Table 163. SHOW RMON ALARM Command

Parameter	Description
Alarm Index	The ID number of the alarm.
Variable	The MIB object the alarm is monitoring, and the ID number of the statistics group used to monitor the port and MIB object.
Interval	The polling interval in seconds.
Alarm Type	The alarm type. This is always "rising and falling," meaning the alarm has both a rising threshold and a falling threshold.
Rising Threshold	The rising threshold.
Event Index	The ID number of the event the alarm performs if the rising threshold is crossed.
Falling threshold	The falling threshold.
Event index	The ID number of the event the alarm performs if the falling threshold is crossed.
Owner	The name of the owner of the alarm. The owner is Agent if no owner was specified when the alarm was created.

Example

The following example displays the RMON alarms on the switch:

```
awplus# show rmon alarm
```

SHOW RMON EVENT

Syntax

```
show rmon event
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the RMON events on the switch. Here is an example of the information.

```
Event index = 2
   Description: broadcast_packets
   Event type: log & trap
   Event community name: wkst12a
   Last Time Sent = 0
   Owner: Agent
Event index = 3
   Description: port24_traffic
   Event type: log
   Event community name:
   Last Time Sent = 0
   Owner: Wilson
```

Figure 235. SHOW RMON EVENT Command

The fields are described in Table 164.

Table 164. SHOW RMON EVENT Command

Parameter	Description
Event index	The ID number of the event.
Description	The description of the event.
Event type	The event type. The types are: ❒ Log - The event enters a message in the event log. ❒ Trap - The event sends an SNMP trap.

Table 164. SHOW RMON EVENT Command (Continued)

Parameter	Description
Event type (continued)	❒ Log & Trap - The event enters a message in the event log and sends an SNMP trap.
Event community name	The SNMP community string used to send SNMP traps.
Last Time Sent	The number of seconds the switch had been operating when it last sent the event trap.
Owner	The owner of the event. The owner is Agent if no owner was specified when the event was created.

Example

The following example displays the RMON events on the switch:

```
awplus# show rmon event
```

SHOW RMON HISTORY

Syntax

```
show rmon history
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the history groups that are assigned to the ports on the switch. Here is an example of the information.

```
History Index = 1
   Data source ifindex = 2
   Buckets requested = 50
   Buckets granted = 50
   Interval = 800
   Owner William

History Index = 4
   Data source ifindex = 7
   Buckets requested = 25
   Buckets granted = 25
   Interval = 120
   Owner Jones

History Index = 2
   Data source ifindex = 14
   Buckets requested = 50
   Buckets granted = 50
   Interval = 1800
   Owner Agent
```

Figure 236. SHOW RMON HISTORY Command

The fields are described in Table 165.

Table 165. SHOW RMON HISTORY Command

Parameter	Description
History Index	The ID number of the history group.

Table 165. SHOW RMON HISTORY Command (Continued)

Parameter	Description
Data source ifindex	The port of the history group.
Buckets requested	The number of buckets that were requested in the command that created the history group.
Buckets granted	The number of buckets allocated by the switch for the history group. The value in this field will be less than the value in the buckets requested field if the switch did not have sufficient memory resources when you created the history group.
Interval	The polling interval in seconds.
Owner	The owner of the group. The owner is Agent if no owner was specified when the history group was created.

Example

The following example displays the history groups that are assigned to the ports on the switch:

```
awplus# show rmon history
```

SHOW RMON STATISTICS

Syntax

```
show rmon statistics
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the RMON statistics groups on the switch ports. Here is an example of the command.

```
Stats Index = 5
   Data source ifindex = 5
   Owner Agent

Stats Index = 16
   Data source ifindex = 16
   Owner Agent
```

Figure 237. SHOW RMON STATISTICS Command

The fields are described in Table 166.

Table 166. SHOW RMON STATISTICS Command

Parameter	Description
Stats Index	The ID number of the port statistics group.
Data source ifindex	The port number of the group.
Owner	The owner of the group. The owner is Agent if no owner was specified when the statistics group was created.

Example

```
awplus# show rmon statistics
```

Section XII

Management Security

This section contains the following chapters:

Chapter 86

Local Manager Accounts

This chapter provides the following topics:

Overview

Each AT-FS970M Series switch is pre-configured at the factory with one default manager account. The factory-default values for the user name and password are “manager” and “friend”. If you are the only administrator of the switch, you may not need more than one manager account. But if you plan for the switch to be managed by more than one administrator, you may want to create additional accounts so that each administrator has a separate account.

There are two ways to add more manager accounts. One method adds local accounts. A local account is so called because it is the switch that authenticates the user name and password when a manager logs in. The default manager account is a local account. This chapter explains how to create more local accounts.

The switch also supports remote manager accounts. These are accounts that are authenticated by a RADIUS or TACACS+ server on your network. For information, refer to Chapter 98, “RADIUS and TACACS+ Clients” on page 1509.

Privilege Levels

Manager accounts have privilege levels that determine where in the command mode structure managers can go and, consequently, which commands they can access. The privilege levels are 1 and 15.

Manager accounts with a privilege level of 15 have access to the entire command mode structure and, thus, to all of the commands. Managers should be assigned accounts with this level if they need to configure the parameter settings of the switch. The default manager account has this privilege level.

Manager accounts with a privilege level of 1 are restricted to the User Exec mode, in which many of the SHOW commands are stored. Accounts with this level are appropriate for managers who only need to monitor the switch.

Command Mode Restriction

Command mode restriction allows you to enhance the security of the manager accounts by requiring that managers who have the privilege level 15 enter a special password to move from the User Exec mode to the Privileged Exec mode. Managers who do not know the special password are restricted to the User Exec mode, just as if their accounts had the privilege level 1.

When command mode restriction is active on the switch, managers are prompted for the special password when they enter the ENABLE command to move from the User Exec mode to the Privilege Exec mode. The prompt is shown in Figure 238 on page 1409.

```
awplus Login: adams
Password: ********



awplus> enable
Password:
```

Figure 238. Password Prompt for Command Mode Restriction

If the manager enters the correct password, the Privileged Exec mode prompt is displayed. If the wrong password or no password is entered, the manager remains in the User Exec mode, and the switch displays the error message shown in Figure 239.

```
awplus> enable
%No Local Enable Password Set
awplus>
```

Figure 239. Command Mode Restriction Error Message

The command for activating command mode restriction and defining the special password is the ENABLE PASSWORD command, in the Global Configuration mode. For instructions on how to use the command, refer to "Activating Command Mode Restriction and Creating the Special Password" on page 1414.

Command mode restriction does not apply to manager accounts with the privilege level 1. Manager accounts with that privilege level are always restricted to the User Exec mode.

Password Encryption

When you create a new manager account, you have to assign it a password. You also have to create a new password if you activate command mode restrictions. The commands for creating manager accounts and activating command mode restriction give you the choice of entering new passwords in either plaintext or encrypted form. Passwords that are entered in plaintext are stored by the switch in either plaintext or encrypted form in the running configuration and the active boot configuration file, depending on the password encryption setting. If password encryption is enabled (the default setting), plaintext passwords are stored in encrypted form. If password encryption is disabled, plaintext passwords are stored in plaintext.

Passwords entered in encrypted form when you create manager accounts, or activate command mode restriction, remain encrypted in the running configuration and the active boot configuration file, regardless of the setting of password encryption.

Password encryption is activated with the SERVICE PASSWORD-ENCRYPTION command and deactivated with the NO SERVICE PASSWORD-ENCRYPTION command, both of which are found in the Global Configuration mode. When you activate password encryption with the SERVICE PASSWORD-ENCRYPTION command, the switch searches the running configuration for plaintext passwords and encrypts them. It also automatically encrypts the plaintext passwords of new manager accounts.

When you deactivate password encryption with the NO SERVICE PASSWORD-ENCRYPTION command, the switch searches the running configuration and decrypts passwords that were initially created in plaintext.

Decrypting passwords can pose a security risk because managers can issue the NO SERVICE PASSWORD-ENCRYPTION command to see the passwords of the other accounts. To permanently encrypt passwords so that they remain in that form, even if someone issues the command, enter them in their encrypted form when you create the manager accounts or activate command mode restriction. This is illustrated in the examples in the next section.

Creating Local Manager Accounts

The command for creating local manager accounts is the USERNAME command in the Global Configuration mode. Here is the command's format:

```
username name privilege level password [8] password
```

The NAME parameter specifies the log-on name for the new account. The name is case-sensitive and can have up to 15 alphanumeric characters including special characters. Spaces are not allowed.

The LEVEL parameter specifies the privilege level of the account. The level can be either 1 or 15. Manager accounts with the privileged level 15 have access to all of the command modes, while manager accounts with the privilege level 1 are restricted to the User Exec mode.

The PASSWORD parameter specifies the password for the new manager account. You can enter the password in plaintext or encrypted. A plaintext password is case-sensitive and can have up to 16 alphanumeric characters including punctuation and printable special characters. Spaces are not permitted. To enter an encrypted password, precede it with the number '8'.

This example of the command creates an account for the user, john. The privilege level is 15 to give the manager access to the entire command mode structure. The password is "pmat762:"

```
awplus> enable
awplus# configure terminal
awplus(config)# username john privilege 15 password pmat762
```

This example creates a manager account for the user, allen. The privilege level is 1 to restrict the manager to the User Exec mode. The password for the account is "laf238pl:"

```
awplus> enable
awplus# configure terminal
awplus(config)# username allen privilege 1 password laf238pl
```

This example creates an account for the user, sjones. The privilege level is 1 to restrict the manager to the User Exec mode. The password is "bluesky," entered in its encrypted form.

```
awplus> enable
awplus# configure terminal
awplus(config)# username sjones privilege 1 password 8
c1a23116461d5856f98ee072ea319bc9
```

Passwords entered in encrypted form remain encrypted in the running configuration even if you disable password encryption by issuing the NO SERVICE PASSWORD-ENCRYPTION command.

Deleting Local Manager Accounts

To delete local manager accounts from the switch, use the NO USERNAME command in the Global Configuration mode. Here is the format of the command:

```
no username name
```

The NAME parameter specifies the name of the manager account you want to delete from the switch. The name is case sensitive. You can delete just one manager account at a time with this command.

Once an account is deleted, you cannot use it to manage the switch. If you delete the account with which you logged on to the switch, your current management session is not interrupted. But you will not be able to use that account again to log in and configure the unit.

This example of the command deletes the manager account bjspring:

```
awplus> enable
awplus# configure terminal
awplus(config)# no username bjspring
```

Note
You can delete the default "manager" account from the switch.

Caution
Do not delete all of the local manager accounts that have the privilege level 15 if the switch does not have any remote RADIUS or TACACS+ accounts. Otherwise, you will not be able to log in again as manager and will have to contact Allied Telesis for assistance.

Activating Command Mode Restriction and Creating the Special Password

Command mode restriction is a security feature. It requires that managers who have the privilege level 1 enter a special password to manage the switch. The switch prompts for the special password when the ENABLE command is used to move to the Privileged Exec mode from the User Exec mode. The prompt is shown in Figure 238 on page 1409. Managers who do not know the password or have the privilege level 1 are restricted to the User Exec mode.

Note
Managers with a privilege level of 15 are only required to enter the ENABLE command to access the Privileged Exec mode and are not required to enter this password.

The command for activating command mode restriction and creating or changing the password is the ENABLE PASSWORD command in the Global Configuration mode. The switch can have only one special password. Here is the format of the command:

`enable password [8] password`

The PASSWORD parameter specifies the special password. You can enter the password in plaintext or encrypted. A plaintext password is case-sensitive and can have up to 16 alphanumeric characters including special characters. Spaces are not allowed. An encrypted password must be preceded by the number “8” and a space.

This example activates command mode restriction and creates the special password “Day89lane:”

```
awplus> enable
awplus# configure terminal
awplus(config)# enable password Day89lane
```

This example activates command mode restriction and specifies the password as “ship247,” in encrypted form:

```
awplus> enable
awplus# configure terminal
awplus(config)# enable password 8 85076026566ed1dd84a709c0f
dd1fa9f
```

To confirm the configuration, display the running configuration with “SHOW RUNNING-CONFIG” on page 168.

Deactivating Command Mode Restriction and Deleting the Special Password

The command for deactivating command mode restriction and deleting the special password is the NO ENABLE PASSWORD command in the Global Configuration mode. When command mode restriction is deactivated, manager accounts with a privilege level of 15 do not have to enter the special password when they enter the ENABLE command to move from the User Exec mode to the Privilege Exec mode. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# no enable password
```

Activating or Deactivating Password Encryption

Password encryption controls the manner in which the switch stores the plaintext passwords of manager accounts and command mode restriction in the running configuration. When password encryption is enabled (the default setting), plaintext passwords are stored in encrypted form. When password encryption is disabled, plaintext passwords are stored in plaintext. For more information, refer to “Password Encryption” on page 1409

To activate password encryption, issue the SERVICE PASSWORD-ENCRYPTION command in the Global Configuration mode:

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

When password encryption is activated, the switch searches the running configuration for plaintext passwords and encrypts them. It also automatically encrypts the plaintext passwords of new manager accounts.

To disable password encryption, use the NO SERVICE PASSWORD-ENCRYPTION command:

```
awplus> enable
awplus# configure terminal
awplus(config)# no service password-encryption
```

The switch searches the running configuration and decrypts passwords that were initially created in plaintext.

To keep passwords permanently encrypted, even when password encryption is disabled, create them in encrypted form when you use the USERNAME command, as explained in “Creating Local Manager Accounts” on page 1411. The switch does not decrypt passwords created in their encrypted form, even when password encryption is disabled.

Displaying the Local Manager Accounts

To view the local accounts on the switch, use "SHOW RUNNING-CONFIG" on page 168 to display the running configuration. Here is an example of several accounts.

```
username manager privilege 15 password WestWind11a
username sjones privilege 15 password Lat76rose
username smith privilege 1 password Positive89act
username adams privilege 15 password 8 c1a23116461d5856f98ee072ea319bc9
```

Figure 240. Displaying the Local Manager Accounts in the Running Configuration

Chapter 87
Local Manager Account Commands

The local manager account commands are summarized in Table 167 and described in detail within the chapter.

Table 167. Local Manager Account Commands

Command	Mode	Description
“ENABLE PASSWORD” on page 1420	Global Configuration	Activates command mode restriction on the switch and specifies the password.
“NO ENABLE PASSWORD” on page 1422	Global Configuration	Deactivates command mode restriction on the switch.
“NO SERVICE PASSWORD-ENCRYPTION” on page 1423	Global Configuration	Disables password encryption.
“NO USERNAME” on page 1424	Global Configuration	Deletes manager accounts from the switch.
“SERVICE PASSWORD-ENCRYPTION” on page 1425	Global Configuration	Encrypts all manager account passwords in the running configuration.
“USERNAME” on page 1426	Global Configuration	Creates new manager accounts.

ENABLE PASSWORD

Syntax

```
enable password [8] password
```

Parameters

8
: Specifies that the password is encrypted.

password
: Specifies the password for command mode restriction. A plaintext password is case-sensitive and can have up to 16 alphanumeric characters including special characters. Spaces are not allowed.

Mode

Global Configuration mode

Description

Use this command to activate command mode restriction on the switch and to specify the password. When command mode restriction is active, managers with a privilege level of 1 must enter the password to move to the Privileged Exec mode from the User Exec mode. Managers who do not know the password or have a privilege level of 1 are restricted to the User Exec mode.

Note
Managers with a privilege level of 15 are only required to enter the ENABLE command to access the Privileged Exec mode and are not required to enter this password.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

This example activates command mode restriction and specifies “wah87” as the password:

```
awplus> enable
awplus# configure terminal
awplus(config)# enable password wah87
```

This example activates command mode restriction and specifies the password as “Paperclip45c,” in encrypted form:

```
awplus> enable
awplus# configure terminal
awplus(config)# enable password 8 1255bbf963118fcf750aca356d
35f6ab
```

NO ENABLE PASSWORD

Syntax

```
no enable password
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to deactivate command mode restriction on the switch to allow managers who have the privilege level 15 to access all of the command modes without having to enter the special password.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example disables command mode restriction on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no enable password
```

NO SERVICE PASSWORD-ENCRYPTION

Syntax

```
no service password-encryption
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable password encryption. The passwords of new local manager accounts are entered in clear text in the running configuration file, unless they are entered in their encrypted forms in the USERNAME command. Also, the switch decrypts all of the passwords of the current manager accounts in the running configuration file, except for passwords that were entered in their encrypted forms when the manager accounts were created.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example disables password encryption on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no service password-encryption
```

NO USERNAME

Syntax

```
no username name
```

Parameters

name
: Specifies the name of the manager account you want to delete from the switch. The name is case sensitive.

Mode

Global Configuration mode

Description

Use this command to delete local manager accounts from the switch.

Note
You can delete the default “manager” account from the switch.

Caution
Do not delete all of the local manager accounts that have the privilege level 15 if the switch does not have any remote RADIUS or TACACS+ accounts. Otherwise, you will not be able to log in again as manager and will have to contact Allied Telesis for assistance.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example deletes the manager account msmith:

```
awplus> enable
awplus# configure terminal
awplus(config)# no username msmith
```

SERVICE PASSWORD-ENCRYPTION

Syntax

```
service password-encryption
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate password encryption. This feature encrypts all of the manager account passwords in the running configuration of the switch and the passwords of new manager accounts. This is the default setting for password encryption.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example enables password encryption:

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

USERNAME

Syntax

```
username name privilege level password [8] password
```

Parameters

name
: Specifies the name of a new manager account. The name is case-sensitive and can have up to 15 alphanumeric characters including special characters. Spaces are not allowed.

level
: Specifies the privilege level of either 1 or 15 for the new account. Manager accounts with the privileged level 15 have access to all of the command modes, unless command mode restriction is activated. Manager accounts with the privilege level 1 are restricted to the User Exec mode.

8
: Specifies that the password is encrypted.

password
: Specifies the password of the new manager account. A non-encrypted password is case-sensitive and can have up to 16 alphanumeric characters including punctuation and printable special characters. Spaces are not permitted.

Mode

Global Configuration mode

Description

Use this command to create new manager accounts on the switch.

Note
Passwords for manager accounts used with the web browser interface must not be encrypted.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

This example creates a manager account for the user, allen. The privilege level is 15 to give the manager access to all of the modes, unless command mode restriction is activated. The password is "laf238pl:"

```
awplus> enable
awplus# configure terminal
awplus(config)# username allen privilege 15 password
laf238pl
```

This example creates a manager account for the user, sjones. The privilege level is 1 to restrict the manager to the User Exec mode. The password is "bluesky," entered in its encrypted form.

```
awplus> enable
awplus# configure terminal
awplus(config)# username sjones privilege 1 password 8
c1a23116461d5856f98ee072ea319bc9
```

Chapter 88

Telnet Server

This chapter provides the following topics:

Overview

The switch comes with a Telnet server so that you can remotely manage the device from Telnet clients on your network. Remote Telnet management gives you access to the same AlliedWare Plus commands and management functions as local management sessions, which are conducted through the Console port.

The guidelines to using the Telnet server for remote management are listed here.

- The switch must have a management IP address. For instructions, refer to Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.
- The management workstations with the Telnet clients must be members of the same subnet as the management IP address of the switch or have access to it through routers or other Layer 3 devices.
- If the Telnet clients are not members of the same subnet as the switch’s management IP address, the switch must have a default gateway. This is the IP address of an interface on a router or other Layer 3 routing device that is the first hop to reaching the subnets of the Telnet clients. For background information, refer to Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.
- The Telnet server uses protocol port 23. This parameter cannot be changed.
- Telnet management sessions are not secure. The packets are sent in readable text. For secure remote management using the command line interface, use the Secure Shell protocol, described Chapter 92, “Secure Shell (SSH) Server” on page 1447.

For instructions on how to start a remote Telnet management session, refer to “Starting a Remote Telnet or SSH Management Session” on page 78.

Enabling the Telnet Server

To enable the server, go to the Global Configuration mode and issue the SERVICE TELNET command. Here is the command:

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

Once the server is started, you can conduct remote management sessions over your network from Telnet clients, provided that the switch has a management IP address. For instructions on how to start a remote Telnet management session, refer to "Starting a Remote Telnet or SSH Management Session" on page 78.

Disabling the Telnet Server

To disable the Telnet server, use the NO SERVICE TELNET command in the Global Configuration mode. Here is the command:

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

Note
If you disable the server from a remote Telnet management session, your session ends. To resume managing the unit, establish a local management session or remote web browser session. If the maximum number of manager sessions on the switch is set to one, you must wait for the console timer on the switch to expire before starting a new manager session. The default setting for the console timer is 10 minutes.

Displaying the Telnet Server

To display the status of the Telnet server, use the SHOW TELNET command in the User Exec mode or Privileged Exec mode. Here is the command:

```
awplus# show telnet
```

Here is the information the command displays.

```
Telnet Server Configuration
-------------------------------------------
Telnet server                  : Enabled
```

Figure 241. SHOW TELNET Command

Chapter 89
Telnet Server Commands

The Telnet server commands are summarized in Table 168 and described in detail within the chapter.

Table 168. Telnet Server Commands

Command	Mode	Description
“NO SERVICE TELNET” on page 1436	Global Configuration	Disables the Telnet server.
“SERVICE TELNET” on page 1437	Global Configuration	Enables the Telnet server.
“SHOW TELNET” on page 1438	User Exec and Privileged Exec	Displays the status of the Telnet server on the switch.

NO SERVICE TELNET

Syntax

```
no service telnet
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable the Telnet server on the switch. You cannot remotely manage the switch with a remote Telnet client when the server is disabled. The default setting for the Telnet server is enabled.

Note
Your management session ends if you disable the server from a remote Telnet session. To resume managing the unit, establish a local management session or remote web browser session. If the maximum number of manager sessions on the switch is set to one, you must wait for the console timer on the switch to expire before starting a new management session. The default setting for the console timer is 10 minutes.

Confirmation Command

“SHOW TELNET” on page 1438

Example

This example disables the Telnet server:

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

SERVICE TELNET

Syntax

```
service telnet
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enable the Telnet server so that you can remotely manage the switch with a Telnet application protocol. The default setting for the Telnet server is enabled.

> **Note**
> The switch must have a management IP address for remote Telnet management. For background information, refer to Chapter 13, "IPv4 and IPv6 Management Addresses" on page 295.

Confirmation Command

"SHOW TELNET" on page 1438

Example

This example enables the Telnet server:

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

SHOW TELNET

Syntax

```
show telnet
```

Parameters

None

Mode

User Exec mode and Privileged Exec mode

Description

Use this command to display the status of the Telnet server on the switch. The status of the server can be either enabled or disabled. Here is the information.

```
Telnet Server Configuration
-------------------------------------------
Telnet server : Enabled
```

Figure 242. SHOW TELNET Command

Example

This example displays the status of the Telnet server on the switch:

```
awplus# show telnet
```

Chapter 90

Telnet Client

This chapter provides the following topics:

Overview

The switch has a Telnet client. You may use the client to remotely manage other network devices from the switch. Here are the guidelines to using the client:

- The client has the two commands: TELNET, which is used to manage network devices that have IPv4 addresses, and TELNET IPV6, for devices that have IPv6 addresses.
- You may use the Telnet client from local or Telnet management sessions of the switch, but not from remote SSH management sessions.
- The switch must have an IP address that is of the same type, IPv4 or IPv6, as the addresses on the remote devices. For example, the switch must have an IPv6 address for you to remotely manage devices that have IPv6 addresses. For instructions, refer to Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.
- The other network devices that you intend to manage with the Telnet client must be members of the same subnet as the IP address of the switch or have access to it through routers or other Layer 3 devices.
- If the other devices are not members of the same subnet as the switch’s IP address, the switch must have a default gateway. This is the IP address of an interface on a router or other Layer 3 routing device that is the first hop to reaching the subnets of the devices. For background information, refer to Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.
- A remote device must be configured for Telnet management before you can manage it with the Telnet client on the switch. It must have either an IPv4 or IPv6 address, and its Telnet server must be active.

Starting a Remote Management Session with the Telnet Client

Here are the steps to using the Telnet client on the switch to manage other devices on your network:

1. Start a local or Telnet management session on the switch.

   Note
   The Telnet client is not supported from remote SSH management sessions.

2. If the remote device that you want to manage through the switch has an IPv4 address, move to the Privileged Exec mode and enter the TELNET command, which has this format:

   `telnet` *`ipv4_address`* `[`*`port`*`]`

   The IPV4_ADDRESS parameter is the IP address of the device to be managed. The optional PORT parameter is the protocol port number of the Telnet client. The default is 23. For example, if the IPv4 address of the remote device is 149.174.154.12, you enter:

   ```
   awplus> enable
   awplus# telnet 149.174.154.12
   ```

   You should now see the login prompts of the remote device.

3. If the remote device to be managed has an IPv6 address, move to the Privileged Exec mode and enter the TELNET IPV6 command, which has this format:

   `telnet ipv6` *`ipv6_address`* `[`*`port`*`]`

   The IPV6_ADDRESS parameter is the IP address of the device to be managed. For example, if the remote device had the IPv6 address 45ac:be45:78::c45:8156, you enter:

   ```
   awplus> enable
   awplus# telnet ipv6 45ac:be45:78::c45:8156
   ```

   You should now see the login prompts of the remote device.

4. Enter the appropriate user name and password for the remote device.

5. When you finish managing the remote device, enter the appropriate logout command to return to the management session on the AT-FS970M Switch.

Chapter 91

Telnet Client Commands

The Telnet client commands are summarized in Table 169 and described in detail within the chapter.

Table 169. Telnet Client Commands

Command	Mode	Description
“TELNET” on page 1444	Privileged Exec	Starts Telnet management sessions on remote devices that have IPv4 addresses.
“TELNET IPV6” on page 1445	Privileged Exec	Starts Telnet management sessions on remote devices that have IPv6 addresses.

TELNET

Syntax

```
telnet ipv4_address [port]
```

Parameters

ipv4_address
: Specifies the IPv4 address of a remote device you want to manage using the Telnet client on the switch. You can specify just one address.

port
: Specifies the protocol port number of the Telnet client. The default value is 23.

Mode

Privileged Exec mode

Description

Use this command to start Telnet management sessions on network devices that have IPv4 addresses. You can manage just one remote device at a time.

> **Note**
> This command is available from local and Telnet management sessions.

Example

This example starts a Telnet management session on a network device that has the IP address 132.154.67.134:

```
awplus> enable
awplus# telnet 132.154.67.134
```

TELNET IPV6

Syntax

```
telnet ipv6 ipv6_address [port]
```

Parameters

ipv6_address

Specifies the IPv6 address of a remote device you want to manage using the Telnet client on the switch. You can specify just one address.

port

Specifies the protocol port number of the Telnet client. The default value is 23.

Mode

Privileged Exec mode

Description

Use this command to start Telnet management sessions on network devices that have IPv6 addresses. You can manage just one remote device at a time.

Note
This command is available from local and Telnet management sessions, but not from SSH management sessions.

Example

This example starts a Telnet management session on a network device that has the IPv6 address 45ac:be45:78::c45:8156:

```
awplus> enable
awplus# telnet ipv6 45ac:be45:78::c45:8156
```

Chapter 92

Secure Shell (SSH) Server

This chapter provides the following topics:

Overview

The Secure Shell (SSH) protocol is an alternative to the Telnet protocol for remote management of the switch from workstations on your network. The difference between the two management methods is that SSH management is more secure because the packets the switch and your management workstation exchange during management sessions are encrypted. In contrast, Telnet management sessions are unsecured and are vulnerable to snooping because the packets are sent in readable text.

The SSH server on the switch supports SSH protocol versions 1.3, 1.5, and 2.0. Client software is available on the Internet.

Algorithms

The SSH server on the switch encrypts the packets using an encryption key. The key is created with an algorithm. You can choose from three available algorithms to create the key for SSH:

- RSA
- RSA1
- DSA

Support for SSH

The implementation of the SSH protocol on the switch is compliant with the SSH protocol versions 1.3, 1.5, and 2.0.

In addition, the following SSH options and features are supported:

- Inbound SSH connections (server mode) is supported.
- The following security algorithms are supported:
  - 128-bit Advanced Encryption Standard (AES), 192-bit AES, and 256-bit AES
  - Arcfour (RC4) security algorithm is supported.
  - Triple-DES (3DES) encryption for SSH sessions is supported.
- RSA public keys with lengths of 768 to 2048 bits are supported. Keys are stored in a format compatible with other Secure Shell implementations.
- Compression of SSH traffic.
- The switch uses the well-known port 22 as the SSH default port.

The following SSH options and features are **not** supported:

- IDEA or Blowfish encryption
- Non-encrypted Secure Shell sessions
- Tunnelling of TCP/IP traffic

Guidelines

Here are the guidelines to using SSH to manage the switch:

- The switch must have a management IP address. For background information, refer to Chapter 13, "IPv4 and IPv6 Management Addresses" on page 295.
- The management workstations with the SSH clients must be members of the same subnet as the management IP address of the switch or have access to it through routers or other Layer 3 devices.
- If the SSH clients are not members of the same subnet as the switch's management IP address, the switch must have a default gateway. This is the IP address of an interface on a router or other Layer 3 routing device that is the first hop to reaching the subnets of the Telnet clients. For background information, refer to Chapter 13, "IPv4 and IPv6 Management Addresses" on page 295.

- The SSH server uses protocol port 22. This parameter cannot be changed.
- If you are using the enhanced stacking feature, you activate and configure SSH server on the master switch, not on the member switches.

Note
If your switch is in a network that is protected by a firewall, you may need to configure the firewall to permit SSH connections.

For instructions on how to start a remote management session, refer to “Starting a Remote Telnet or SSH Management Session” on page 78.

SSH and Enhanced Stacking

The switch allows for encrypted SSH management sessions between a management station and the master switch of an enhanced stack, but not with member switches, as explained in this section.

When you remotely manage a member switch, all management communications are conducted through the master switch using the enhanced stacking feature. Management packets from your workstation are first directed to the master switch before being forwarded to the member switch. The reverse is true as well. Management packets from a member switch first pass through the master switch before reaching your management station.

Enhanced stacking uses a proprietary protocol different from Telnet and SSH protocols. Consequently, there is no encryption between a master switch and a member switch. The result is that SSH encryption only occurs between your workstation and the master switch, not between your workstation and a member switch.

This is illustrated in Figure 243. The figure shows an SSH management station that is managing a member switch of an enhanced stack. The packets exchanged between the member switch and the master switch are transmitted in plaintext and those exchanged between the master switch and the SSH management station are encrypted.

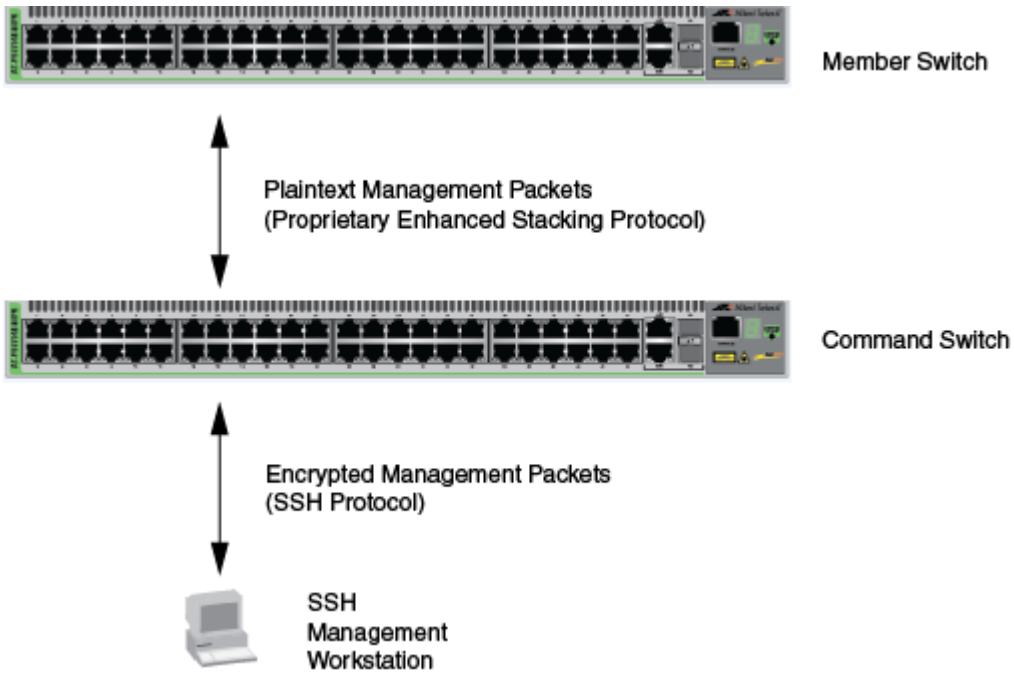

Figure 243. SSH Remote Management of a Member Switch

Because enhanced stacking does not allow for SSH encrypted management sessions between a management station and a member switch, you configure SSH only on the master switch of a stack. Activating SSH on a member switch has no effect.

Creating the Encryption Key Pair

The first step to using the SSH server on the switch for remote management is to create the encryption key. Here is the base command:

```
crypto key generate hostkey dsa|rsa|rsa1 [value]
```

The VALUE parameter only applies to an RSA key.

To create a DSA key, enter these commands:

```
awplus> enable
awplus# configure terminal
awplus(config)# crypto key generate hostkey dsa
```

To create an RSA1 key, enter these commands:

```
awplus> enable
awplus# configure terminal
awplus(config)# crypto key generate hostkey rsa1
```

An RSA key is different from the other keys because you can specify a length in bits by using the VALUE parameter in the command. The other keys have a fixed key length of 1024 bits. The range is 768 to 2048 bits. Entering the length is optional. This example creates an RSA key with a length of 768 bits:

```
awplus> enable
awplus# configure terminal
awplus(config)# crypto key generate hostkey rsa 768
```

DSA and RSA1 keys take less than a minute to create. An RSA key that has the maximum key length of 2048 bits may take as much as four minutes for the switch to create.

Note
Creating a key is a very CPU intensive process for the switch. The switch does not stop forwarding network packets, but it may delay handling some network events, such as spanning tree BPDU packets. To avoid unexpected or unwanted switch behavior, create a key during periods of low network activity.

Enabling the SSH Server

The switch does not allow you to enable the SSH server and begin remote management until you have created the encryption key. So if you have not done that yet, perform the instructions in the previous procedure.

The command that activates the server is the SERVICE SSH command in the Global Configuration mode. Here is the command:

```
awplus> enable
awplus# configure terminal
awplus(config)# service ssh
```

After you enter the command, the switch searches its database for an encryption key. If it finds a key, it immediately enables the server. Otherwise, it does not activate the server.

With the server activated, you can begin to manage the switch remotely from SSH clients on your network.

Disabling the SSH Server

If you decide that you want to disable the server because you do not want to remotely manage the switch with SSH, enter the following commands:

```
awplus> enable
awplus# configure terminal
awplus(config)# no service ssh
```

Note
If you disable the server during a remote SSH management session, your session ends. To resume managing the unit with the same management account, you must wait for the console timer on the switch to expire and then establish a local management session or remote Telnet or web browser session.

Deleting Encryption Keys

To delete encryption keys from the switch, use the CRYPTO KEY DESTROY HOSTKEY command in the Global Configuration mode. Here is the format of the command:

```
crypto key destroy hostkey dsa|rsa|rsa1
```

Note
You should disable the SSH server before deleting the encryption key. The operations of the server will be impaired if you delete the active key when the server is enabled.

Note
If you disable the server during a remote SSH management session, your session ends. To resume managing the unit with the manager account, you must wait for the console timer on the switch to expire and then establish a local management session or remote Telnet or web browser session.

This example deletes the DSA key:

```
awplus> enable
awplus# configure terminal
awplus(config)# no service ssh
awplus(config)# crypto key destroy hostkey dsa
```

This example deletes the RSA key:

```
awplus> enable
awplus# configure terminal
awplus(config)# no service ssh
awplus(config)# crypto key destroy hostkey rsa
```

This example deletes the RSA1 key:

```
awplus> enable
awplus# configure terminal
awplus(config)# no service ssh
awplus(config)# crypto key destroy hostkey rsa1
```

Displaying the SSH Server

To display the current settings of the server, enter this command in the Privileged Exec or Global Configuration mode:

```
awplus# show ssh server
```

Chapter 93
SSH Server Commands

The SSH server commands are summarized in Table 170 and described in detail within the chapter.

Table 170. Secure Shell Server Commands

Command	Mode	Description
“CRYPTO KEY DESTROY HOSTKEY” on page 1460	Global Configuration	Deletes encryption keys from the switch.
“CRYPTO KEY GENERATE HOSTKEY” on page 1462	Global Configuration	Creates encryption keys.
“NO SERVICE SSH” on page 1464	Global Configuration	Disables the SSH server.
“SERVICE SSH” on page 1465	Global Configuration	Activates the SSH server and specifies the host and server encryption keys.
“SHOW CRYPTO KEY HOSTKEY” on page 1466	Privileged and Global Configuration	Displays the encryption keys.
“SHOW SSH SERVER” on page 1467	Privileged and Global Configuration	Displays the parameter settings of the SSH server.

CRYPTO KEY DESTROY HOSTKEY

Syntax

```
crypto key destroy hostkey dsa|rsa|rsa1
```

Parameters

dsa
: Deletes the DSA key.

rsa
: Deletes the RSA key.

rsa1
: Deletes the RSA1 key.

Mode

Global Configuration mode

Description

Use this command to delete encryption keys from the switch. Deleted encryption keys are permanently removed by the switch when you enter this command. You do not have to enter the WRITE command or the COPY RUNNING-CONFIG STARTUP-CONFIG command to save your changes on the switch.

Confirmation Command

“SHOW CRYPTO KEY HOSTKEY” on page 1466

Examples

This example deletes the DSA key:

```
awplus> enable
awplus# configure terminal
awplus(config)# crypto key destroy hostkey dsa
```

This example deletes the RSA key:

```
awplus> enable
awplus# configure terminal
awplus(config)# crypto key destroy hostkey rsa
```

This example deletes the RSA1 key:

```
awplus> enable
awplus# configure terminal
awplus(config)# crypto key destroy hostkey rsa1
```

CRYPTO KEY GENERATE HOSTKEY

Syntax

```
crypto key generate hostkey dsa|rsa|rsa1 [value]
```

Parameters

dsa
Creates a DSA key that is compatible with SSH versions 1 and 2.

rsa
Creates an RSA key that is compatible with SSH version 2.

rsa1
Creates an RSA key that is compatible with SSH version 1.

value
Specifies the length of the encryption key in bits. The length is specified only for an RSA key and is optional. The range is 768 to 2048 bits. DSA and RSA1 keys have fixed lengths of 1024 bits.

Mode

Global Configuration mode

Confirmation Command

“SHOW CRYPTO KEY HOSTKEY” on page 1466

Description

Use this command to create the encryption key for the Secure Shell server. You must create the key before activating the server. The switch can have one key of each type at the same time.

If you create a new key when the switch already has a key of that type, the new key overwrites the old key. For example, if you create a new RSA key when the switch already has an RSA key, the new key replaces the existing key.

A new encryption key is automatically saved by the switch when you enter the command. You do not have to enter the WRITE command or the COPY RUNNING-CONFIG STARTUP-CONFIG command to save your changes on the switch.

DSA and RSA1 keys take less than a minute to create. However, an RSA key that has the maximum key length of 2048 bits may take as much as four minutes for the switch to create.

Note
Creating a key is a very CPU intensive process for the switch. The switch does not stop forwarding network packets, but it may delay handling some network events, such as spanning tree BPDU packets. To avoid unexpected or unwanted switch behavior, create a key during periods of low network activity.

Examples

This example creates a DSA key:

```
awplus> enable
awplus# configure terminal
awplus(config)# crypto key generate hostkey dsa
```

This example creates an RSA key with a length of 1280 bits:

```
awplus> enable
awplus# configure terminal
awplus(config)# crypto key generate hostkey rsa 1280
```

This example creates an RSA1 key:

```
awplus> enable
awplus# configure terminal
awplus(config)# crypto key generate hostkey rsa1
```

NO SERVICE SSH

Syntax

```
no service ssh
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable the Secure Shell server to prevent remote management of the switch using a Secure Shell client. The default setting for the Secure Shell server is disabled.

> **Note**
> Your management session of the switch ends if you disable the server from a remote SSH management session. To resume managing the switch from a local management session or a remote Telnet or web browser session, you must wait for the console timer to expire if the switch is configured to support one manager session at a time. The default setting for the console timer is 10 minutes.

Confirmation Command

“SHOW SSH SERVER” on page 1467

Example

This example disables the Secure Shell server:

```
awplus> enable
awplus# configure terminal
awplus(config)# no service ssh
```

SERVICE SSH

Syntax

```
service ssh
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enable the Secure Shell server on the switch.

You must create an encryption key before enabling the server. For instructions, refer to "CRYPTO KEY GENERATE HOSTKEY" on page 1462.

Confirmation Command

"SHOW SSH SERVER" on page 1467

Example

This example enables the Secure Shell server on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# service ssh
```

SHOW CRYPTO KEY HOSTKEY

Syntax

```
show crypto key hostkey [dsa|rsa|rsa1]
```

Parameters

dsa
: Displays the DSA key.

rsa
: Displays the RSA key.

rsa1
: Displays the RSA1 key.

Mode

Global Configuration mode

Description

Use this command to display the encryption keys. Here is an example of the information for an RSA key.

```
Type    Bits    Fingerprint
-------------------------------------------------------------
RSA     1280    60:59:ff:78:e7:4e:58:24:e6:57:bc:c9:d1:c9:73:91
```

Figure 244. SHOW CRYPTO KEY HOSTKEY Command

Examples

This example displays all of the keys:

```
awplus# show crypto key hostkey
```

This example displays the RSA1 key only:

```
awplus# show crypto key hostkey rsa1
```

SHOW SSH SERVER

Syntax

```
show ssh server
```

Parameters

None

Modes

Privileged Exec and Global Configuration modes

Description

Use this command to display the current status of the SSH server.

- Versions supported
- Server Status
- Server Port

Example

This example displays the status of the SSH server:

```
awplus# show ssh server
```

An example of the information the command displays is shown in Figure 245.

```
Secure Shell Server Configuration
Versions Supported ........ 2,1
SSH Server :   Enabled
Server Port ............... 22
```

Figure 245. SHOW SSH SERVER Command

Chapter 94

Non-secure HTTP Web Browser Server

This chapter describes the following topics:

Overview

The switch has a web browser server. The server is used to remotely manage the unit over the network with web browser applications. The server can operate in either plain text HTTP mode or encrypted HTTPS mode. This chapter explains how to activate the server for the HTTP mode.

Caution

Management sessions of the switch conducted in the HTTP mode are non-secure because the packets exchanged by your web browser application and the server on the switch are sent in clear text, leaving them vulnerable to snooping. If an individual captures the management packet that contains your user name and password, he or she could use that information to access the switch and make unauthorized changes to its configuration settings.

Here are the guidelines to using the web browser server in the non-secure HTTP mode:

- The switch must have a management IP address. For instructions, refer to Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.
- The management workstations from which you will configure the switch with web browser applications must be members of the same network as the management IP address of the switch, or they must have access to it through routers or other Layer 3 devices.
- The web browser server cannot operate in both HTTP mode and HTTPS mode at the same time.
- The switch supports the HTTP v1.0 and v1.1 protocols.

Enabling the Web Browser Server

The command to activate the web browser server for non-secure HTTP operation is the SERVICE HTTP command in the Global Configuration mode. The command, which does not have any parameters, is shown here:

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

Here are the guidelines to using the command:

- The switch should already have a management IP address. For instructions, refer to Chapter 13, "IPv4 and IPv6 Management Addresses" on page 295.
- If the web browser server is already configured for secure HTTPS, and you are changing it back to non-secure HTTP operation, you must first deactivate the HTTPS server with the NO SERVICE HTTPS command, also in the Global Configuration mode.

Now that the server is activated for HTTP operation, you can begin to manage the switch remotely using a web browser application from a workstation on your network. Enter the IP address of the switch in the URL field of the application and, when prompted by the switch, enter your login user name and password.

Setting the Protocol Port Number

The default setting of port 80 for the protocol port of the HTTP web server can be adjusted with the IP HTTP PORT command in the Global Configuration mode. This example of the command changes the protocol port to 100:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip http port 100
```

The range of the port number is 0 to 65535.

Disabling the Web Browser Server

The command to disable the HTTP server is the NO SERVICE HTTP command in the Global Configuration mode:

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

No further web browser management sessions are permitted by the switch after the server is disabled. Any web browser sessions that are in progress when the server is disabled are interrupted and are not allowed to continue.

Displaying the Web Browser Server

To display whether the HTTP web server is enabled or disabled on the switch, issue the SHOW IP HTTP command in the Privileged Exec mode. The command also displays the protocol port number if the server is enabled. Here is the command:

```
awplus> enable
awplus# show ip http
```

Here is an example of the display.

```
HTTP server enabled. Port 80.
```

Figure 246. SHOW IP HTTP Command

Chapter 95

Non-secure HTTP Web Browser Server Commands

The non-secure HTTP web browser server commands are summarized in Table 171 and described in detail within the chapter.

Table 171. Non-secure HTTP Web Browser Server Commands

Command	Mode	Description
“SERVICE HTTP” on page 1476	Global Configuration	Enables the HTTP web browser server.
“IP HTTP PORT” on page 1477	Global Configuration	Sets the protocol port number of the server.
“NO SERVICE HTTP” on page 1478	Global Configuration	Disables the web browser server.
“SHOW IP HTTP” on page 1479	Privileged Exec	Displays the settings of the server.

SERVICE HTTP

Syntax

```
service http
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate the HTTP web browser server on the switch. The switch supports non-secure HTTP web browser management sessions when the server is activated.

Confirmation Command

“SHOW IP HTTP” on page 1479.

Example

This example activates the HTTP web browser server on the switch:

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

IP HTTP PORT

Syntax

```
ip http port port
```

Parameters

port

Specifies the TCP port number the HTTP web server listens on. The range is 0 to 65535.

Mode

Global Configuration mode

Description

Use this command to set the TCP port for the web browser server.

Confirmation Command

"SHOW IP HTTP" on page 1479

Example

This examples sets the TCP port for the HTTP server to 74:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip http port 74
```

NO SERVICE HTTP

Syntax

```
no service http
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable the HTTP web browser server on the switch to prevent any further remote management with a web browser. Any active web browser management session are interrupted and are not allowed to continue. You might disable the server to prevent remote web browser management sessions of the switch or in prelude to activating the secure HTTPS web browser server.

Confirmation Command

“SHOW IP HTTP” on page 1479.

Example

This example disables the HTTP web browser server on the switch:

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

SHOW IP HTTP

Syntax

```
show ip http
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the status of the HTTP server on the switch. Here is an example of the information.

```
HTTP server enabled. Port: 80
```

Figure 247. SHOW IP HTTP Command

Example

This example display the status of the HTTP server on the switch:

```
awplus# show ip http
```

Chapter 96

Secure HTTPS Web Browser Server

This chapter describes the following topics:

Overview

The switch has a web browser server for remote management of the unit with a web browser application from management workstations on your network. The server has a secure HTTPS mode and a non-secure HTTP mode. Web browser management sessions that use the secure HTTPS mode are protected against snooping because the packets exchanged between the switch and your management workstations are encrypted. Only the switch and the workstations are able to decipher the packets.

In contrast, web browser management sessions conducted in the non-secure HTTP mode are vulnerable to eavesdropping because the packets are sent in clear text.

This chapter explains how to configure the switch for the secure HTTPS mode. For directions on the non-secure mode, refer to Chapter 94, “Non-secure HTTP Web Browser Server” on page 1469.

Certificates

When you initiate an HTTPS connection from your management workstation to the switch, the switch responds by sending a certificate to your workstation. This file contains the encryption key that the two devices use to encrypt and decrypt their packets to each other. Also included in the certificate is a distinguished name that identifies the owner of the certificate, which in the case of a certificate for your switch, is the switch itself and your company.

The switch does not come with a certificate. You have to create it, along with the encryption key and distinguished name, as part of the HTTPS configuration process.

There are two ways to create the certificate. The quickest and easiest way is to have the switch create it itself. This type of certificate is called a self-signed certificate because the switch authenticates the certificate itself.

Another option is to create the encryption key and have someone else issue the certificate. That person, group, or organization is called a certification authority (CA), of which there are public and private CAs. A public CA issues certificates typically intended for use by the general public, for other companies or organizations. Public CAs require proof of the identify of the company or organization before they will issue a certificate. VeriSign is an example of a public CA.

Because the certificate for the switch is not intended for general use and will only be used by you and other network managers to manage the device, having a public CA issue the certificate will probably be unnecessary.

Some large companies have private CAs. This is a person or group that is responsible for issuing certificates for the company’s network equipment.

Private CAs allow companies to keep track of the certificates and control access to various network devices.

If your company is large enough, it might have a private CA, and you might want that group to issue the certificate for the switch so that you are in compliance with company policy.

If you choose to have a public or private CA issue the certificate, you must first create a self-signed certificate. Afterwards, you have to generate a digital document, called an enrollment request, which you send to the CA. The document contains the public key and other information that the CA will use to create the certificate.

Before sending an enrollment request to a CA, you should contact the CA to determine what other documents or procedures might be required in order for the CA to process the certificate. This is particularly important with public CAs, which typically have strict guidelines on issuing certificates.

Distinguished Name

A certificate, whether its self-signed by the switch or issued by a CA, must identity its owner, which, in the case of a certificate for the switch, is the switch itself and your company. The name of the owner is entered in the form of a distinguished name, which has six parts.

- Common name (cn): This is the IP address or name of the switch.
- Organizational unit (ou): This is the name of the department, such as Network Support or IT, that the switch is serving.
- Organization (o): This is the name of your company.
- Location: The location of the switch or company, such as the city.
- State (st): The state where the switch or company is located.
- Country (c): This is the country.

The common name of a certificate for the switch should be its IP address.

At the start of an HTTPS web browser management session with the switch, the web browser on your management station checks to see if the name to whom the certificate was issued matches the name of the web site. In the case of the switch, the web site's name is the switch's IP address. If they do not match, your web browser displays a security warning. It is for this reason that the common name in the distinguished name should be the IP address of the switch. Of course, even if you see the security warning, you can close the warning prompt and still configure the switch using your web browser.

Alternatively, if your network has a Domain Name System, and you mapped a name to the IP address of the switch, you can specify the switch's name, instead of the IP address as the common name in the distinguished name.

Note
If the certificate will be issued by a private or public CA, you should check with the CA to see if they have any rules or guidelines on distinguished names for the certificates they issue.

Guidelines

The guidelines for creating certificates are:

- The switch must have a management IP address. For instructions, refer to Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.
- The management workstations from which you will configure the switch with web browser applications must be members of the same network as the management IP address of the switch, or they must have access to it through routers or other Layer 3 devices.
- The web browser server cannot operate in both HTTP mode and HTTPS mode at the same time.
- A certificate can have only one encryption key.
- The switch can use only certificates containing keys that it generated.
- The switch can have up to eight certificates, but only one can be active at a time.
- Your web browser must support HTTPS to use encryption.
- The switch supports HTTPS v1.0 and v1.1 protocols running over SSL.
- The switch supports RSA encryption.

The switch supports the following SSL protocols:

- SSL version 2.0
- SSL version 3.0
- TLS (Transmission Layer Security) version 1.0

Creating a Self-signed Certificate

Here are the main steps to configuring the switch for a self-signed certificate:

1. Create a new self-signed certificate with "CRYPTO CERTIFICATE GENERATE" on page 1497, in the Global Configuration mode. The command has this format:

   `crypto certificate` *`id_number`* `generate` *`length passphrase common_name organizational_unit organization location state country duration`*

   The ID_NUMBER parameter is a value from 1 to 10 that uniquely identifies the certificate on the switch. Since the switch cannot have more than eight certificates, and since only one certificate can be active at a time, you probably will not create more than one or two certificates.

   The length specifies the length in bits of the encryption key of the certificate. The range is 512 to 1536 bits.

   The PASSPHRASE parameter consists of 4 to 20 alphanumeric characters that are used to export the certificate in PKCS12 file format. Although the switch does not allow you to export certificates, you are still required to include a value for this parameter in the command.

   The COMMON_NAME, ORGANIZATIONAL_UNIT, ORGANIZATION, LOCATION, STATE, and COUNTRY parameters make up the distinguished name of the certificate. All of these parameters, with the exception of the COUNTRY parameter, have lengths up to 64 characters. Spaces and special characters are not allowed.

   The COUNTRY parameter is the two-character ISO 3166-1 initials of the country, in uppercase letters.

2. After creating the self-signed certificate, designate it as the active certificate on the switch with "IP HTTPS CERTIFICATE" on page 1504, in the Global Configuration mode. The command has this format:

   `ip https certificate` *`id_number`*

   The ID_NUMBER parameter is the ID number of the new certificate you created in Step 1.

3. Activate the HTTPS web browser server with "SERVICE HTTPS" on page 1503, in the Global Configuration mode. This command has no parameters.

At this point, the switch, if it has a management IP address, is ready for remote management with a web browser application. To start a management session, enter the IP address of the switch in the URL field of your web browser, being sure to include the prefix “https://”.

Here is an example of how to create a self-signed certificate and how to configure the HTTPS web browser server for the certificate. The specifications of the certificate are listed here:

- ID number: 2
- Key length: 1280
- Passphrase: trailtree
- Common name: 167.214.121.45 (This is the IP address of the switch.)
- Organizational unit: Sales
- Organization: Jones_Industries
- Location: San_Jose
- State: California
- Country: US
- Duration: 365 days

Table 172. Creating a Self-Signed Certificate and Configure HTTPS Web Browser

`awplus> enable`	Enter the Privileged Exec mode from the User Exec mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# crypto certificate 2 generate 1280 trailtree 167.214.121.45 Sales Jones_Industries San_Jose California US 365`	Create the self-signed certificate with “CRYPTO CERTIFICATE GENERATE” on page 1497.

`Generating a 1280 bit RSA private key`
`.....................................+++++`
`.................................+++++`
`writing new private key to '/cfg/cert2.pem'`
	Here is what the switch displays as it creates the certificate.

`awplus(config)# ip https certificate 2`	Designate the new certificate as the active certificate on the switch with “IP HTTPS CERTIFICATE” on page 1504.

Table 172. Creating a Self-Signed Certificate and Configure HTTPS Web Browser

`awplus(config)# no service http`	If the non-secure HTTP web browser server is enabled on the unit, disabled it with "NO SERVICE HTTP" on page 1478.
`awplus(config)# service https`	Enable the HTTPS server with "SERVICE HTTPS" on page 1503.
`awplus(config)# exit`	Return to the Privileged Exec mode.
`awplus# show ip https`	Confirm the confirmation with "SHOW IP HTTPS" on page 1507.

```
HTTPS server enabled. Port: 443
Certificate 2 is active
Issued by: self-signed
Valid from: 1/1/2000 to 12/31/2000
Subject: C=US, ST=California, L=San_Jose, O=Jones_Industries, OU=Sales,
CN=167.214.121.45
Finger print: FBFBAA5F 2673E463 E784F1C1 A3717881
```

The switch is now ready for remote web browser management with HTTPS, provided that it has a management IP address.

Configuring the HTTPS Web Server for a Certificate Issued by a CA

Here are the main steps to configuring the HTTPS web browser server for a certificate from a CA:

1. Create a self-signed certificate with “CRYPTO CERTIFICATE GENERATE” on page 1497, in the Global Configuration mode. The command has this format:

   `crypto certificate` *`id_number`* `generate` *`length passphrase common_name organizational_unit organization location state country duration`*

   The parameters are described in Step 1 in the previous procedure and in “CRYPTO CERTIFICATE GENERATE” on page 1497.

2. Create an enrollment request with “CRYPTO CERTIFICATE REQUEST” on page 1501, in the Global Configuration mode. The format of the command is shown here:

   `crypto certificate` *`id_number`* `request` *`common_name organizational_unit organization location state country`*

   The values of the parameters in this command must be exactly the same as the corresponding values from the CRYPTO CERTIFICATE GENERATE command, used to create the self-signed certificate. This includes the ID_NUMBER parameter. Any differences, including differences in capitalizations, will cause the switch to reject the CA certificate when you import it into the switch’s certificate database.

3. Cut and paste the enrollment request from your screen into a word processor document.

4. Submit the enrollment request to the CA.

5. After you receive the certificate files from the CA, download them into the switch’s file system using TFTP or Zmodem. For instructions, refer to Chapter 40, “File Transfer” on page 607. Be sure to download all certificate files from the CA.

6. Import the certificate into the certificate database with “CRYPTO CERTIFICATE IMPORT” on page 1500. The command has this format:

   `crypto certificate` *`id_number`* `import`

   The ID_NUMBER parameter is the ID number you assigned the self-signed certificate and enrollment request.

7. Designate the new certificate from the CA as the active certificate on the switch with "IP HTTPS CERTIFICATE" on page 1504, in the Global Configuration mode. The command has this format:

   ```
   ip https certificate id_number
   ```

   The ID_NUMBER parameter is the ID number you assigned the self-signed certificate and enrollment request.

8. Activate the HTTPS web browser server with "SERVICE HTTPS" on page 1503, in the Global Configuration mode. This command has no parameters.

Here is an example of how to configure the HTTPS web browser server for a certificate from a public or private CA. The certificate is assigned these specifications:

- ID number: 1
- Key length: 512
- Passphrase: hazeltime
- Common name: 124.201.76.54 (This is the IP address of the switch.)
- Organizational unit: Production
- Organization: ABC_Industries
- Location: San_Jose
- State: California
- Country: US
- Duration: 365 days

Table 173. Configuring the HTTPS Web Server for a Certificate Issued by a CA

`awplus> enable`	Enter the Privileged Exec mode from the User Exec mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# crypto certificate 1 generate 512 hazeltime 124.201.76.54 Production ABC_Industries San_Jose California US 365`	Create the self-signed certificate with "CRYPTO CERTIFICATE GENERATE" on page 1497.

`Generating a 512 bit RSA private key`
`.....+++++`
`.....+++++`
`writing new private key to '/cfg/cer1.pem'`
	This is the information the switch displays as it creates the certificate.

Table 173. Configuring the HTTPS Web Server for a Certificate Issued by a CA

`awplus(config)# crypto certificate 1 request 124.201.76.54 Production ABC_Industries San_Jose California US`	Create an enrollment request that has exactly the same information, including the same ID number, as the self-signed certificate, with "CRYPTO CERTIFICATE REQUEST" on page 1501.
	Cut and paste the certificate request from your screen into a word processor document.

```
-----BEGIN CERTIFICATE REQUEST-----

MIIBuzCCASQCAQAwezELMAkGA1UEBhMCVVMxEzARBgNVBAgTCkNhbGlmb3JuaWEx
ETAPBgNVBAcUCFNhbl9Kb3NlMRcwFQYDVQQKFA5BQkNfSW5kdXN0cmllczETMBEG
A1UECxMKUHJvZHVjdGlvbjEWMBQGA1UEAxMNMTI0LjIwMS43Ni41NDCBnzANBgkq
hkiG9w0BAQEFAAOBjQAwgYkCgYEAs4BrmXN3IEdOvyMEwE3DXLxl77NMKjy1OIDU
PYGJK6DuP2M+fk1sBMG/gjFIeMldmWl2HcILehGU9lCRtjqs0XLp4yVj1D8CmrPM
ipnu7UhYWD8T7hF9y7sGfx0KhzSc7x1pOkiZzfi/nQZ89TYWn9hxPMCTtpY+iBCH
IXAXXW8CAwEAAaAAMA0GCSqGSIb3DQEBBQUAA4GBACmW6H1yRWUrbPn2J8B2ygFP
DZ42gjN0pJdfK94vmS7Kv/VZpFHxakjLjSiXlDaUbqmqceG+JtBnOyEP0+Xr/WBl
llyf9tr29O/temY9iD+U2E9PVdl6mKgOsB+762Ys1kqNy7S79SS9grMnPmbO+rvH
ipN2U4jKPOZH0rIrdxaN

-----END CERTIFICATE REQUEST-----
```

–	Submit the request, along with any other necessary information, to the public or private CA.
–	After receiving the certificate from the CA, download it into the switch's file system, with TFTP or Zmodem. Be sure to download all the certificate files from the CA. For instructions, refer to Chapter 40, "File Transfer" on page 607.
`awplus(config)# crypto certificate 1 import`	Import the new certificate into the certificate database with "CRYPTO CERTIFICATE IMPORT" on page 1500.
`awplus(config)# ip https certificate 1`	Designate the new certificate as the active certificate on the switch with "IP HTTPS CERTIFICATE" on page 1504.

Table 173. Configuring the HTTPS Web Server for a Certificate Issued by a CA

`awplus(config)# no service http`	If the non-secure HTTP web browser server is enabled on the unit, disabled it with "NO SERVICE HTTP" on page 1478.
`awplus(config)# service https`	Enable the HTTPS server with "SERVICE HTTPS" on page 1503.
`awplus(config)# exit`	Return to the Privileged Exec mode.
`awplus# show ip https`	Confirm the confirmation with "SHOW IP HTTPS" on page 1507.

```
HTTPS server enabled. Port: 443
Certificate 1 active
Issued by: ABC_Industries_IT
Valid from: 1/1/2000 to 12/31/2000
Subject: C=US, ST=California, L=San_Jose, O=ABC_Industries,
OU=Production, CN=124.201.76.54
Finger print: FBFBAA5F 2673E463 E784F1C1 A3717881
```

The switch, if it has a management IP address, is now ready for remote HTTPS web browser management. To start a management session, enter the IP address of the switch in the URL field of your web browser, being sure to include the prefix "https://".

Enabling the Web Browser Server

The command to activate the web browser server for secure HTTPS operation is the SERVICE HTTPS command in the Global Configuration mode. The command, which does not have any parameters, is shown here:

```
awplus> enable
awplus# configure terminal
awplus(config)# service https
```

Here are the guidelines to the command:

- The switch should already have a management IP address. For instructions, refer to Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.
- The switch should have a HTTPS certificate.
- If the HTTP mode is enabled, you must disable it with the NO SERVICE HTTP command before activating the HTTPS mode. The command is in the Global Configuration mode.

Now that the server is activated for HTTPS operation, you can begin to manage the switch remotely using a web browser application from a workstation on your network. Enter the IP address of the switch in the URL field of the application and, when prompted by the switch, enter your login user name and password. Be sure to include the “HTTPS://” prefix with the IP address.

Disabling the Web Browser Server

The command to disable the HTTPS mode is the NO SERVICE HTTPS command in the Global Configuration mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# no service https
```

No further web browser management sessions are permitted by the switch after the server is disabled. Any web browser sessions that are in progress when the server is disabled are interrupted and are not allowed to continue.

Displaying the Web Browser Server

To display whether the HTTPS web server is enabled or disabled on the switch, issue the SHOW IP HTTPS command in the Privileged Exec mode. The command also displays the protocol port number if the server is enabled. Here is the command:

```
awplus> enable
awplus# show ip https
```

Here is an example of the display.

```
HTTPS server enabled. Port: 443
Certificate 1 is active
Issued by: self-signed
Valid from: 5/17/2010 to 5/16/2011
Subject: C=US, ST=California, L=San_Jose, O=ABC_Inc, OU=Production,
CN=169.254.143.1
Finger print: 5C7D34A9 5283B3C 87901271 6C66D2F5
```

Figure 248. SHOW IP HTTPS Command

The fields are described in Table 175 on page 1507.

Chapter 97

Secure HTTPS Web Browser Server Commands

The secure HTTPS web browser server commands are summarized in Table 174 and described in detail within the chapter.

Table 174. Secure HTTPS Web Browser Server Commands

Command	Mode	Description
“CRYPTO CERTIFICATE DESTROY” on page 1496	Global Configuration	Deletes unused certificates from the switch.
“CRYPTO CERTIFICATE GENERATE” on page 1497	Global Configuration	Creates self-signed certificates for secure HTTPS web browser management of the switch.
“CRYPTO CERTIFICATE IMPORT” on page 1500	Global Configuration	Imports certificates from public or private CAs into the certificate database on the switch.
“CRYPTO CERTIFICATE REQUEST” on page 1501	Global Configuration	Creates certificate enrollment requests for submittal to public or private CAs.
“SERVICE HTTPS” on page 1503	Global Configuration	Enables the HTTPS web server.
“IP HTTPS CERTIFICATE” on page 1504	Global Configuration	Designates the active certificate of the HTTPS web server.
“NO SERVICE HTTPS” on page 1505	Global Configuration	Disables the HTTPS web browser server.
“SHOW CRYPTO CERTIFICATE” on page 1506	Privileged Exec	Displays detailed information about the certificates on the switch.
“SHOW IP HTTPS” on page 1507	Privileged Exec	Displays the settings of the HTTPS web browser server.

CRYPTO CERTIFICATE DESTROY

Syntax

```
crypto certificate id_number destroy
```

Parameters

id_number
: Specifies the ID number of a certificate to be deleted from the switch. The range is 0 to 10. You can enter just one ID number.

Mode

Global Configuration mode

Description

Use this command to delete unused certificates from the switch. You can delete just one certificate at a time with this command.

Entering the WRITE or COPY RUNNING-CONFIG STARTUP-CONFIG command after deleting a certificate is unnecessary because certificates are not stored in the active boot configuration file.

Confirmation Command

“SHOW IP HTTPS” on page 1507

Example

This example deletes the certificate with the ID number 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# crypto certificate 5 destroy
```

CRYPTO CERTIFICATE GENERATE

Syntax

```
crypto certificate id_number generate length passphrase
common_name organizational_unit organization location state
country duration
```

Parameters

id_number

Specifies a certificate ID number. The range is 0 to 10. A certificate must be assigned an ID number that is unique from the ID numbers of all other certificates already on the switch.

length

Specifies the length of the encryption key in bits. The range is 512 to 1536 bits. The default is 512 bits.

passphrase

Specifies a passphrase, used to export the certificate in PKCS12 file format. This parameter must be from 4 to 20 characters. Spaces and special characters are not allowed. (Even though the switch does not permit the export of certificates, a passphrase is still required in the command.)

common_name

Specifies a common name for the certificate. This should be the IP address or fully qualified URL designation of the switch. This parameter can have up to 64 characters. Spaces and special characters are not allowed.

organizational_unit

Specifies the name of a department, such as Network Support or IT. This parameter can have up to 64 characters. Spaces and special characters are not allowed.

organization

Specifies the name of a company. This parameter can have up to 64 characters. Spaces and special characters are not allowed.

location

Specifies a location of the switch. This parameter can have up to 64 characters. Spaces and special characters are not allowed.

state

Specifies a state, such as California or Nevada. This parameter can have up to 64 characters. Spaces and special characters are not allowed.

country
Specifies the ISO 3166-1 initials of a country. This parameter must be two uppercase characters.

duration
Specifies the number of days the certificate is valid. The range is 30 to 3650 days.

Note
For a valid certificate to be active, you need to set the system clock. See “Manually Setting the Date and Time” on page 127 or “Activating the SNTP Client and Specifying the IP Address of an NTP or SNTP Server” on page 379.

Mode

Global Configuration mode

Description

Use this command to create self-signed certificates for secure HTTPS web browser management of the switch. All the parameters in the command are required.

Entering the WRITE or COPY RUNNING-CONFIG STARTUP-CONFIG command after creating a self-signed certificate is unnecessary because certificates are not stored in the active boot configuration file.

Note
Generating a certificate is CPU intensive. It should be performed before the switch is connected to your network or during periods of low network activity.

Confirmation Command

“SHOW IP HTTPS” on page 1507

Example

This example creates a self-signed certificate with the following specifications:

- ID number: 2
- Key length: 1280
- Passphrase: trailtree
- Common name: 167.214.121.45

- Organizational unit: Sales
- Organization: Jones_Industries
- Location: San_Jose
- State: California
- Country: US
- Duration: 365 days

```
awplus> enable
awplus# configure terminal
awplus(config)# crypto certificate 2 generate 1280 trailtree
167.214.121.45 Sales Jones_Industries San_Jose California US
365
```

CRYPTO CERTIFICATE IMPORT

Syntax

```
crypto certificate id_number import
```

Parameters

id_number
: Specifies the ID number of a certificate to be imported into the certificate database on the switch. You can specify just one ID number.

Mode

Global Configuration mode

Description

Use this command to import certificates from public or private CAs into the certificate database of the switch. A certificate has to be residing in the file system on the switch before you can import it into the certificate database.

Entering the WRITE or COPY RUNNING-CONFIG STARTUP-CONFIG command after importing a certificate is unnecessary because certificates are not stored in the active boot configuration file.

Confirmation Command

“SHOW IP HTTPS” on page 1507

Example

This example imports a certificate with the ID number 2 into the certification database from the file system:

```
awplus> enable
awplus# configure terminal
awplus(config)# crypto certificate 2 import
```

CRYPTO CERTIFICATE REQUEST

Syntax

```
crypto certificate id_number request common_name
organizational_unit organization location state country
```

Parameters

id_number

Specifies a certificate ID number. The range is 0 to 10. A certificate must be assigned an ID number that is unique from the ID numbers of any certificates already on the switch.

common_name

Specifies a common name for the certificate. This should be the IP address or fully qualified URL designation of the switch. This parameter can have up to 64 characters. Spaces and special characters are not allowed.

organizational_unit

Specifies the name of a department, such as Network Support or IT. This parameter can have up to 64 characters. Spaces and special characters are not allowed.

organization

Specifies the name of a company. This parameter can have up to 64 characters. Spaces and special characters are not allowed.

location

Specifies the location of the switch. This parameter can have up to 64 characters. Spaces and special characters are not allowed.

state

Specifies the state, such as California or Nevada. This parameter can have up to 64 characters. Spaces and special characters are not allowed.

country

Specifies the ISO 3166-1 initials of the country. This parameter must be two uppercase characters.

Mode

Global Configuration mode

Description

Use this command to create certificate enrollment requests for submittal to public or private CAs. Enrollment requests are stored in the file system in Base64-encoded X.509 format, with a ".pem" extension.

> **Note**
> An enrollment request must have the same ID number and other information as its corresponding self-signed certificate.

Confirmation Command

"DIR" on page 585

Example

This example creates a certificate enrollment request that has these specifications:

- ID number: 2
- Common name: 167.214.121.45
- Organizational unit: Sales
- Organization: Jones_Industries
- Location: San_Jose
- State: California
- Country: US

```
awplus> enable
awplus# configure terminal
awplus(config)# crypto certificate 2 request 167.214.121.45
Sales Jones_Industries San_Jose California US
```

SERVICE HTTPS

Syntax

```
service https
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate the HTTPS web server on the switch. The switch supports secure HTTPS web browser management sessions when the server is activated. Here are the preconditions to activating the server:

- The non-secure HTTP server on the switch must be disabled. For instructions, refer to "NO SERVICE HTTP" on page 1478.
- The switch must have an HTTPS certificate that was designated as the active certificate with the IP HTTPS CERTIFICATE command.

Confirmation Command

"SHOW IP HTTPS" on page 1507

Example

This example activates the HTTPS web server on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# service https
```

IP HTTPS CERTIFICATE

Syntax

```
ip https certificate id_number
```

Parameters

id_number
Specifies a certificate ID number.

Mode

Global Configuration mode

Description

Use this command to designate the active certificate for the secure HTTPS web server. The switch can have only one active certificate. The certificate, which must already exist on the switch, can be a self-signed certificate that the switch created itself or a certificate that was issued by a CA, from a certificate request generated by the switch.

Confirmation Command

“SHOW IP HTTPS” on page 1507

Example

This example designates the certificate with the ID number 1 as the active certificate on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip https certificate 1
```

NO SERVICE HTTPS

Syntax

```
no service https
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable the secure HTTPS web server on the switch. The switch rejects secure HTTPS web browser management sessions when the server is deactivated. You might disable the server to prevent remote web browser management sessions of the switch or prior to activating the non-secure HTTP web browser server.

Confirmation Command

"SHOW IP HTTPS" on page 1507

Example

```
awplus> enable
awplus# configure terminal
awplus(config)# no service https
```

SHOW CRYPTO CERTIFICATE

Syntax

```
show crypto certificate id_number
```

Parameters

id_number
Specifies a certificate ID number.

Mode

Privileged Exec mode

Description

Use this command to display detailed information about the certificates on the switch. You can display just one certificate at a time.

Example

This example displays detailed information about the certificates on the switch:

```
awplus# show crypto certificate 1
```

SHOW IP HTTPS

Syntax

```
show ip http
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the status of the HTTPS server and basic information about the certificates on the switch. An example of the information is shown here.

```
HTTPS server enabled. Port: 443
Certificate 1 is active
Issued by: self-signed
Valid from: 5/17/2010 to 5/16/2011
Subject: C=US, ST=California, L=San_Jose, O=Jones_Industries, OU=Sales,
CN=167.214.121.45
Finger print: 3FB9D543 72D8E6F8 2159F35E B634A738
```

Figure 249. SHOW IP HTTPS Command

The fields are defined in Table 175.

Table 175. SHOW IP HTTPS Command

Field	Description
HTTPS server enabled	Indicates that the HTTPS server is activated on the switch. This line is not displayed when the server is disabled.
Port	The TCP port number of the server. This parameter, which cannot be changed, is not displayed when the server is disabled.

Table 175. SHOW IP HTTPS Command (Continued)

Field	Description
Certificate # is active|inactive	Displays the status of the certificate. An active status indicates that the certificate was designated with “IP HTTPS CERTIFICATE” on page 1504 as the active certificate for the HTTPS server. The switch can have just one active certificate.
Valid from	Displays the dates during which the certificate is valid.
Subject	Displays certificate configuration information.

Example

This example displays the status of the HTTPS server and basic information about the certificates on the switch:

```
awplus# show ip https
```

Chapter 98

RADIUS and TACACS+ Clients

This chapter describes the following topics:

Overview

The switch has RADIUS and TACACS+ clients for remote authentication. Here are the two features that use remote authentication:

- 802.1x port-based network access control. This feature lets you increase network security by requiring that network users log on with user names and passwords before the switch will forward their packets. This feature is described in Chapter 73, “802.1x Port-based Network Access Control” on page 1087.
- Remote manager accounts. This feature lets you add more manager accounts to the switch by transferring the task of authenticating the accounts from the switch to an authentication server on your network. This feature is described in “Remote Manager Accounts” on page 1511.

The RADIUS client supports both features, but the TACACS+ client supports only the remote manager accounts feature. Here are the guidelines:

- Only one client can be active on the switch at a time.
- If you want to use just the remote manager account feature, you can use either RADIUS or TACACS+ because both clients support that feature.
- If you want to use 802.1x port-based network access control, you have to use the RADIUS client because the TACACS+ client does not support that feature.

Remote Manager Accounts

The switch has one local manager account. The account is referred to as a local account because the switch authenticates the user name and password when a manager uses the account to log on. If the user name and password are valid, the switch allows the individual to access its management software. Otherwise, it cancels the login to prevent unauthorized access.

There are two ways to add more manager accounts. One way is to create additional local accounts. This is explained in Chapter 86, "Local Manager Accounts" on page 1407 and Chapter 87, "Local Manager Account Commands" on page 1419. There can be up to eight local manager accounts.

The other way to add more accounts is with a RADIUS or TACACS+ authentication server on your network. With these features, the authentication of the user names and passwords of the manager accounts is performed by one or more authentication servers. The switch forwards the information to the servers when managers log on. The following steps illustrate the authentication process that occurs between the switch and an authentication server when a manager logs on:

1. The switch uses its RADIUS or TACACS+ client to transmit the user name and password to an authentication server on the network.

2. The server checks to see if the user name and password are valid.

3. If the combination is valid, the authentication server notifies the switch, which completes the login process, allowing the manager access to its management software.

4. If the user name and password are invalid, the authentication protocol server notifies the switch, which cancels the login.

As explained in "Privilege Levels" on page 1408, local manager accounts can have a privilege level of 1 or 15. Managers with a privilege level of 15 have access to all command modes. Managers with accounts that have a privilege level of 1 are restricted to the User Exec mode when command mode restriction is active on the switch, unless they know the special password.

Privilege levels also apply to remote manager accounts. When you create accounts on an authentication server, assign them a level of 1 or 15, just like local accounts. If command mode restriction is active on the switch, managers with a privilege level of 1 are limited to the User Exec mode, while managers with a privilege level of 15 are given access to the entire command mode structure. If command mode restriction is not active on

the switch, the privilege level of an account is ignored and all accounts have access to the entire command mode structure.

Here are the main steps to using the remote manager accounts feature on the switch:

1. Install TACACS+ or RADIUS server software on one or more of your network servers or management stations. Authentication protocol server software is not available from Allied Telesis.

2. Add the new manager accounts to the authentication servers. Here are the guidelines:

   – Assign each account a user name and password. The maximum length of a user name is 38 alphanumeric characters and spaces, and the maximum length of a password is 16 alphanumeric characters and spaces.

   – Assign each account a privilege level. This process differs depending on the server software. The TACACS+ server provides sixteen levels of the Privilege attribute (0 to 15); however, the AT-FS970M switch provides only two settings of the Privilege attribute (0 or 15). If command mode restriction is active on the switch, a manager account with a privilege level of 0 is restricted to the User Exec mode, while an account with a privilege level of 15 has access to all the command modes.

   Note
   If you enter a value other than 0 or 15 for the TACACS+ privilege level, the switch does not recognize the privilege level and responds with a “failed to authenticate” error message.

   For RADIUS, the management level is controlled by the Service Type attribute. Of its 11 values, only two apply to the switch. A value of “NAS Prompt” is equivalent to a privilege level of 1, while a value of “Administrative” is equivalent to the privilege level 15.

   Note
   This manual does not explain how to configure a TACACS+ or RADIUS server. For instructions, refer to the documentation included with the server software.

3. Assign the switch a management IP address. For instructions, refer to “What to Configure First” on page 80 or Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295.

4. Configure the RADIUS or TACACS+ client on the switch by entering the IP addresses of up to three authentication servers. For instructions, refer to "Managing the RADIUS Client" on page 1514 or "Managing the TACACS+ Client" on page 1518.

5. Enable the TACACS+ or RADIUS client.

6. Activate remote manager authentication on the switch. For instructions, refer to "Configuring Remote Authentication of Manager Accounts" on page 1521.

Note
For information on the RADIUS and TACACS+ authentication protocols, refer to the RFC 2865 and RFC 1492 standards, respectively.

Guidelines

Here are the guidelines to using the RADIUS and TACACS+ clients:

- Only one client can be active on the switch at a time.
- The clients can have a maximum of three IP addresses of authentication servers.
- The switch must have a management IP address. For instructions, refer to Chapter 13, "IPv4 and IPv6 Management Addresses" on page 295.
- The authentication servers on your network must be members of the same subnet as the management IP address of the switch or have access to it through routers or other Layer 3 devices.
- If the authentication servers are not members of the same subnet as the management IP address, the switch must have a default gateway. The default gateway defines the IP address of the first hop to reaching the remote subnet of the servers. For instructions, refer to Chapter 13, "IPv4 and IPv6 Management Addresses" on page 295.
- The client polls the servers for authentication information in the order in which they are listed in the client.
- The switch does not support the two earlier versions of the TACACS+ protocol, TACACS and XTACACS.
- The TACACS+ client does not support 802.1x port-based network access control. You must use the RADIUS client and a RADIUS server for that feature.

Managing the RADIUS Client

The following subsections describe how to manage the RADIUS client:

Adding IP Addresses of RADIUS Servers

The RADIUS client can store up to three IP addresses of RADIUS servers on your network. The order that you add an IP address determines its order on the switch. For instance, the first IP address that you add becomes server one, the second IP address that you add becomes server two, and the third IP address that you add becomes server three. Also, when you remove an IP address from the switch, the IP addresses below it are moved up. For example, if you make the following assignments:

- ❒ server one is 186.178.11.154
- ❒ server two is 186.178.11.156
- ❒ server three is 186.178.11.158

If you delete server one with an IP address of 186.178.11.154, server two remains the IP address of 186.178.11.156 and moves up to server one in the list, and the IP address of 186.178.11.158 moves up to server two. As a result, the next server address that you add to the switch is added to the bottom of the list and becomes server three.

To add an IP address, use the RADIUS-SERVER HOST command in the Global Configuration mode. Here is the format of the command:

```
radius-server host ipaddress [acct-port value] [auth-port
value] [key value]
```

You can add only one address at a time with this command.

The HOST parameter specifies the IP address of a RADIUS server on the network.

The ACCT-PORT parameter specifies the accounting port. This is 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.

The AUTH-PORT parameter 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.

The KEY parameter specifies the encryption key used by the designated RADIUS server. The maximum length is 40 characters.

The AUTH-PORT parameter specifies the UDP destination port for RADIUS authentication requests. The default UDP port is 1812.

The KEY parameter specifies the encryption key used by the designated RADIUS server. The maximum length is 40 characters. Special characters are allowed, but spaces are not permitted.

This example adds the IP address 111.111.111.111 as the second address in the list. The accounting port is 1811, and the authentication port is 1815. The encryption key is "ATI:"

```
awplus> enable
awplus# configure terminal
awplus(config)# radius-server host 111.111.111.111 acct-port
1811 auth-port 1815 key ATI
```

Specifying a RADIUS Global Encryption Key

If the RADIUS servers on your network use the same encryption key, use the RADIUS-SERVER KEY command in the Global Configuration mode to enter a global encryption key in the client. The format of the command is:

```
radius-server key secret
```

This example specifies "4tea23" as the global encryption key of the RADIUS servers:

```
awplus> enable
awplus# configure terminal
awplus(config)# radius-server key 4tea23
```

To remove the global encryption key without specifying a new value, use the NO form of this command:

```
awplus> enable
awplus# configure terminal
awplus(config)# no radius-server key
```

Specifying the Server Timeout

When the switch sends an authentication request to a RADIUS server, it waits a predefined time period for a response. This time period is referred to as the server timeout value. If the switch does not receive a response to an authentication request, it queries the next server in the list. If none of the servers respond, the switch activates the local manager accounts.

To set the server timeout period, use the RADIUS-SERVER TIMEOUT command in the Global Configuration mode. The range is 1 to 1000 seconds. The default is 5 seconds.

This example sets the RADIUS timeout to 15 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# radius-server timeout 15
```

Specifying RADIUS Accounting

To specify RADIUS accounting for *all* shell login sessions, use the AAA ACCOUNTING LOGIN command in the Global Configuration mode. Here is the format of the command:

```
aaa accounting login default start-stop|stop-only|none group
radius|tacacs [local]
```

The DEFAULT parameter indicates the default accounting method list.

The START-STOP parameter indicates a start accounting message is sent at the beginning of a session, and a stop accounting message is sent at the end of the session.

The STOP-ONLY parameter indicates a stop accounting message is sent at the end of the session.

The NONE parameter disables accounting messages.

The GROUP parameter indicates the user server group. Specify the RADIUS server.

The LOCAL parameter indicates that if the first attempt to authenticate a user with the RADIUS server fails, the authentication process fails, and the user is approved to access the switch with the local name and password.

This example configures RADIUS accounting for all login shell sessions to send a start accounting message at the beginning of a session and a stop accounting message at the end of the session:

```
awplus> enable
awplus# configure terminal
awplus(config)# aaa accounting login default start-stop
group radius
```

Removing the Accounting Method List

To reset the configuration of the default accounting list for login shell sessions, use the NO AAA ACCOUNTING LOGIN DEFAULT command. This command causes the switch to revert to the authentication method used by the local user database:

```
awplus> enable
awplus# configure terminal
awplus(config)# no aaa accounting login default
```

Deleting Server IP Addresses

To delete the IP address of a RADIUS server from the list of servers on the switch, use the NO RADIUS-SERVER HOST command in the Global Configuration mode. You can delete only one IP address at a time with this command. This example removes the IP address 211.132.123.12 from the list of RADIUS servers:

```
awplus> enable
awplus# configure terminal
awplus(config)# no radius-server host 211.132.123.12
```

Displaying the RADIUS Client

To display the settings of the RADIUS client, use the SHOW RADIUS command in the User Exec mode or Privileged Exec mode.

```
awplus# show radius
```

Here is an example of the RADIUS client information.

```
RADIUS Global Configuration
    Source Interface     : 192.168.20.33
    Timeout              : 5 sec
Server Host : 192.168.1.75
    Authentication Port  : 1812
    Accounting Port      : 1813
```

Figure 250. SHOW RADIUS Command

The information is described in Table 177 on page 1544.

Managing the TACACS+ Client

The following subsections describe how to manage the TACACS+ client:

Adding IP Addresses of TACACS+ Servers

The TACACS+ client can store the IP addresses of three TACACS+ servers on your network. The order that you add an IP address determines its order on the switch. For instance, the first IP address that you add becomes server one, the second IP address that you add becomes server two, and the third IP address that you add becomes server three. Also, when you remove an IP address from the switch, the IP addresses below it are moved up. For example, if you make the following assignments:

- ❒ server one is 186.178.11.154
- ❒ server two is 186.178.11.156
- ❒ server three is 186.178.11.158

If you delete the IP address of 186.178.11.154 for server one in the list, the server two IP address of 186.178.11.156 moves up to the server one position, and the IP address of 186.178.11.158 moves up to the server two position. As a result, the next server address that you add to the switch is added to the bottom of the list and becomes server three.

Use the TACACS-SERVER HOST command in the Global Configuration mode command to add an IP address of a server to the client. Here is the format of the command:

```
tacacs-server host ipaddress key value
```

You can add only one IP address at a time with this command.

The HOST parameter specifies an IP address of a TACACS+ server.

The KEY parameter specifies the secret key of a TACACS+ server. The maximum length is 40 characters. Special characters are allowed, but spaces are not permitted.

This example adds the IP address 115.16.172.54 as a TACACS+ authentication server at the bottom of the list. The server has the key "prt17:"

```
awplus> enable
awplus# configure terminal
awplus(config)# tacacs-server host 115.16.172.54 key prt17
```

Specifying TACACS+ Accounting

To specify TACACS+ accounting for *all* shell login sessions, use the AAA ACCOUNTING LOGIN command in the Global Configuration mode. Here is the format of the command:

```
aaa accounting login default start-stop|stop-only|none group
radius|tacacs
```

The DEFAULT parameter indicates the default accounting method list.

The START-STOP parameter indicates a start accounting message is sent at the beginning of a session, and a stop accounting message is sent at the end of the session.

The STOP-ONLY parameter indicates a stop accounting message is sent at the end of the session.

The NONE parameter disables accounting messages.

The GROUP parameter indicates the user server group. Specify the TACACS+ server.

This example configures TACACS+ accounting for all login shell sessions to send a start accounting message at the beginning of a session and a stop accounting message at the end of the session:

```
awplus> enable
awplus# configure terminal
awplus(config)# aaa accounting login default start-stop
group tacacs
```

Removing the Accounting Method List

To reset the configuration of the default accounting list for login shell sessions, use the NO AAA ACCOUNTING LOGIN DEFAULT command. This command causes the switch to revert to the authentication method used by the local user database:

```
awplus> enable
awplus# configure terminal
awplus(config)# no aaa accounting login default
```

Deleting IP Addresses of TACACS+ Servers

To delete the IP address of a TACACS+ server from the client on the switch, use the NO TACACS-SERVER HOST command in the Global Configuration mode. You can delete only one IP address at a time with this command. This example removes the IP address 122.124.15.7 from the TACACS+ client:

```
awplus> enable
awplus# configure terminal
awplus(config)# no tacacs-server host 122.114.15.7
```

Displaying the TACACS+ Client

To display the settings of the TACACS+ client, use the SHOW TACACS command in the Privileged Exec mode.

```
awplus# show tacacs
```

Here is an example of the TACACS+ client information.

```
TACACS+ Global Configuration
   Timeout            : 5 sec

Server Host/     Server
IP Address       Status
-----------------------
10.0.0.170       Alive
192.168.1.166    Unknown
```

Figure 251. SHOW TACACS Command

The fields are explained in Table 178 on page 1546.

Configuring Remote Authentication of Manager Accounts

Check that you performed the following steps before activating remote authentication of manager accounts on the switch:

- Added at least one RADIUS or TACACS+ server to your network.
- Added the manager accounts to the authentication servers.
- Assigned a management IP address to the switch.
- Added the IP addresses of the authentication servers to the RADIUS or TACACS+ client on the switch.

To activate the feature, use the AAA AUTHENTICATION LOGIN commands in the Global Configuration mode. The commands for the two clients are different. If you are using RADIUS, enter:

```
awplus> enable
awplus# configure terminal
awplus(config)# aaa authentication login radius
```

If you are using TACACS+, enter:

```
awplus> enable
awplus# configure terminal
awplus(config)# aaa authentication login tacacs
```

After you activate the feature, all future login attempts by managers are forwarded by the switch to the designated authentication servers for authentication.

To deactivate the feature, use the NO versions of the commands. The following example deactivates the feature if it is using RADIUS:

```
awplus> enable
awplus# configure terminal
awplus(config)# no aaa authentication login radius
```

The following example deactivates the feature if it is using TACACS+:

```
awplus> enable
awplus# configure terminal
awplus(config)# no aaa authentication login tacacs
```

The switch supports both local and remote manager accounts at the same time for different management methods. You can toggle the remote manager authenticator on or off for local, Telnet, and SSH management sessions. For example, you may configure the switch to use its local manager accounts for local management sessions and remote manager accounts for Telnet and SSH management sessions. You can even toggle remote authentication on or off for the ten individual VTY lines the switch

uses for remote Telnet and SSH sessions. (For background information, refer to “VTY Lines” on page 79.)

Toggling remote authentication is accomplished with the LOGIN AUTHENTICATION and NO LOGIN AUTHENTICATION commands, found in the Console Line and Virtual Terminal Line modes. Here are several examples of how to use the commands.

Assume you used the appropriate AAA AUTHENTICATION LOGIN command to activate remote authentication on the switch. At the default settings, the switch activates remote authentication for all local, Telnet, and SSH management sessions. Now assume that you want the switch to use the local manager accounts instead of the remote manager accounts whenever anyone logs in using the Console port. To do this, you need to toggle off remote authentication for local management sessions using the NO LOGIN AUTHENTICATION command in the Console Line mode, as shown here:

```
awplus> enable
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# no login authentication
```

Now, even though remote authentication is activated, the switch uses its local manager accounts to authenticate the user name and password whenever someone logs on through the Console port.

If you change your mind and want to reactivate remote authentication for local management sessions, enter the LOGIN AUTHENTICATION command, again in the Console Line mode, as shown here:

```
awplus> enable
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# login authentication
```

Toggling remote authentication for Telnet and SSH management sessions is more complex because there are ten VTY lines and you can toggle remote authentication on each line individually. For example, you might configure the lines so that the switch uses its local manager accounts to authenticate management sessions on lines 0 and 1, and the remote manager accounts on the other lines.

Toggling remote authentication on the VTY lines is performed with the same commands as for local management sessions, but in different modes. They are called VTY Line modes, and there is one mode for each line. The command for entering the modes is the LINE VTY command, which has this format:

```
line vty line_id
```

The LINE_ID parameter has a range of 0 to 9. The following example of the command toggles off remote authentication on VTY line 0.

```
awplus> enable
awplus# configure terminal
awplus(config)# line vty 0
awplus(config-line)# no login authentication
```

Now, the switch uses the local manager accounts, instead of the remote accounts, to authenticate the user name and password when an administrator establishes a Telnet or SSH management session on VTY line 0.

The following example reactivates remote authentication on VTY line 0:

```
awplus> enable
awplus# configure terminal
awplus(config)# line vty 0
awplus(config-line)# login authentication
```

Chapter 99

RADIUS and TACACS+ Client Commands

The commands for the RADIUS and TACACS+ clients are summarized in Table 176 and described in detail within the chapter.

Table 176. RADIUS and TACACS+ Client Commands

Command	Mode	Description
“AAA ACCOUNTING LOGIN” on page 1527	Global Configuration	Configures RADIUS or TACACS+ accounting for login shell session.
“AAA AUTHENTICATION ENABLE (TACACS+)” on page 1529	Global Configuration	Enables the TACACS+ password on the switch.
“AAA AUTHENTICATION LOGIN” on page 1531	Global Configuration	Enables RADIUS or TACACS+ on the switch globally.
“IP RADIUS SOURCE-INTERFACE” on page 1533	Global Configuration	Configures the RADIUS source IP address interface.
“LOGIN AUTHENTICATION” on page 1535	Console Line and Virtual Terminal Line	Activates remote authentication for local management sessions and remote Telnet and SSH sessions.
“NO LOGIN AUTHENTICATION” on page 1537	Console Line and Virtual Terminal Line	Deactivates remote authentication for local management sessions and remote Telnet and SSH sessions.
“NO RADIUS-SERVER HOST” on page 1538	Global Configuration	Deletes IP addresses of RADIUS servers from the list of authentication servers in the RADIUS client.
“NO TACACS-SERVER HOST” on page 1539	Global Configuration	Deletes IP addresses of TACACS+ servers from the list of authentication servers in the TACACS+ client.
“RADIUS-SERVER HOST” on page 1540	Global Configuration	Adds IP addresses of RADIUS servers to the RADIUS client for remote authentication and accounting.
“RADIUS-SERVER KEY” on page 1542	Global Configuration	Specifies the global encryption key of the RADIUS servers.

Table 176. RADIUS and TACACS+ Client Commands (Continued)

Command	Mode	Description
“RADIUS-SERVER TIMEOUT” on page 1543	Global Configuration	Specifies the maximum amount of time the RADIUS client waits for a response from a RADIUS authentication server for an authentication request.
“SHOW RADIUS” on page 1544	Privileged Exec	Displays the configuration settings of the RADIUS client.
“SHOW TACACS” on page 1546	Privileged Exec	Displays the configuration settings of the TACACS+ client.
“TACACS-SERVER HOST” on page 1548	Global Configuration	Adds IP addresses of TACACS+ servers to the TACACS+ client in the switch.
“TACACS-SERVER KEY” on page 1549	Global Configuration	Specifies the global encryption key of the TACACS+ servers.
“TACACS-SERVER TIMEOUT” on page 1550	Global Configuration	Specifies the maximum amount of time the TACACS+ client waits for a response from a TACACS+ authentication server for an authentication request.

AAA ACCOUNTING LOGIN

Syntax

`aaa accounting login` *`default start-stop|stop-only|none group radius|tacacs`*

Parameters

default
Indicates the default accounting method list.

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 the session.

none
Disables accounting messages.

group
Indicates the user server group. Specify one of the following:

radius: Uses all RADIUS servers.

tacacs: Uses all TACACS+ servers.

Mode

Global Configuration mode

Description

This command configures RADIUS or TACACS+ accounting for all login shell sessions. This command creates a default method list that is applied to every console and vty line unless another accounting method list is applied on that line.

Use the no form of this command, NO AAA ACCOUNTING LOGIN DEFAULT, to remove the accounting method list for login shell sessions. This command causes the switch to revert to the authentication method used by the local user database. In addition, it disables accounting on every line that has the default accounting configuration.

Confirmation Commands

“SHOW RADIUS” on page 1544

“SHOW TACACS” on page 1546

Examples

To configure RADIUS accounting for login shell sessions, use the following commands:

```
awplus> enable
awplus# configure terminal
awplus(config)# aaa accounting login default start-stop
group radius
```

To reset the configuration of the default accounting list, use the following commands:

```
awplus> enable
awplus# configure terminal
awplus(config)# no aaa accounting login default
```

To configure TACACS+ accounting for login shell sessions, use the following commands:

```
awplus> enable
awplus# configure terminal
awplus(config)# aaa accounting login default start-stop
group tacacs
```

AAA AUTHENTICATION ENABLE (TACACS+)

Syntax

```
aaa authentication enable default group tacacs [local]
```

Parameters

default
Indicates the default accounting method list.

group
Indicates the user server group. Specify the following:

tacacs: Uses all TACACS+ servers.

local
Indicates that authentication using the password provided in the ENABLE PASSWORD command is attempted if a TACACS+ server is not available. For information about this command, see "ENABLE PASSWORD" on page 1420. This is an optional parameter.

Mode

Global Configuration mode

Description

Use this command to enable the TACACS+ password on the switch. This password is used to verify the TACACS+ server, thereby providing another layer of security. By default, the AAA AUTHENTICATION ENABLE command is disabled.

Note
This command only applies to TACACS+ clients.

Use the no form of this command, NO AAA AUTHENTICATION ENABLE, to disable the TACACS+ password on the switch.

Confirmation Commands

"SHOW TACACS" on page 1546

Examples

To enable the TACACS+ password on the switch and specify authentication using the password provided in the ENABLE PASSWORD

command is attempted if a TACACS+ server is not available, use the following commands:

```
awplus> enable
awplus# configure terminal
awplus(config)# aaa authentication enable default group
tacacs local
```

To enable the TACACS+ password on the switch, use the following commands:

```
awplus> enable
awplus# configure terminal
awplus(config)# aaa authentication enable default group
tacacs
```

AAA AUTHENTICATION LOGIN

Syntax

```
aaa authentication login default [group radius|tacacs]
[local]
```

Parameters

default

Indicates the default accounting method list.

group

Indicates the user server group. Specify one of the following:

radius: Uses all RADIUS servers.

tacacs: Uses all TACACS+ servers.

local

Indicates that authentication using the password provided in the ENABLE PASSWORD command is attempted if a RADIUS or TACACS+ server is not available. For information about this command, see "ENABLE PASSWORD" on page 1420. This is an optional parameter.

Mode

Global Configuration mode

Description

Use this command to enable RADIUS or TACACS+ on the switch globally. This command creates an ordered list of methods used to authenticate a RADIUS or TACACS+ user login. Specify the local parameter or the group parameter in the order that you want these parameters to be applied.

Use the no version of this command, NO AAA AUTHENTICATION LOGIN, to remove the authentication setting on the switch. This command returns the default method list to its default state which is local.

Note
The NO AAA AUTHENTICATION LOGIN command does not remove the default method list from the software.

Confirmation Commands

“SHOW RADIUS” on page 1544

“SHOW TACACS” on page 1546

Examples

To enable RADIUS servers on the switch, use the following commands:

```
awplus> enable
awplus# configure terminal
awplus(config)# aaa authentication login default group
radius local
```

To enable TACACS+ servers on the switch, use the following commands:

```
awplus> enable
awplus# configure terminal
awplus(config)# aaa authentication login default group
tacacs local
```

IP RADIUS SOURCE-INTERFACE

Syntax

```
ip radius source-interface Ipv4 Address | VID
```

Parameters

Ipv4 Address
Indicates an IPv4 address in the following format:

xxx.xxx.xxx.xxx

VID
Specifies a VLAN ID.

Modes

Global Configuration mode

Description

Use this command to assign the RADIUS source interface to an IPv4 address or VLAN ID. The RADIUS client uses the specified IP address on every outgoing RADIUS packet.

Use the no version of this command, NO IP RADIUS SOURCE-INTERFACE, to remove the RADIUS source IP address from the client.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

This example configures the RADIUS source IP address using a VLAN ID:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip radius source-interface vlan 1
```

This example configures the RADIUS source IP address with an IPv4 address:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip radius source-interface 192.168.1.78
```

This example removes the RADIUS source IP address from the RADIUS client:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip radius source-interface
```

LOGIN AUTHENTICATION

Syntax

```
login authentication
```

Parameters

None

Modes

Console Line and Virtual Terminal Line modes

Description

Use this command to activate remote authentication of manager accounts for local management sessions and remote Telnet and SSH sessions.

You can activate remote authentication separately for the different management methods. Remote authentication of local management sessions is activated in the Console Line mode while remote authentication for remote Telnet and SSH management sessions is activated in the Virtual Terminal Line mode.

Note
If the switch is unable to communicate with the authentication servers when a manager logs on, because either the servers are not responding or the RADIUS or TACACS+ client is configured incorrectly, the switch automatically reactivates the local manager accounts so that you can continue to log on and manage the unit.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

This example activates remote authentication for local management sessions:

```
awplus> enable
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# login authentication
```

This example activates remote authentication for remote Telnet and SSH management sessions that use VTY line 0:

```
awplus> enable
awplus# configure terminal
awplus(config)# line vty 0
awplus(config-line)# login authentication
```

NO LOGIN AUTHENTICATION

Syntax

```
no login authentication
```

Parameters

None

Modes

Console Line and Virtual Terminal Line modes

Description

Use this command to deactivate remote authentication for local management sessions and remote Telnet and SSH sessions.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

This example deactivates remote authentication for local management sessions:

```
awplus> enable
awplus# configure terminal
awplus(config)# line console 0
awplus(config-line)# no login authentication
```

This example deactivates remote authentication on VTY line 0, used by remote Telnet and SSH management sessions:

```
awplus> enable
awplus# configure terminal
awplus(config)# line vty 0
awplus(config-line)# no login authentication
```

NO RADIUS-SERVER HOST

Syntax

```
no radius-server host ipaddress
```

Parameter

ipaddress
: Specifies an IP address of a RADIUS server to be deleted from the authentication server list.

Mode

Global Configuration mode

Description

Use this command to delete IP addresses of RADIUS servers from the list of authentication servers on the switch. You can delete only one IP address at a time with this command.

Confirmation Command

“SHOW RADIUS” on page 1544

Example

This example removes the IP address 122.34.122.47 from the list of RADIUS servers:

```
awplus> enable
awplus# configure terminal
awplus(config)# no radius-server host 122.34.122.47
```

NO TACACS-SERVER HOST

Syntax

```
no tacacs-server host ipaddress
```

Parameter

ipaddress

Specifies an IP address of a TACACS+ server to be deleted from the TACACS+ client. You can delete just one address at a time with this command.

Mode

Global Configuration mode

Description

Use this command to delete IP addresses of TACACS+ servers from the client. You can delete only one IP address at a time with this command.

Confirmation Command

"SHOW TACACS" on page 1546

Example

This example removes the IP address 152.112.12.7 from the TACACS+ client:

```
awplus> enable
awplus# configure terminal
awplus(config)# no tacacs-server host 152.112.12.7
```

RADIUS-SERVER HOST

Syntax

```
radius-server host ipaddress [acct-port value] [auth-port
value] [key value]
```

Parameters

ipaddress
: Specifies the IP address of a RADIUS server on the network.

acct-port
: Specifies the accounting port. This is 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.

auth-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.

key
: Specifies the encryption key used by the designated RADIUS server. The maximum length is 40 characters.

Mode

Global Configuration mode

Description

Use this command to add IP addresses of RADIUS servers to the authentication server list on the switch. Servers defined with this command are used for remote authentication only.

The switch can have up to three RADIUS authentication servers, but only one can be added at a time with this command. The order that you add an IP address determines its order on the switch.

Confirmation Command

“SHOW RADIUS” on page 1544

Examples

This example adds a RADIUS server with the IP address 176.225.15.23. The UDP port is 1811, and the encryption key is "abt54:"

```
awplus> enable
awplus# configure terminal
awplus(config)# radius-server host 176.225.15.23 auth-port
1811 key abt54
```

This example adds the IP address 149.245.22.22 of a RADIUS server to the RADIUS client on the switch. The UDP port is 1815, and the encryption key is "tiger12:"

```
awplus> enable
awplus# configure terminal
awplus(config)# radius-server host 149.245.22.22 auth-port
1815 key tiger12
```

This example adds a RADIUS server with the IP address 176.225.15.23 to the switch. The accounting port is 1811, and the UDP port is 1815. The encryption key is "kieran7:"

```
awplus> enable
awplus# configure terminal
awplus(config)# radius-server host 176.225.15.23 acct-port
1811 auth-port 1815 key kieran7
```

This example adds the IP address 149.245.22.22 of a RADIUS server to the RADIUS client on the switch. The accounting port is set to 0 which indicates the server is not used for accounting. The UDP port is 1814, and the encryption key is "jared6:"

```
awplus> enable
awplus# configure terminal
awplus(config)# radius-server host 149.245.22.22 acct-port 0
auth-port 1814 key jared6
```

RADIUS-SERVER KEY

Syntax

```
radius-server key value
```

Parameters

key

Specifies the global encryption key of the RADIUS servers. The maximum length is 40 characters.

Mode

Global Configuration mode

Description

Use this command to add the global encryption key of the RADIUS servers to the RADIUS client. You can add a global encryption key if you defined one RADIUS server in the RADIUS client; or if there is more than one server, and they all use the same encryption key. To define two or three servers that use different encryption keys, do not enter a global encryption key with this command. Instead, define the individual keys when you add the IP addresses of the servers to the client with “RADIUS-SERVER HOST” on page 1540.

To remove an existing global key without specifying a new value, use the NO form of this command, NO RADIUS-SERVER KEY.

Confirmation Command

“SHOW RADIUS” on page 1544

Examples

This example sets the RADIUS global encryption key to ‘key22a’:

```
awplus> enable
awplus# configure terminal
awplus(config)# radius-server key key22a
```

This example deletes the current RADIUS global encryption key without defining a new value:

```
awplus> enable
awplus# configure terminal
awplus(config)# no radius-server key
```

RADIUS-SERVER TIMEOUT

Syntax

radius-server timeout value

Parameters

timeout

Specifies the maximum amount of time the RADIUS client waits for a response from a RADIUS authentication server. The range is 1 to 1,000 seconds. The default is 5 seconds.

Mode

Global Configuration mode

Description

Use this command to set the timeout value for the RADIUS client on the switch. The timeout is the amount of time the client waits for a response from a RADIUS server for an authentication request. If the timeout expires without a response, the client queries the next server in the list. If there are no further servers in the list to query, the switch defaults to the standard manager and operator accounts.

Use the no form of this command, NO RADIUS-SERVER TIMEOUT, to set the RADIUS timeout to the default value of 5 seconds.

Confirmation Command

"SHOW RADIUS" on page 1544

Examples

This example sets the RADIUS timeout to 55 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# radius-server timeout 55
```

This example returns the RADIUS timeout to the default value of 5 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# no radius-server timeout
```

SHOW RADIUS

Syntax

```
show radius
```

Parameters

None

Modes

Privileged Exec mode

Description

Use this command to display the configuration of the RADIUS client. Here is an example of the client information.

```
RADIUS Global Configuration
    Source Interface     : 192.168.3.97
    Timeout              : 5 sec
Server Host : 192.168.1.75
    Authentication Port  : 1812
    Accounting Port      : 1813
```

Figure 252. SHOW RADIUS Command

The fields are defined in this table.

Table 177. SHOW RADIUS Command

Parameter	Description
Source Interface	An IP address assigned to an interface on the switch that is the source of all outgoing RADIUS packets. WIth hardware stacking, this the source address of the master switch.
Timeout	The length of the time, in seconds, that the switch waits for a response from a RADIUS server to an authentication request, before querying the next server in the list.
Server Host	The IP address of a RADIUS server on the network.
Authentication Port	The authentication protocol port.

Table 177. SHOW RADIUS Command (Continued)

Parameter	Description
Accounting Port	The accounting protocol port.
Encryption Keys	The server encryption keys, if defined.

Example

This example displays the configuration of the RADIUS client:

```
awplus# show radius
```

SHOW TACACS

Syntax

```
show tacacs
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the configuration of the TACACS+ client on the switch. An example of the information is shown in Figure 253.

```
TACACS+ Global Configuration
   Timeout             : 5 sec

Server Host : 149.123.154.12
   Server Status       : Alive
Server Host : 149.123.154.26
   Server Status       : Dead
```

Figure 253. SHOW TACACS Command

The fields are described in Table 178.

Table 178. SHOW TACACS Command

Parameter	Description
Timeout	The length of the time, in seconds, that the switch waits for a response from a TACACS+ server to an authentication request. The default is 40 seconds. If there is no response from any authentication servers, the switch reactivates the local manager accounts. This parameter cannot be changed.
Server Host	The IP address of a TACACS+ server on your network.

Table 178. SHOW TACACS Command (Continued)

Parameter	Description
Server Status	Indicates the status of the server host. One of the following options is displayed: – Alive: Indicates the server is working correctly. The sockets are successful. – Dead: Indicates the server has timed out or the sockets are unsuccessful.

Example

This example displays the configuration of the TACACS+ client on the switch:

```
awplus# show tacacs
```

TACACS-SERVER HOST

Syntax

```
tacacs-server host ipaddress [key value]
```

Parameters

host

Specifies an IP address of a TACACS+ server.*key*
Specifies the secret key of a TACACS+ server. The maximum length is 40 characters.

Mode

Global Configuration mode

Description

Use this command to add IP addresses of TACACS+ servers to the TACACS+ client in the switch. The list can have up to three TACACS+ authentication servers, but you can add only one at a time with this command.

Confirmation Command

“SHOW TACACS” on page 1546

Example

This example adds the IP address 149.11.24.1 to the TACACS+ authentication server list. The server has the key “kenken16:”

```
awplus> enable
awplus# configure terminal
awplus(config)# tacacs-server host 149.11.24.1 order 2 key
kenken16
```

TACACS-SERVER KEY

Syntax

```
tacacs-server key value
```

Parameters

value

Specifies the global encryption key of the TACACS+ servers. The maximum length is 40 characters.

Mode

Global Configuration mode

Description

Use this command to add the global encryption key of the TACACS+ servers to the TACACS+ client. You can add a global encryption key if you defined one TACACS+ server in the TACACS+ client; or if there is more than one server, and they all use the same encryption key. To define two or three servers that use different encryption keys, do not enter a global encryption key with this command. Instead, define the individual keys when you add the IP addresses of the servers to the client with "TACACS-SERVER HOST" on page 1548.

To remove an existing global key without specifying a new value, use the NO form of this command, NO TACACS-SERVER KEY.

Confirmation Command

"SHOW TACACS" on page 1546

Examples

This example sets the TACACS+ global encryption key to 'key12b':

```
awplus> enable
awplus# configure terminal
awplus(config)# tacacs-server key key12b
```

This example deletes the current TACACS+ global encryption key without defining a new value:

```
awplus> enable
awplus# configure terminal
awplus(config)# no tacacs-server key
```

TACACS-SERVER TIMEOUT

Syntax

```
tacacs-server timeout value
```

Parameters

timeout
: Specifies the maximum amount of time the TACACS+ client waits for a response from a TACACS+ authentication server. The range is 1 to 1,000 seconds. The default is 5 seconds.

Mode

Global Configuration mode

Description

Use this command to set the timeout value for the TACACS+ client on the switch. The timeout is the amount of time the client waits for a response from a TACACS+ server for an authentication request. If the timeout expires without a response, the client queries the next server in the list. If there are no further servers in the list to query, the switch defaults to the standard manager and operator accounts.

Use the no form of this command, NO TACACS-SERVER TIMEOUT, to set the TACACS+ timeout to the default value of 5 seconds.

Confirmation Command

"SHOW TACACS" on page 1546

Examples

This example sets the TACACS+ timeout to 55 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# tacacs-server timeout 55
```

This example returns the TACACS+ timeout to the default value of 5 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# no tacacs-server timeout
```

Section XIII

Quality of Service

This section contains the following chapters:

Chapter 100

Advanced Access Control Lists (ACLs)

This chapter describes the following topics:

Overview

Access Control Lists (ACLs) act as filters to control the ingress packets on ports. They are commonly used to restrict the types of packets ports accept to increase port security and create physical links dedicated to carrying specific types of traffic. For instance, you can configure ACLs to permit ports to accept only ingress packets that have a specific source or destination IP address.

There are four types of ACLs:

- Numbered IPv4 ACLs
- Numbered MAC ACLs
- Named IPv4 ACLs (and MAC Addresses)
- Named IPv6 ACLs

Numbered IPv4 ACLs and Numbered MAC ACLs are identified by ID numbers. The ID number range for Numbered IPv4 ACLs is 3000 to 3699. The ID number range for Numbered MAC ACLs is 4000 to 4699. In addition, Numbered IPv4 ACLs and Numbered MAC ACLs take effect immediately. You cannot assign them a date or time to begin filtering. Numbered IPv4 ACLs are only compatible with IPv4 addresses. They are not compatible with IPv6 addresses.

Both Named IPv4 ACLs and Named IPv6 ACLs are identified by user-specified names. You can assign both of these types a date and time to begin and end filtering. In other words, your filtering commands do not have to take effect immediately. Named IPv4 ACLs are compatible with IPv4 addresses and MAC addresses. Named IPv6 ACLs are compatible with IPv6 addresses only.

Filtering Criteria

All types of ACLs identify packets using filtering criteria. There are six criteria:

- Source and destination IP addresses
- ICMP source and destination IP addresses
- Protocol type
- Source and destination TCP ports
- Source and destination UDP ports
- Source and destination MAC addresses

Actions

The action defines the response to packets that match the filtering criterion of the ACL. There are three possible actions:

- Permit— A permit action instructs ports to forward ingress packets that match the specified traffic flow of the ACL. By default, all ingress packets are forwarded by the ports.
- Deny— A deny action instructs ports to discard the specified ingress packets.
- Copy to mirror— This action causes a port to copy all ingress packets that match the ACL to the destination port of the mirror port. This action must be used in conjunction with the port mirror feature, explained in Chapter 27, "Port Mirror" on page 489.

ID Numbers

For both Numbered IPv4 ACLs and Numbered MAC ACLs, you must assign each ACL a unique ID number. There are two ID number ranges that are displayed in Table 179.

Table 179. Access Control List ID Number Ranges

Type of ACL	ID Number Range
Numbered IPv4 ACLs	3000 - 3699
Numbered MAC ACLs	4000 - 4699

How Ingress Packets are Compared Against ACLs

As stated previously, ports that do not have an ACL forward *all* ingress packets. Ports with one or more deny ACLs discard ingress packets that match the ACLs and forward all other traffic. A port that has one ACL that specifies a particular source IP address, for example, discards all ingress packets with the specified source address and forwards all other traffic. In situations where a port has more than one deny ACL, packets are discarded at the first match.

Since ports forward all ingress packets unless they have deny ACLs, permit ACLs are only necessary in situations where you want a port to forward packets that are a subset of a larger traffic flow that is blocked, for example, a port that forwards only packets having a specified destination IP address. A permit ACL specifies the packets with the intended destination IP address, and a deny ACL specifies all traffic.

When ports have both permit and deny ACLs, you must add the permit ACLs first, because packets are compared against the ACLs in the order they are added to the ports. If a permit ACL is added after a deny ACL, ports are likely to discard packets specified by the permit ACL, thus causing them to block packets you want them to forward. This concept is illustrated in the examples in this chapter.

Guidelines

Here are the ACL guidelines:

- An ACL can have a permit, deny, or copy-to-mirror action. The permit action allows ports to forward ingress packets of the designated traffic flow while the deny action causes ports to discard packets. The copy-to-mirror action causes a port to copy all ingress packets that match the ACL to the destination port of the mirror port.
- A port can have more than one ACL.
- An ACL can be assigned to more than one port.
- You can only assign the same ACL to the same port one time.
- ACLs filter ingress packets on ports, but they do not filter egress packets. As a result, you must apply ACLs to the ingress ports of the designated traffic flows.
- ACLs for static port trunks or LACP trunks must be assigned to the individual ports of the trunks.
- Because ports, by default, forward all ingress packets, permit ACLs are only required in circumstances where you want ports to forward packets that are subsets of larger packet flows that are blocked by deny ACLs.
- A port that has more than one ACL checks the ingress packets in the order in which the ACLs are added, and forwards or discards packets at the first match. As a result, if a port has both permit and deny ACLs, add the permit ACLs *before* the deny ACLs. Otherwise, a port is likely to discard packets you want it to forward.
- Ports can have ACLs with different filtering criteria. For example, a port may have ACLs that filter on a source IP address and a UDP port.

Creating ACLs

This section provides examples of how to create all of the ACL types. See the following:

- "Creating Numbered IPv4 ACLs" on page 1557
- "Creating Numbered MAC ACLs" on page 1569
- "Creating Named IPv4 Address ACLs" on page 1571
- "Creating Named IPv6 Address ACLs" on page 1573

For descriptions of the commands mentioned in these procedures, refer to Chapter 101, "ACL Commands" on page 1591.

Creating Numbered IPv4 ACLs

Depending on the type of filter that you want to create, there are five commands for creating Numbered IPv4 ACLs. These commands are listed in Table 180. All of the commands for creating Numbered IPv4 ACLs begin with "ACCESS-LIST" and are found in the Global Configuration mode.

For examples of the commands listed in Table 180, see the following:

- "Numbered IPv4 ACL with IP Packets Examples" on page 1558
- "Numbered IPv4 ACL with ICMP Packets Example" on page 1562
- "Numbered IPv4 ACL with Protocol Packets Example" on page 1564
- "Numbered IPv4 ACL with TCP Port Packets Example" on page 1565
- "Numbered IPv4 ACL with UDP Port Packets Example" on page 1567

Table 180. ACCESS-LIST Commands for Creating Numbered IPv4 ACLs

To Do This Task	Use This Command
Create Numbered IPv4 ACLs for source and destination IPv4 addresses.	ACCESS-LIST *id_number action IP src_ipaddress dst_ipaddress [VLAN vid]*
Create Numbered IPv4 ACLs for ICMP packets.	ACCESS-LIST *id_number action ICMP src_ipaddress dst_ipaddress* [VLAN *vid*]
Create Numbered IPv4 ACLs for packets of specified protocols.	ACCESS-LIST *id_number action* PROTO *protocol_number src_ipaddress dst_ipaddress* [vlan *vid*]
Create Numbered IPv4 ACLs that filter ingress packets based on TCP port numbers.	ACCESS-LIST *id_number action* TCP *src_ipaddress* EQ|LT|GT|NE|RANGE *src_tcp_port dst_ipaddress* EQ|LT|GT|NE|RANGE *dst_tcp_port* [VLAN *vid*]

Table 180. ACCESS-LIST Commands for Creating Numbered IPv4 ACLs (Continued)

To Do This Task	Use This Command
Create Numbered IPv4 ACLs that filter ingress packets based on UDP port numbers.	ACCESS-LIST *id_number action* UDP *src_ipaddress* EQ|LT|GT|NE|RANGE *src_udp_port dst_ipaddress* EQ|LT|GT|NE|RANGE *dst_udp_port* [VLAN *vid*]

Numbered IPv4 ACL with IP Packets Examples

This is the command format for creating ACLs that filter IP packets based on source and destination IPv4 addresses:

access-list *id_number action* ip *src_ipaddress dst_ipaddress* [vlan *vid*]

The ID_NUMBER parameter assigns the ACL a unique ID number in the range of 3000 to 3699. Within this range, you can number ACLs in any order.

The ACTION parameter specifies the action that the port performs on packets matching the filtering criteria of the ACL. Here are the possible actions:

- permit— Forwards all ingress packets that match the ACL. Ports, by default, accept all ingress packets. Consequently, a permit ACL is only necessary when you want a port to forward a subset of packets that are otherwise discarded.
- deny— Discards all ingress packets that match the ACL.
- copy-to-mirror— Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used together with the port mirror feature, explained in Chapter 27, “Port Mirror” on page 489.

The SRC_IPADDRESS and DST_IPADDRESS parameters specify the source and destination IPv4 addresses. Choose from the following options:

- any— Matches any IP address.
- *ipaddress/mask*— Matches packets that have an IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0/24 has a mask of “24” for the first twenty-four bits of the network portion of the address. The IP address and the mask are separated by a slash (/); for example, “149.11.11.0/24.”

- host *ipaddress*— Matches packets with a specified IPv4 address and is an alternative to the IPADRESS/MASK variable for addresses of end nodes. The HOST keyword indicates that the IPv4 address is assigned to a specific end node and that no mask is required.

The *VLAN* parameter determines if an ACL filters VLANs. You use the parameter to specify the VID. You can specify one VID per command. If you omit this parameter, the ACL applies to *all* traffic. In other words, no filtering is done by the ACL based on the VLAN.

The following tables provide several examples of the command. In Table 181, a Numbered IPv4 ACL is created with an ID number of 3097, that blocks all untagged ingress packets with the specified destination address of 149.107.22.0/24:

Table 181. Blocking Ingress Packets Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# access-list 3097 deny ip any 149.107.22.0/24`	Create the deny ACL with the ACCESS-LIST IP command.

The example in Table 182 creates two Numbered IPv4 ACLs that block all traffic with specified subnets 149.87.201.0/24 and 149.87.202.0/24.

Table 182. Blocking Traffic with Two IPv4 Addresses

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# access-list 3104 deny ip 149.87.201.0/24 any`	Creates the deny ACL for the packets from the 149.87.201.0/24 subnet.
`awplus(config)# access-list 3105 deny ip 149.87.202.0/24 any`	Creates the deny ACL for the packets from the 149.87.202.0/24 subnet.

If you want a port to forward a subset of packets of a more-specific traffic flow, you have to create a permit ACL for the permitted packets and a

deny ACL for the denied traffic flow. This is illustrated in the example in Table 183 in which port 15 is configured to forward only ingress packets from the 149.55.65.0/24 subnet and to discard all other traffic. The permit ACL, which has the ID number 3015, specifies the packets from the permitted subnet, while the deny ACL, with the ID number 3011, specifies all traffic.

Note
In the example, the permit ACL is added to the port *before* the deny ACL. This is important because packets are compared against the ACLs in the order in which the ACLs are added to the port. If the deny ACL is added first, the port blocks all traffic, even the traffic specified by the permit ACL.

Table 183. Creating a Permit ACL Followed by a Deny ACL Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# access-list 3015 permit ip 149.55.65.0/24 any`	Create the permit ACL with the ACCESS-LIST command.
`awplus(config)# access-list 3011 deny ip any any`	Create the deny ACL.
`awplus(config)# interface port1.0.15`	Move to the Port Interface mode for port 15.
`awplus(config_if)# access-group 3015` `awplus(config_if)# access-group 3011`	Add the two ACLs to the port with the ACCESS-GROUP command, being sure to add the permit ACL first so that ingress packets are compared against it first.
`awplus(config_if)# end`	Return to the Privileged Exec mode.
`awplus# show access-list`	Confirm the configuration of the ACLs.
`awplus# show interface port1.0.15 access-group`	Confirm that the ACLs have been added to the port.

For another example of permit ACLs, see Table 184 on page 1561. In this example, ports 21 and 22 forward traffic from three specified network devices and discard all other ingress traffic. The allowed traffic is specified with three permit ACLs.

Note
The permit ACLS are added to the ports before the deny ACL to ensure that packets are compared against them first.

Table 184. Permit ACLs IPv4 Packets Example

Command	Description
awplus> enable	Enter the Privileged Executive mode from the User Executive mode.
awplus# configure terminal	Enter the Global Configuration mode.
awplus(config)# access-list 3021 permit ip 149.124.242.52/32 any awplus(config)# access-list 3022 permit ip 149.124.242.53/32 any awplus(config)# access-list 3023 permit ip 149.124.242.54/32 any	Create the three permit ACLs with the ACCESS-LIST command.
awplus(config)# access-list 3018 deny ip any any	Create the deny ACL.
awplus(config)# interface port1.0.21, port1.0.22	Move to the Port Interface mode for ports 21 and 22.
awplus(config_if)# access-group 3021 awplus(config_if)# access-group 3022 awplus(config_if)# access-group 3023 awplus(config_if)# access-group 3018	Add the ACLs to the port with the ACCESS-GROUP command, being sure to add the permit ACLs first so that ingress packets are compared against them first.
awplus(config_if)# end	Return to the Privileged Exec mode.
awplus# show access-list	Confirm the configuration of the ACLs.
awplus# show interface port1.0.21,port1.0.22 access-group	Confirm that the ACLs have been added to the port.

Here is an example of an ACL that filters tagged packets. See Table 185. It blocks all tagged packets with the VID 14 from ports 5 and 6. The ACL is assigned an ID number of 3122:

Table 185. ACL Filters Tagged IPv4 Packets Example

Command	Description
awplus> enable	Enter the Privileged Executive mode from the User Executive mode.
awplus# configure terminal	Enter the Global Configuration mode.
awplus(config)# access-list 3122 deny ip any any vlan 14	Create the deny ACL with the ACCESS-LIST IP command.
awplus(config)# interface port1.0.5, port1.0.6	Move to the Port Interface mode for ports 5 and 6.
awplus(config_if)# access-group 3122	Apply the ACL to the port with the ACCESS-GROUP command.
awplus(config_if)# end	Return to the Privileged Exec mode.
awplus# show access-list	Confirm the configuration of the ACL.
awplus# show interface port1.0.5,port1.0.6 access-group	Confirm that the ACL has been added to the port.

Numbered IPv4 ACL with ICMP Packets Example

This is the command format for creating Numbered IPv4 ACLs that filter ICMP packets based on source and destination IPv4 addresses:

access-list *id_number action* icmp *src_ipaddress dst_ipaddress* [vlan *vid*]

The ID_NUMBER parameter assigns the ACL a unique ID number in the range of 3000 to 3699. Within this range, you can number ACLs in any order.

The ACTION parameter specifies the action that the port performs on packets matching the filtering criteria of the ACL. Here are the possible actions:

- permit— Forwards all ingress packets that match the ACL. Ports, by default, accept all ingress packets. Consequently, a permit ACL

is only necessary when you want a port to forward a subset of packets that are otherwise discarded.

- deny— Discards all ingress packets that match the ACL.
- copy-to-mirror— Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used together with the port mirror feature, explained in Chapter 27, "Port Mirror" on page 489.

The SRC_IPADDRESS and DST_IPADDRESS parameters specify the source and destination IPv4 addresses. Choose from the following options:

- any— Matches any IPv4 address.
- *ipaddress/mask*— Matches packets that have an IPv4 address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0/24 has a mask of "24" for the first twenty-four bits of the network portion of the address. The IPv4 address and the mask are separated by a slash (/); for example, "149.11.11.0/24."
- host *ipaddress*— Matches packets with a specified IPv4 address and is an alternative to the IPADRESS/MASK variable for addresses of end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

The *VLAN* parameter determines if an ACL filters VLANs. You use the parameter to specify the VID. You can specify one VID per command. If you omit this parameter, the ACL applies to *all* traffic. In other words, no filtering is done by the ACL based on the VLAN.

In the following example, a Numbered IPv4 ACL is created with an ID number of 3000, that blocks all untagged ingress ICMP packets with a source address of 192.168.1.10/32:

Table 186. Numbered IPv4 ACL with ICMP Packets Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# access-list 3000 deny icmp host 192.168.1.10 any`	Creates a Numbered IPv4 ACL with an ID of 3000 that denies ICMP packets from the host source address of 192.168.1.10.

Numbered IPv4 ACL with Protocol Packets Example

This is the command format for creating Numbered IPv4 ACLs that filter packets of the specified protocol based on source and destination IPv4 addresses:

`access-list` *`id_number action`* `proto` *`protocol_number src_ipaddress dst_ipaddress`* `[vlan` *`vid`*`]`

The ID_NUMBER parameter assigns the ACL a unique ID number in the range of 3000 to 3699. Within this range, you can number ACLs in any order.

The ACTION parameter specifies the action that the port performs on packets matching the filtering criteria of the ACL. Here are the possible actions:

- permit— Forwards all ingress packets that match the ACL. Ports, by default, accept all ingress packets. Consequently, a permit ACL is only necessary when you want a port to forward a subset of packets that are otherwise discarded.
- deny— Discards all ingress packets that match the ACL.
- copy-to-mirror— Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used together with the port mirror feature, explained in Chapter 27, “Port Mirror” on page 489.

The *protocol_number* parameter specifies a protocol number. You can specify one protocol number per command. Refer to Table 212, “Protocol Numbers” on page 1611 for the list of protocol numbers.

The SRC_IPADDRESS and DST_IPADDRESS parameters specify the source and destination IP addresses. Choose from the following options:

- any— Matches any IPv4 address.
- *ipaddress/mask*— Matches packets that have an IPv4 address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0/24 has a mask of “24” for the first twenty-four bits of the network portion of the address. The IPv4 address and the mask are separated by a slash (/); for example, “149.11.11.0/24.”
- host *ipaddress*— Matches packets with a specified IPv4 address and is an alternative to the IPADRESS/MASK variable for addresses of end nodes. The HOST keyword indicates that the IPv4 address is assigned to a specific end node and that no mask is required.

The *VLAN* parameter determines if an ACL filters VLANs. You use the parameter to specify the VID. You can specify one VID per command. If you omit this parameter, the ACL applies to *all* traffic. In other words, no filtering is done by the ACL based on the VLAN.

This example creates a deny access list to ports 5 and 6 so that they discard all tagged ingress packets that contain protocol 17, a VID of 12, and originate from the 152.12.45.0 subnet. The access list is assigned the ID number 3011:

Table 187. Numbered IPv4 ACL with Protocol Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# access-list 3011 deny proto 17 152.12.45.0/24 any vlan 12`	Create a Numbered IPv4 ACL with an ID of 3011 that denies protocol 17 packets and VLAN ID 12 from the host source address of 152.12.45.0/24 subnet.

Numbered IPv4 ACL with TCP Port Packets Example

This is the command format for creating Numbered IPv4 ACLs that filter packets from TCP ports based on source and destination IPv4 addresses:

`access-list` *`id_number action tcp src_ipaddress`* `eq|lt|gt|ne|range` *`src_tcp_port dst_ipaddress`* `eq|lt|gt|ne|range` *`dst_tcp_port`* `[vlan` *`vid`*`]`

The ID_NUMBER parameter assigns the ACL a unique ID number in the range of 3000 to 3699. Within this range, you can number ACLs in any order.

The ACTION parameter specifies the action that the port performs on packets matching the filtering criteria of the ACL. Here are the possible actions:

- permit— Forwards all ingress packets that match the ACL. Ports, by default, accept all ingress packets. Consequently, a permit ACL is only necessary when you want a port to forward a subset of packets that are otherwise discarded.
- deny— Discards all ingress packets that match the ACL.
- copy-to-mirror— Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used together with the port mirror feature, explained in Chapter 27, "Port Mirror" on page 489.

The SRC_IPADDRESS and DST_IPADDRESS parameters specify the source and destination IPv4 addresses. Choose from the following options:

- any— Matches any IPv4 address.
- *ipaddress/mask*— Matches packets that have an IPv4 address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0/24 has a mask of “24” for first the twenty-four bits of the network portion of the address. The IPv4 address and the mask are separated by a slash (/); for example, “149.11.11.0/24.”
- host *ipaddress*— Matches packets with a specified IPv4 address and is an alternative to the IPADRESS/MASK variable for addresses of end nodes. The HOST keyword indicates that the IPv4 address is assigned to a specific end node and that no mask is required.

The *eq* parameter matches packets that are equal to the TCP port number specified by the SRC_TCP_PORT or DST_TCP_PORT parameter.

The *lt* parameter matches packets that are less than the TCP port number specified by the SRC_TCP_PORT or DST_TCP_PORT parameter.

The *gt* parameter matches packets that are greater than the TCP port number specified by the SRC_TCP_PORT or DST_TCP_PORT parameter.

The *ne* parameter matches packets that are not equal to the TCP port number specified by the SRC_TCP_PORT or DST_TCP_PORT parameter.

The *range* parameter matches packets with TCP port numbers within the range. Separate the numbers of the range by a space. For instance:

range 4 10

The *src_tcp_port* parameter specifies the source TCP port number. The range is 0 to 65535. Omit this parameter to match any TCP port number within the 0 to 65535 range.

The *dst_tcp_port* parameter specifies the destination TCP port number. The range is 0 to 65535. Omit this parameter to match any TCP port number within the 0 to 65535 range.

The *VLAN* parameter determines if an ACL filters VLANs. You use the parameter to specify the VID. You can specify one VID per command. If you omit this parameter, the ACL applies to all traffic. In other words, no filtering is done by the ACL based on the VLAN.

The following example configures two Numbered IPv4 ACLs. ACL 3017 permits packets from TCP port 67 to 87 on IPv4 addresses 154.11.234.0/24 to 154.11.235.0/24. ACL 3005 denies packets from TCP ports 67 through 87 to any IPv4 address. This example requires a permit ACL because the permitted traffic is a subset of all TCP packets on the port:

Table 188. Numbered IPv4 ACL with TCP Port Packets Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# access-list 3017 permit tcp 154.11.234.0/24 range 67 87 154.11.235.0/24 range 67 87`	Define ACL 3017 to permit packets from TCP port 67 to 87 on IPv4 addresses 154.11.234.0/24 to 154.11.235.0/24.
`awplus(config)# access-list 3005 deny tcp any any range 67 87`	Define ACL 3005 to deny packets from TCP ports 67 through 87 to any IPv4 address.
`awplus(config)# interface port1.0.21`	Move to the Port Interface mode for port 21.
`awplus(config_if)# access-group 3017`	Apply ACL 3017 to the port with the ACCESS-GROUP command.
`awplus(config_if)# access-group 3005`	Apply ACL 3005 to the port with the ACCESS-GROUP command.

Numbered IPv4 ACL with UDP Port Packets Example

`access-list` *`id_number action`* `udp` *`src_ipaddress`* `eq|lt|gt|ne|range` *`src_udp_port dst_ipaddress`* `eq|lt|gt|ne|range` *`dst_udp_port`* `vlan` *`vid`*

The ID_NUMBER parameter assigns the ACL a unique ID number in the range of 3000 to 3699. Within this range, you can number ACLs in any order.

The ACTION parameter specifies the action that the port performs on packets matching the filtering criteria of the ACL. Here are the possible actions:

- permit— Forwards all ingress packets that match the ACL. Ports, by default, accept all ingress packets. Consequently, a permit ACL is only necessary when you want a port to forward a subset of packets that are otherwise discarded.
- deny— Discards all ingress packets that match the ACL.
- copy-to-mirror— Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used

together with the port mirror feature, explained in Chapter 27, “Port Mirror” on page 489.

The SRC_IPADDRESS and DST_IPADDRESS parameters specify the source and destination IPv4 addresses. Choose from the following options:

- any— Matches any IPv4 address.
- *ipaddress/mask*— Matches packets that have an IPv4 address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0/24 has a mask of “24” for the first twenty-four bits of the network portion of the address. The IPv4 address and the mask are separated by a slash (/); for example, “149.11.11.0/24.”
- host *ipaddress*— Matches packets with a specified IPv4 address and is an alternative to the IPADRESS/MASK variable for addresses of end nodes. The HOST keyword indicates that the IPv4 address is assigned to a specific end node and that no mask is required.

The *eq* parameter matches packets that are equal to the UDP port number specified by the SRC_UDP _PORT or DST_UDP _PORT parameter.

The *lt* parameter matches packets that are less than the UDP port number specified by the SRC_TCP_PORT or DST_TCP_PORT parameter.

The *gt* parameter matches packets that are greater than the UDP port number specified by the SRC_UDP _PORT or DST_UDP _PORT parameter.

The *ne* parameter matches packets that are not equal to the UDP port number specified by the SRC_UDP _PORT or DST_UDP _PORT parameter.

The *range* parameter matches packets with UDP port numbers within the range. Separate the numbers of the range by a space. For instance:

range 4 10

The *src_udp_port* parameter specifies the source UDP port number. The range is 0 to 65535. Omit this parameter to match any UDP port number within the 0 to 65535 range.

The *dst_udp_port* parameter specifies the destination UDP port number. The range is 0 to 65535. Omit this parameter to match any UDP port number within the 0 to 65535 range.

The *VLAN* parameter determines if an ACL filters VLANs. You use the parameter to specify the VID. You can specify one VID per command. If you omit this parameter, the ACL applies to *all* traffic. In other words, no filtering is done by the ACL based on the VLAN.

The following example configures two ACLs. When they are applied in combination on port 21, they forward tagged packets to UDP source and destination ports in the range of 67 to 87 only if they are from the 154.11.234.0 network and are going to the 154.11.235.0 network, and have the VID, 20. The Numbered IPv4 ACL with UDP port example requires a permit ACL because the permitted traffic is a subset of all UDP packets on the port:

Table 189. Numbered IPv4 ACL with UDP Port Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# access-list 3119 permit udp 154.11.234.0/24 range 67 87 154.11.235.0/24 range 67 87 vlan 20`	Define ACL 3119 to permit packets from UDP ports 67 through 87 on IP addresses 154.11.234.0/24 and 154.11.234.0/24, and VLAN with a VID of 20.
`awplus(config)# access-list 3005 deny udp any any range 67 87`	Define ACL 3005 to deny packets from UDP ports 67 through 87 from any source or destination IPv4 address.

Creating Numbered MAC ACLs

There is one command to create Numbered MAC ACLs. The following command creates Numbered MAC ACLs that filter source and destination MAC addresses. Here is the format:

ACCESS-LIST *id_number action src_mac_address*|ANY *src_mac_mask dst_mac_address*|ANY *dst_mac_mask*

The *id_number* parameter specifies the ID number for the new ACL. The range is 4000 to 4699.

The ACTION parameter specifies the action that the port performs on packets matching the filtering criteria of the ACL. Here are the possible actions:

- permit— Forwards all ingress packets that match the ACL. Ports, by default, accept all ingress packets. Consequently, a permit ACL is only necessary when you want a port to forward a subset of packets that are otherwise discarded.
- deny— Discards all ingress packets that match the ACL.

- copy-to-mirror— Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used together with the port mirror feature, explained in Chapter 27, “Port Mirror” on page 489.

The *src_mac_address* parameter specifies the source MAC address of the ingress packets. Here are the possible options:

- *src_mac_address*— Specifies the source MAC address of the packets. The address must be entered in hexadecimal in one of the following formats: xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx
- any— Matches any source MAC address.

The *src_mac_mask* parameter specifies the source MAC address mask. The mask must be entered in one of the following formats: xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

The “x” variable can be either “0” or “F”. Use a “0” mask to indicate the parts of the MAC address the ACL is to filter. Use an “F” mask for parts of the MAC address the ACL should ignore.

Note
Do not include a mask if you specified ANY as the source MAC address.

The *dst_mac_address* parameter specifies the destination MAC address of the ingress packets. Here are the possible options:

- *dst_mac_address*— Specifies the destination MAC address of the packets. The address must be entered in hexadecimal in one of the following formats: xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx
- any— Matches any destination MAC address.

The *dst_mac_mask* parameter specifies the destination MAC address mask. The mask must be entered in one of the following formats: xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

The “x” variable can be either “0” or “F”. Use a “0” mask for parts of the MAC address the ACL is to filter. Use an “F” mask for parts of the MAC address the ACL should ignore.

```
awplus(config)# access-list 4000 deny any
00:ao:d2:01:02:04 00:00:00:00:00:00 any vlan 20
```

The example in Table 190 configures port 19 to reject packets containing destination MAC addresses starting with A4:54:86:12:

Table 190. Numbered MAC ACL Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# access-list 4102 deny any a4:54:86:12:00:00 00:00:00:00:ff:ff`	Define ACL 4012 to deny any frame with the destination MAC address that starts with a4:54:86:12.
`awplus(config)# interface port1.0.19`	Access the Port Interface mode for port 19.
`awplus(config_if)# mac access-group 4102`	Apply the ACL to the port.

Creating Named IPv4 Address ACLs

The Named IPv4 address ACLs are created with the IP ACCESS-LIST commands. The Named IP ACL with the IP ACCESS-LIST command automatically places you in the IP ACL mode where you can add the filter as well as the source and destination IPv4 addresses. Also, you can assign the ACL to a VLAN.

There are seven commands for creating Named IPv4 ACLs. The IP ACCESS-LIST command allows you to create a Named IPv4 ACL and enters the IP ACL command mode. After you enter the IP ACL mode, you can enter the remaining six commands which provide one command for each filtering criterion. The commands are listed in Table 191.

Table 191. IP ACCESS-LIST Commands for Creating Named IPv4 ACLs

To Do This Task	Use this Command
Create a Named IPv4 Address ACL and enter the IP ACL command mode.	`IP ACCESS-LIST` *`name`*
Define a Named IPv4 Address ACL that filters ICMP packets.	`action` *`icmp`* `scr_ipaddress dest_ipaddres`*`time-range`* `[vlan` *`vid`*`]`
Define a Named IPv4 Address ACL that filters IP packets based on source and destination IP addresses.	`action` *`ip`* `scr_ipaddress dest_ipaddress` *`time-range`* `[vlan` *`vid`*`]`
Define a Named IPv4 Address ACL that filters packets based on source and destination MAC addresses.	`action scr_mac_address dest_mac_address` *`time-range`* `[vlan` *`vid`*`]`

Table 191. IP ACCESS-LIST Commands for Creating Named IPv4 ACLs (Continued)

To Do This Task	Use this Command
Define a Named IPv4 Address ACL that filters traffic flows based on protocol numbers and source and destination IP addresses.	`action` *`proto protocol_number`* `scr_ip_address dest_ipaddress` *`time-range`* `[vlan` *`vid`*`]`
Define a Named IPv4 Address ACL that filters TCP packets based on source and destination IP addresses.	`action` *`tcp`* `scr_ipaddress gt|lt|ne|range|eq` *`src_tcp_port`* `dest_ipaddress gt|lt|ne|range|eq` *`dsp_tcp_port time-range`* `[vlan` *`vid`*`]`
Define a Named IPv4 Address ACL that filters UDP packets based on source and destination IP addresses.	`action` *`udp`* `scr_ipaddress gt|lt|ne|range|eq src_upd_port dest_ipaddress gt|lt|ne|range|eq dst_upd_port` *`time-range`* `[vlan` *`vid`*`]`

This example creates a Named IPv4 ICMP ACL, called “icmppermit,” that permits ICMP packets from any IP source address to any IP destination address on VLAN 12:

Table 192. Named IPv4 ACL ICMP Permit Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# ip access-list icmppermit`	Create a named IPv4 ACL called “icmppermit” and enter the IP ACL mode.
`awplus(config-ip-acl)# permit icmp any any vlan 12`	Allow the filter to permit ICMP ingress packets from any source IPv4 address to any destination IPv4 address on VLAN 12.

This example creates a Named IPv4 ACL, called “tcpdeny,” that denies TCP packets from source IPv4 address 152.12.45.2/32 to destination IPv4 address 152.12.45.3/32 on VLAN 5:

Table 193. Named IPv4 ACL TCP Deny Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.

Table 193. Named IPv4 ACL TCP Deny Example (Continued)

Command	Description
`awplus(config)# ip access-list tcpdeny`	Create a Named IPv4 ACL called "tcpdeny" and enter the IP ACL mode.
`awplus(config-ip-acl)# deny tcp 152.12.45.2/32 152.12.45.3/32 vlan 5`	Allow the filter to deny TCP ingress packets from source IPv4 address 152.12.45.2/32 to destination IPv4 address 152.12.45.3/32 on VLAN 5.

Creating Named IPv6 Address ACLs

The Named IPv6 address ACLs are created with the IPv6 ACCESS-LIST commands. For a description of all the IPv6 ACCESS-LIST commands, see Chapter 101, "ACL Commands" on page 1591. First, you create the Named IPv6 ACL with the IPv6 ACCESS-LIST command. It automatically places you in the IPv6 ACL mode where you can add the filter, as well as the source and destination IPv6 addresses. In addition, you can classify tagged packets by assigning a VLAN ID. The time range parameter allows you to decide when (time and date) filtering begins and ends.

There are six commands for creating Named IPv6 ACLs. The IPv6 ACCESS-LIST command allows you to create a Named IPv6 ACL and enter the IPv6 ACL command mode. The remaining five commands provide one command for each filtering criterion of ICMP, IP, Protocol, TCP, and UDP. The commands are listed in Table 194.

Table 194. IPv6 ACCESS-LIST Commands for Creating ACLs

To do this task	Use this Command
Create an Named IPv6 Address ACL and enter the IP ACL command mode.	`ipv6 access-list <`*`ipv6 access list`*`>`
Define a Named IPv6 Address ACL that filters ICMP packets.	`action` *`icmp`* `scr_ip_address dest_ipaddress` *`time-range`* `vlan [`*`vid`*`]`
Define a Named IPv6 Address ACL that filters IP packets based on source and destination IP addresses.	`action` *`ip`* `scr_ip_address dest_ipaddress` *`time-range vlan [vid]`*
Define a Named IPv6 Address ACL that filters traffic flows based on protocol numbers and source and destination IPv6 addresses.	`action` *`proto`* `proto_type scr_ip_address dest_ipaddress` *`time-range vlan <vid>`*

Table 194. IPv6 ACCESS-LIST Commands for Creating ACLs (Continued)

To do this task	Use this Command
Define a Named IPv6 Address ACL that filters TCP packets based on source and destination IP addresses.	`action tcp scr_ip_address` *eq|lt|gt|ne src_tcp_port* `dest_ipaddress` *eq|lt|gt|ne|range dest_tcp_port time-range vlan <vid>*
Define a Named IPv6 Address ACL that filters UDP packets based on source and destination IPv6 addresses.	`action udp scr_ip_address` *eq|lt|gt|ne|range* `dest_ipaddress` *eq|lt|gt|ne|range time-range vlan <vid>*

This example creates a protocol ACL, called “protocopytomirror,” that copies RDP packets (protocol type 27) from IPv6 source address 2001:0db8::a2:1c50/64 to any IPv6 destination address:

Table 195. Named IPv6 ACL Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# ipv6 access-list protocopytomirror`	Create a named IPv6 ACL called “protocopytomirror” and enter the IPv6 ACL mode.
`awplus(config-ip-acl)# copy-to-mirror proto 27 2001:0db8::a2:1c50/64 any`	Allow the filter to copy RDP packets from source IPv6 address 2001:0db8::a2:1c50 with a subnet mask of 64 to any destination IPv6 address.

Assigning ACLs to Ports

Before you can assign an ACL to a port, you must first create an ACL. The command that you use to assign an ACL to a port depends on which type of ACL you have created. See the following sections:

- "Assigning Numbered IPv4 ACLs to a Port" on page 1575
- "Assigning MAC Address ACLs to a Port" on page 1576
- "Assigning Named IPv4 ACLs" on page 1577
- "Assigning Named IPv6 ACLs" on page 1578

Note
In situations where ports have both permit and deny ACLs, you must assign the permit ACLs to a port *first* because ingress packets are compared against the ACLs in the order in which they are added to the ports. If you add the deny ACLs first, the ports may block packets you want them to forward.

Note
The Numbered IPv4 ACLs and the MAC Address Lists ACLs do not allow you to set a time range. Ports immediately begin to filter traffic as soon as you assign an ACL. However, you can set time ranges for the Named IPv4 and Named IPv6 ACLs. See "Setting ACL Time Ranges" on page 1585.

Assigning Numbered IPv4 ACLs to a Port

To assign a Numbered IPv4 ACL to a port on the switch, use the ACCESS-GROUP command in the Port Interface mode. Using this command, you can add one Numbered IPv4 ACL to a port or several ports. The ACL must exist on the switch. Here is the format of the command:

```
access-group id_number
```

For more information about this command, see "ACCESS-GROUP" on page 1598.

In this example, ports 12 and 13 are assigned an ACL, ID number 3075, that blocks all untagged ingress packets with a destination address in the 149.107.22.0 subnet. See Table 196.

Table 196. Assigning Numbered IPv4 ACLs

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# access-list 3075 deny ip any 149.107.22.0/24`	Create the deny ACL.
`awplus(config)# interface port1.0.12,port1.0.13`	Enter the Port Interface mode for ports 12 and 13.
`awplus(config_if)# access-group 3075`	Apply the ACL to the ports with the ACCESS-GROUP command.

Assigning MAC Address ACLs to a Port

To assign a MAC ACL to a port on the switch, use the MAC ACCESS-GROUP command in the Port Interface mode. Using this command, you can add one MAC ACL to a port or several ports. The ACL must exist on the switch. Here is the format of the command:

`mac access-group` *`id_number`*

For more information about this command, see “MAC ACCESS-GROUP” on page 1663.

This example creates two MAC ACLs with ID numbers of 4025 and 4055. ACL 4025 permits only packets that have source MAC addresses starting with “45:2A:B5:”. ACL 4055 denies all other MAC addresses. Then assign both ACLs to port 7:

Table 197. Assigning MAC Address ACLs Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# access-list 4025 permit 45:2a:b5:00:00:00 00:00:00:ff:ff:ff any`	Create the permit ACL.
`awplus(config)# access-list 4055 deny any any`	Create the deny ACL.

Table 197. Assigning MAC Address ACLs Example (Continued)

Command	Description
awplus(config)# interface port1.0.7	Move to the Port Interface mode for port 7.
awplus(config_if)# mac access-group 4025	Apply the ACL to the port with the ACCESS-GROUP command.
awplus(config_if)# mac access-group 4055	Apply the ACL to the port with the ACCESS-GROUP command.

Assigning Named IPv4 ACLs

To assign a Named IPv4 ACL to a port on the switch, use the ACCESS-GROUP command in the Port Interface mode. Before you can assign an ACL to a port, you must create the ACL on the switch. You can add one ACL at a time to a port with the IP ACCESS-GROUP command. This is the format of the command:

access-group *list_name*

For more information about this command, see "ACCESS-GROUP" on page 1598.

This example creates a Named IPv4 ACL, called "udpdeny", that denies UDP packets from IPv4 source address 190.155.0.0/16 to IPv4 destination address 190.155.22.3/32. See Table 198. Then the ACCESS-GROUP command assigns "udpdeny" to port 20:

Table 198. Assigning Named IPv4 ACLs Example

Command	Description
awplus> enable	Enter the Privileged Executive mode from the User Executive mode.
awplus# configure terminal	Enter the Global Configuration mode.
awplus(config)# ip access-list udpdeny	Create the deny ACL.
awplus(config-ip-acl)# deny udp 190.155.0.0/16 190.155.22.3/32	Assign filter criterion to the deny ACL.
awplus(config-ip-acl)# exit	Exit the IP ACL mode.
awplus(config)# interface port1.0.20	Move to the Port Interface mode for port 20.
awplus(config_if)# access-group udpdeny	Apply the ACL to the port with the ACCESS-GROUP command.

Assigning Named IPv6 ACLs

To assign a Named IPv6 ACL to a port on the switch, use the IPV6 TRAFFIC-FILTER command in the Port Interface mode. Before assigning an ACL to a port, you must create the ACL on the switch. With this command, you can add one ACL at a time to a port. To add another ACL to a port, repeat the command. Here is the format of the command:

```
ipv6 traffic-filter <ipv6_access_list>
```

For more information about this command, see “IPV6 TRAFFIC-FILTER” on page 1662.

This example creates a Named IPv6 ACL called “icmppermit” that permits ICMP packets from any IPv6 source address to any IPv6 destination address. Then the IPV6 TRAFFIC-FILTER command assigns “icmppermit” to port 18:

Table 199. Assigning Named IPv6 ACLs Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# ipv6 access-list icmppermit`	Create the permit ACL.
`awplus(config-ipv6-acl)# permit icmp any any`	Assign the filter criteria to icmppermit ACL.
`awplus(config-ipv6-acl)# exit`	Exit the IP ACL mode.
`awplus(config)# interface port1.0.18`	Enter the Port Interface mode for port 18.
`awplus(config_if)# ipv6 traffic-filter icmppermit`	Apply the ACL filter criteria with the IPv6 traffic-filter command.

Removing ACLs from Ports

The command that you use to remove an ACL from a port depends on which type of ACL you have created. See the following sections:

- "Removing Numbered IPv4 ACLs" on page 1579
- "Removing MAC Address ACLs" on page 1579
- "Removing Named IPv4 ACLs" on page 1580
- "Removing Named IPv6 ACLs" on page 1580

Removing Numbered IPv4 ACLs

To remove Numbered IPv4 ACLs from ports so that the ports stop filtering traffic, use the NO ACCESS-GROUP command in the Port Interface mode. The command has the following format:

```
no access-group id_number
```

For more information about this command, see "ACCESS-GROUP" on page 1598.

With this command, you can remove one ACL at a time. See Table 200. The following example removes an ACL with an ID number of 3082 from port 15:

Table 200. Removing Numbered IP ACLs Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# interface port1.0.15`	Enter the Port Interface mode for port 15.
`awplus(config_if)# no access-group 3082`	Remove ACL 3082 from port 15.

Removing MAC Address ACLs

To remove a MAC ACL from a port on the switch, use the NO MAC ACCESS-GROUP command in the Port Interface mode. Here is the format of the command:

```
no mac access-group id_number
```

For more information about this command, see "NO ACCESS-LIST" on page 1664.

This example removes a MAC ACL with an ID number of 4037 from port 5:

Table 201. Removing MAC Address ACLs Example

Command	Description
awplus> enable	Enter the Privileged Executive mode from the User Executive mode.
awplus# configure terminal	Enter the Global Configuration mode.
awplus(config)# interface port1.0.5	Enter the Port Interface mode for port 5.
awplus(config_if)# no mac access-group 4037	Remove MAC ACL 4037 from port 5.

Removing Named IPv4 ACLs

To remove a Named IPv4 ACL from a port on the switch, use the NO ACCESS-GROUP command with the list_name parameter in the Port Interface mode. Here is the format of the command:

```
no access-group list_name
```

For more information about this command, see “ACCESS-GROUP” on page 1598.

The following example removes a Named IPv4 ACL called “protodeny” from port 22:

Table 202. Removing Named IPv4 ACLs Example

Command	Description
awplus> enable	Enter the Privileged Executive mode from the User Executive mode.
awplus# configure terminal	Enter the Global Configuration mode.
awplus(config)# interface port1.0.22	Enter the Port Interface mode for port 22.
awplus(config_if)# no access-group protodeny	Remove Named IPv4 ACL called “protodeny” from port 22.

Removing Named IPv6 ACLs

To remove a Named IPv6 ACL from a port on the switch, use the NO IPV6 TRAFFIC-FILTER command in the Port Interface mode. Here is the format of the command:

```
no ipv6 traffic-filter <ipv6_access_list>
```

For more information about this command, see “IPV6 TRAFFIC-FILTER” on page 1662.

The following example removes a Named IPv6 ACL called "icmpdeny" from port 17:

Table 203. Removing Named IPv6 ACLs Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# interface port1.0.17`	Enter the Port Interface mode for port 17.
`awplus(config_if)# no ipv6 traffic-filter icmpdeny`	Remove a Named IPv6 ACL called "icmpdeny" from port 17.

Deleting ACLs from the Switch

The command that you use to delete an ACL from the switch depends on the ACL type. See the following sections:

- “Deleting Numbered IPv4 and MAC Address ACLs” on page 1582
- “Deleting Named IPv4 Address ACLs” on page 1583
- “Deleting Named IPv6 Address ACL” on page 1583

Before you delete an ACL from the switch, you must remove it from its port assignment. For instructions, see “Removing ACLs from Ports” on page 1579.

Deleting Numbered IPv4 and MAC Address ACLs

The NO ACCESS-LIST command in the Global Configuration mode is the command that deletes Numbered IPv4 and MAC Address ACLs from the switch. It has the following format:

```
no access-list id_number
```

You can delete one ACL at a time with this command. Before you can delete ACLs that are assigned to ports, you must remove them from their port assignments. For instructions, see “Removing Numbered IPv4 ACLs” on page 1579 and “Removing MAC Address ACLs” on page 1579.

The following example deletes Numbered IPv4 ACLs with ID numbers 3018 and 3019 from the switch:

Table 204. Deleting Numbered IPv4 ACLs Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# no access-list 3018`	Remove Numbered IPv4 ACL with ID number 3018 from the switch.
`awplus(config)# no access-list 3019`	Remove Numbered IPv4 ACL with ID number 3019 from the switch.

The following example deletes a MAC ACL with ID number 4415 from the switch:

Table 205. Deleting MAC ACL Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# no access-list 4415`	Remove Numbered MAC ACL with ID number 4415 from the switch.

Deleting Named IPv4 Address ACLs

The NO IP ACCESS-LIST command in the Global Configuration mode is the command that deletes Named IPv4 address ACLs from the switch. It has the following format:

`no ip access-list` *`list_name`*

You can delete one ACL at a time with this command. Before you can delete ACLs that are assigned to ports, you must remove them from their port assignments. For instructions, see "Removing Named IPv4 ACLs" on page 1580.

The following example deletes a Named IPv4 address ACL with the list name "protopermit" from the switch:

Table 206. Deleting Named IPv4 ACLs Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# no ip access-list protopermit`	Remove Named IPv4 ACL named "protopermit" from the switch.

Deleting Named IPv6 Address ACL

The NO IPV6 ACCESS-LIST command in the Global Configuration mode deletes Named IPv6 address ACLs from the switch. It has the following format:

`no ipv6 access-list` *`list_name`*

You can delete one ACL at a time with this command. Before you can delete ACLs that are assigned to ports, you must remove them from their port assignments. For instructions, see "Removing Named IPv6 ACLs" on page 1580.

This example deletes a Named IPv6 address ACL with the list name “denytcp” from the switch:

Table 207. Deleting Named IPv6 ACLs Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# no ipv6 access-list denytcp`	Remove Named IPv6 ACL named “denytcp” from the switch.

Setting ACL Time Ranges

By default, an ACL filter is effective immediately. However, if you want to set a date and time when the ACL filter begins and ends, you need to assign a time range. The time range commands support Named IPv4 and Named IPv6 ACLs only. There are five time range commands which are listed in Table 208.

Table 208. Time Range Commands

To do this task	Use this Command
Create a time range and enter the Time-Range mode.	`time-range <time-range-name>`
Set beginning and ending time and dates for ACL filtering.	`absolute start (time date) end (time date)`
Set reoccurring days of the week and time of day for filtering.	`periodic day days-of-the-week time (hh:mm:ss) to day days-of-the-week time (hh:mm:ss)`
Set a daily, weekday, or weekend date and time range for ACL filtering.	`periodic (daily) day (daily|weekdays|weekend) time (hh:mm:ss) to time (hh:mm:ss)`
Display time range settings on the switch.	`show time-range`

The first step is to create a time setting with the TIME-RANGE command. Also, the TIME-RANGE command places you in the Configuration Time-Range mode which allows you to enter the ABSOLUTE START, PERIODIC, or PERIODIC (DAILY) time settings commands.

The following example creates a time range setting that starts on February 1, 2012 at 9 am and ends on February 28, 2012 at 5 pm:

Table 209. Absolute Time Range Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# time-range t1`	Create a time range called "t1."

Table 209. Absolute Time Range Example (Continued)

Command	Description
`awplus(config-time-range)# absolute start 8:00:00 01 02 2012 end 17:00:00 29 02 2012`	Set the time range to begin on February 1, 2012 at 8 am and end on February 29, 2012 at 5 pm.
`awplus(config-time-range)# exit`	Exit the Time Range mode.
`awplus(config)# exit`	Exit the Global Configuration mode.
`awplus# show time-range`	Display the time ranges configured on the switch.

The following example creates a time range setting that starts on Mondays through Fridays from 7 am to 4 pm.

Table 210. Periodic Time Range Example

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# time-range t1`	Create a time range called “t1.”
`awplus(config-time-range)# periodic weekdays time 07:00:00 to time 16:00:00`	Set the time range to begin on Mondays at 7 am and end on Fridays at 4 pm.
`awplus(config-time-range)# exit`	Exit the Time Range mode.
`awplus(config)# exit`	Exit the Global Configuration mode.
`awplus# show time-range`	Display the time ranges configured on the switch.

Displaying the ACLs

There are several ways of displaying information about ACLs on the switch. For example, you can use one command to display a list of both the Numbered IPv4 and Named IPv4 ACLs, and another command to display only the Named IPv6 ACLs. You can display the port assignments of all the ACLs and the ACLs assigned to VTY lines. In addition, you can display the time settings for both the Named IPv4 and IPv6 ACLs. See the following:

- ❒ "Displaying IPv4 ACLs" on page 1587
- ❒ "Displaying IP ACL Port Assignments" on page 1587
- ❒ "Displaying Named IPv6 ACLs" on page 1588
- ❒ "Displaying Time Range Information" on page 1588

Displaying IPv4 ACLs

To display the Numbered IPv4 and Named IPv4 ACLs, use the SHOW ACCESS-LIST command in the Privileged Exec mode. Here is the command syntax followed by an example display.

```
awplus# show access-list
```

```
IP access-list 3000
   permit icmp any any
IP access-list 3104
   deny 149.87.201.1 mask 255.255.255.0 any
MAC access-list 4400
   permit any any
IP access-list icmppermit
   ICMP permit an any time-range daily
IP access-list denytcp
   TCP deny 149.55.65.0 mask 255.255.255.0 any time-range NONE

Total number of access-lists= 5
```

Figure 254. SHOW ACCESS-LIST Command

As you can see from the example, the SHOW ACCESS-LIST command does not display which, if any, ports the ACLs are assigned to. To display that information, use the SHOW INTERFACE ACCESS-GROUP command. See "Displaying IP ACL Port Assignments," next.

Displaying IP ACL Port Assignments

To display the IP ACL port assignments for both IPv4 and IPv6 ACLs, use the SHOW INTERFACE ACCESS-GROUP command in the Privileged Exec mode. Here is the format of the command:

```
show interface port access-group
```

The following example displays the ACLs assigned to ports 1 to 5:

```
awplus# show interface port1.0.1-port1.0.5 access-
group
```

```
Interface port1.0.1

   access-group 3010

   access-group 3002

Interface port1.0.2

   access-group 3025
```

Figure 255. SHOW INTERFACE ACCESS-GROUP Command

Displaying Named IPv6 ACLs

Use the SHOW IPV6 ACL command to display Named IPv6 ACLs in the Privileged Exec mode. Here is the format of the command:

```
awplus# show ipv6 access-list
```

See Figure 256 for an example of the display.

```
IPV6 access-list udp
   deny udp any any
IPV6 access-list protomirror
   copy-to-mirror proto 27 20010db8::00a2.1c50/64 any
```

Figure 256. SHOW IPV6 ACL Command

Displaying Time Range Information

To display the ACL time settings, use the SHOW TIME-RANGE command in the Privileged Exec mode. This command supports Named IPv4 and IPv6 ACLs. Here is the format of the command:

```
awplus# show time-range
```

See Figure 257 on page 1589 for an example of the SHOW TIME-RANGE display.

This display shows that time range t1 has an absolute start time (immediately effective start) of 9 am on January 2, 2012 and absolute end time (immediately effective end) on January 31, 2012 at 10 am. Time range t2 has an absolute start time of noon on January 2, 2012 and an absolute end time of 4 pm on February 29, 2012. Time range t3 has an absolute start time of 9 am on March 15, 2012 and an absolute end time of 9 am on March 31, 2012.

```
awplus# show time-range
Time-Range        t1
    absolute start 09:00:00 2 January 2012 to end 10:00:00 31 January 2012

Time-Range        t2
    absolute start 12:00:00 2 January 2012 to end 16:00:00 29 February 2012

Time-Range        t3
    absolute start 09:00:00 15 March 2012 to end 9:00:00 31 March 2012
```

Figure 257. SHOW TIME-RANGE Command

Chapter 101
ACL Commands

The Access Control List (ACL) commands are summarized in Table 211 and described in detail within the chapter.

Table 211. Access Control List Commands

Command	Mode	Description
“ABSOLUTE START” on page 1594	Configuration Time Range	Sets a time range for an associated permit or deny statement.
“ACCESS-CLASS” on page 1596	Virtual Terminal Line mode	Assigns an ACL to a VTY line.
“ACCESS-GROUP” on page 1598	Port Interface	Adds IP ACLs to ports.
“ACCESS-LIST (MAC Address)” on page 1600	Global Configuration	Creates ACLs that identify packets based on source and destination MAC addresses.
“ACCESS-LIST ICMP” on page 1603	Global Configuration	Creates ACLs that identify packets based on ICMP source and destination IP addresses.
“ACCESS-LIST IP” on page 1606	Global Configuration	Creates ACLs that filter packets based on source and destination IP addresses.
“ACCESS-LIST PROTO” on page 1610	Global Configuration	Creates ACLs that identify packets based on protocol numbers and source and destination IP addresses.
“ACCESS-LIST TCP” on page 1615	Global Configuration	Creates access control lists that filter ingress packets based on TCP port numbers.
“ACCESS-LIST UDP” on page 1619	Global Configuration	Creates access control lists that identify ingress packets based on UDP port numbers.
“IP ACCESS-LIST” on page 1623	Global Configuration	Creates a Named IP ACL and enters the IP ACL mode.
“IP ACCESS-LIST (ICMP)” on page 1624	IP ACL	Defines an ACL that filters ICMP packets based on source and destination IP addresses.

Table 211. Access Control List Commands (Continued)

Command	Mode	Description
“IP ACCESS-LIST (IP)” on page 1627	IP ACL	Defines an ACL that filters IP packets based on source and destination IP addresses.
“IP ACCESS-LIST (MAC)” on page 1630	IP ACL	Defines an ACL that filters packets based on source and destination MAC addresses.
“IP ACCESS-LIST (PROTO)” on page 1633	IP ACL	Defines an ACL that filters traffic flows based on protocol numbers and source and destination IP addresses.
“IP ACCESS-LIST (TCP)” on page 1636	IP ACL	Defines an ACL that filters TCP packets based on source and destination IP addresses.
“IP ACCESS-LIST (UDP)” on page 1640	IP ACL	Defines an ACL that filters UDP packets based on source and destination IP addresses.
“IPV6 ACCESS-LIST” on page 1644	Global Configuration	Creates an IPv6 ACL and enters the Configuration IPv6 ACL mode.
“IPV6 ACCESS-LIST (ICMP)” on page 1645	IPv6 ACL	Defines an ACL that filters packets based on ICMP type and source and destination IPv6 addresses.
“IPV6 ACCESS-LIST (IP)” on page 1648	IPv6 ACL	Defines an ACL that filters traffic flows based on the IPv6 source and destination addresses of the packets.
“IPV6 ACCESS-LIST (PROTO)” on page 1651	IPv6 ACL	Defines an ACL that filters traffic flows based on protocol numbers and source and IPv6 destination addresses.
“IPV6 ACCESS-LIST (TCP)” on page 1654	IPv6 ACL	Defines an ACL that filters packets based on TCP type and source and destination IPv6 addresses.
“IPV6 ACCESS-LIST (UDP)” on page 1658	IPv6 ACL	Defines an ACL that filters packets based on UDP type and source and destination IPv6 addresses.
“IPV6 TRAFFIC-FILTER” on page 1662	Port Interface	Assigns an IPv6 ACL to an interface.
“MAC ACCESS-GROUP” on page 1663	Global Configuration	Adds MAC address ACLs to ports on the switch.

Table 211. Access Control List Commands (Continued)

Command	Mode	Description
"NO ACCESS-LIST" on page 1664	Global Configuration	Deletes ACLs from the switch.
"NO ACCESS-GROUP" on page 1665	Port Interface	Removes ACLs from ports on the switch.
"NO MAC ACCESS-GROUP" on page 1666	Port Interface	Removes MAC address ACLs from ports on the switch.
"PERIODIC" on page 1667	Configuration Time Range	Sets a date and time range for ACL filtering.
"PERIODIC (DAILY)" on page 1669	Configuration Time Range	Sets a daily, weekdays, or weekend time range for ACL filtering.
"SHOW ACCESS-LIST" on page 1671	Privileged Exec	Displays the ACLs on the switch.
"SHOW INTERFACE ACCESS-GROUP" on page 1673	Privileged Exec	Displays the port assignments of the ACLs.
"SHOW IPV6 ACCESS-LIST" on page 1674	Privileged Exec	Displays the contents of IPv6 ACLs.
"SHOW TIME-RANGE" on page 1675	Privileged Exec	Displays the time range settings.
"TIME-RANGE" on page 1676	Port Interface	Defines a time range.

ABSOLUTE START

Syntax

absolute *start <hours:minutes:seconds DD MM YYYY> end <hours:minutes:seconds DD MM YYYY>*

Parameters

start

Specifies the time and date that the associated permit or deny statement goes into effect. Time is expressed in a 24-hour clock and specified in hours, minutes, and seconds as 00:00:00 with a colon separating each entry. The date is expressed in month, day, and year in the 00 00 0000 format with a space separating each entry.

end

Specifies the time and date that the permit and deny statement terminates. Time is expressed in a 24-hour clock and specified in hours:minutes:seconds as 00:00:00 with a colon separating each entry. The date is expressed in month, day, and year in the 00 00 0000 format with a space separating each entry.

Mode

Configuration Time-Range mode

Description

Use this command to set the time and date that an associated permit or deny statement goes into effect and then the time and date it terminates. For example, 8 am is expressed as 8:00:00 and 8 pm as 20:00:00. The minimum start time is 00:00:01. An example of the date in the day, month, and year format is 23 07 2012 which represents July 23, 2012.

If no start time and date are specified, the permit or deny statement is effective immediately.

Note
This command does not have a “NO” version.

Confirmation Command

“SHOW ACCESS-LIST” on page 1671

Examples

This example uses a time range called "February2012" that enables the permit or deny statement to start at 8 am on February 3, 2012 and end filtering at 8 pm on February 15, 2012:

```
awplus> enable
awplus# configure terminal
awplus(config)# time-range February2012
awplus(config-time-range)# absolute start 8:00:00 03 02 2012
end 20:00:00 15 02 2012
```

This example uses a time range called "March2012" that enables the permit or deny statement to start at 9 am on March 1, 2012 and end filtering at 5 pm on March 31, 2012:

```
awplus> enable
awplus# configure terminal
awplus(config)# time-range March2012
awplus(config-time-range)# absolute start 9:00:00 01 03 2012
end 17:00:00 31 03 2012
```

ACCESS-CLASS

Syntax

```
access-class <3000 - 3699>|<4000 - 4699>

access-class <3000 - 3699>|<4000 - 4699>|NamedIP
```

Parameters

3000 - 3699
: Specifies the ID number of the access control list. The range is 3000 to 3699.

4000 - 4699
: Specifies the ID number of the MAC access control list. The range is 4000 to 4699.

NamedIP
: Specifies the name of either an IPv4 or IPv6 Named ACL.

Mode

Virtual Terminal Line mode

Description

Use this command to assign an Access Control List to a VTY. This is done to restrict the remote access of the switch via Telnet, Web, SNMP, or SSH access. You can add one ACL to multiple VTY lines with this command.

Note
Allied Telesis recommends specifying all ten of the VTY lines with the ACCESS-LIST command because the switch assigns VTY lines randomly.

Use the no version of this command, NO ACCESS-CLASS, to remove an ACL assignment from the VTY lines.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

This example assigns the switch an IP address of 10.0.0.20/24. It creates a Numbered ACL with an ID of 3022 that allows IP address 10.0.0.3 full access to the switch. Then it creates an ACL with an ID number of 3025 that denies all IP addresses access to the switch.

It assigns ACL 3022 to VTY lines 0 through 9. Finally, ACL 3025 is assigned to VTY lines 0 through 9. The result is that IP address 10.0.0.3 has full remote access to the switch. All other IP addresses are denied remote access to the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan10
awplus(config-if)# ip address 10.0.0.20/24
awplus(config-if)# quit
awplus(config)# access-list 3022 permit ip host 10.0.0.3
host 10.0.0.20
awplus(config)# access-list 3025 deny ip any host 10.0.0.20
awplus(config)# line vty 0 9
awplus(config-line)# access-class 3022
awplus(config-line)# access-class 3025
```

ACCESS-GROUP

Syntax

```
access-group id_number

access-group id_number|list_name
```

Parameters

id_number
: Specifies the ID number of an access control list you want to add to a port. The range is 3000 to 3699. You can add one ACL to a port at a time with this command.

list_name
: Specifies Named IP ACL. You can add one ACL to a port at a time with this command.

Mode

Port Interface mode

Description

Use this command to add IP ACLs to ports on the switch. Ports begin to filter packets as soon as they are assigned ACLs. This command works for all ACLs, except for MAC address ACLs, which are added to ports with the MAC ACCESS-GROUP command. See “MAC ACCESS-GROUP” on page 1663.

Note
If a port is to have both permit and deny ACLs, you must add the permit ACLs first because ingress packets are compared against the ACLs in the order in which they are added to a port. If you add the deny ACLs before the permit ACLs, a port is likely to block traffic you want it to forward.

Use the no version of this command, NO ACCESS-GROUP, to remove IP ACL from a port on the switch.

Confirmation Command

“SHOW INTERFACE ACCESS-GROUP” on page 1673

Examples

This example adds an IP ACL with an ID of 3022 to port 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# access-group 3022
```

This example removes an IP ACL with an ID of 3001 from port 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.7
awplus(config-if)# no access-group 3001
```

This example adds an IP ACL with a list name of "protomirror" to port 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# access-group protomirror
```

This example adds the Named IP ACL, called "protodeny" to port 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.7
awplus(config-if)# access-group protodeny
```

ACCESS-LIST (MAC Address)

Syntax

```
access-list id_number action src_mac_address|any
src_mac_mask dst_mac_address|any dst_mac_mask
```

Parameters

id_number

Specifies the ID number for the new ACL. The range is from 4000 to 4699.

action

Specifies the action of the ACL. Here are the possible actions:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used in conjunction with the port mirror feature, explained in Chapter 27, “Port Mirror” on page 489.

src_mac_address

Specifies the source MAC address of the ingress packets. Here are the possible options:

src_mac_address: Specifies the source MAC address of the packets. The address must be entered in hexadecimal in one of the following formats:

xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

any: Matches any source MAC address.

src_mac_mask

Specifies the source MAC address mask. The mask must be entered in one of the following formats:

xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

Assign the “x” variable a value of either “0” or “F.” Specify “0” to indicate the parts of the MAC address the ACL is to filter. Specify “F” for parts of the MAC address the ACL should ignore.

Do not include a mask if you specified ANY as the source MAC address.

dst_mac_address

Specifies the destination MAC address of the ingress packets. Choose from the following options:

dst_mac_address: Specifies the destination MAC address of the packets. The address must be entered in hexadecimal in one of the following formats:

xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

any: Matches any destination MAC address.

dst_mac_mask

Specifies the destination MAC address mask. The mask must be entered in one of the following formats:

xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

Assign the "x" variable a value of either "0" or "F." Specify "0" to indicate the parts of the MAC address the ACL is to filter. Specify "F" for parts of the MAC address the ACL should ignore.

Mode

Global Configuration mode

Description

Use this command to create ACLs that filter packets based on source and destination MAC addresses.

Confirmation Commands

"SHOW ACCESS-LIST" on page 1671 and "SHOW INTERFACE ACCESS-GROUP" on page 1673

Examples

This example configures port 3 to accept packets only from three specific devices:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 4001 permit 12:a3:4b:89:10:98
00:00:00:00:00:00 any
awplus(config)# access-list 4002 permit 00:8b:2a:56:11:80
00:00:00:00:00:00 any
awplus(config)# access-list 4003 permit 76:9a:8c:b2:88:1a
00:00:00:00:00:00 any
awplus(config)# access-list 4011 deny any any
awplus(config)# interface port1.0.3
awplus(config_if)# mac access-group 4001
```

```
awplus(config_if)# mac access-group 4002
awplus(config_if)# mac access-group 4003
awplus(config_if)# mac access-group 4011
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.3 access-group
```

This example configures a 28-port switch to block Cisco Discovery Protocol (CDP) packets on all ports:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 4001 deny any 01:00:0c:cc:cc:cc
00:00:00:00:00:00
awplus(config)# interface port1.0.1-port1.0.28
awplus(config-if)# mac access-group 4001
awplus(config-if)# end
awplus# show access-list
awplus# show interface port1.0.1-port1.0.28 access-group
```

This example configures port 7 to accept only those packets that have source MAC addresses starting with 45:2A:B5:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 4025 permit 45:2a:b5:00:00:00
00:00:00:ff:ff:ff any
awplus(config)# access-list 4055 deny any any
awplus(config)# interface port1.0.7
awplus(config_if)# mac access-group 4025
awplus(config_if)# mac access-group 4055
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.7 access-group
```

This example configures port 19 to reject packets containing destination MAC addresses starting with A4:54:86:12:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 4102 deny any a4:54:86:12:00:00
00:00:00:00:ff:ff
awplus(config)# interface port1.0.19
awplus(config_if)# mac access-group 4102
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.19 access-group
```

ACCESS-LIST ICMP

Syntax

```
access-list id_number action icmp src_ipaddress
dst_ipaddress [vlan vid]
```

Parameters

id_number

Specifies an ID number for a new ACL. The range is 3000 to 3699. Each access list on the switch must have a unique ID number.

action

Specifies the action of the ACL. Here are the possible actions:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the port mirror. This action must be used in conjunction with the port mirror feature, explained in Chapter 27, "Port Mirror" on page 489.

scr_ipaddress

Specifies the source IP address of the ingress packets the access list should filter. Here are the possible options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0 would have a mask of "24" for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, "149.11.11.0/24".

host ipaddress: Matches packets with a source IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

dst_ipaddress

Specifies the destination IP address of the ingress packets the access list should filter. Here are the possible options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a destination IP address of a specific subnet or end node.

host ipaddress: Matches packets with a destination IP address of a specific end node. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

vlan

Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

Global Configuration mode

Description

Use this command to create Numbered IPv4 ACLs that identify traffic flows based on ICMP and source and destination IP addresses.

Confirmation Commands

“SHOW ACCESS-LIST” on page 1671 and “SHOW INTERFACE ACCESS-GROUP” on page 1673

Examples

This example adds a deny access list to port 16 so that it discards all untagged ingress packets that are ICMP, regardless of their source or destination address. The access list is assigned the ID number 3012. Since the VID parameter is not included, this ACL applies to untagged packets:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3012 deny icmp any any
awplus(config)# interface port1.0.16
awplus(config_if)# access-group 3012
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.16 access-group
```

This example adds a deny access list to ports 4 and 5 to discard all untagged ingress packets that are ICMP, from the 152.12.45.0 subnet. The access list is assigned the ID number 3094:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3094 deny icmp 152.12.45.0/24
any
awplus(config)# interface port1.0.4,port1.0.5
awplus(config_if)# access-group 3094
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.4,port1.0.5 access-group
```

This example adds a deny access list to port 11 to discard all ingress packets that are ICMP and that have source and destination addresses from the 115.201.312.0/24 and 115.201.313.0/24 subnets, respectively. The ACLs are assigned the ID numbers 3045 and 3046:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3045 deny icmp 115.201.312.0/24
115.201.313.0/24
awplus(config)# access-list 3046 deny icmp 115.201.312.0/24
115.201.313.0/24
awplus(config)# interface port1.0.11
awplus(config_if)# access-group 3045
awplus(config_if)# access-group 3046
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.11 access-group
```

This example creates a deny access list that discards all tagged ingress IGMP packets with a VID of 12, from ports 12 to 20:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3156 deny icmp any any vlan 12
awplus(config)# interface port1.0.12-port1.0.20
awplus(config_if)# access-group 3156
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.12-port1.0.20 access-group
```

ACCESS-LIST IP

Syntax

```
access-list id_number action ip src_ipaddress dst_ipaddress
[vlan vid]
```

Parameters

id_number

Specifies the ID number for a new ACL. The range is 3000 to 3699.

action

Specifies the action of the access list. Here are the possible actions:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used in conjunction with the port mirror feature, explained in Chapter 27, “Port Mirror” on page 489.

scr_ipaddress

Specifies the source IP address of the ingress packets the access list should filter. Here are the possible options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0 would have a mask of “24” for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, “149.11.11.0/24”.

host ipaddress: Matches packets with a source IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific and node and that no mask is required.

dst_ipaddress: Specifies the destination IP address of the ingress packets the access list should filter. Here are the possible options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a destination IP address of a specific subnet or end node.

host ipaddress: Matches packets with a destination IP address of a specific end node. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

vlan

Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

Global Configuration mode

Description

Use this command to create ACLs that identify traffic flows based on the source and destination IP addresses of the packets.

Confirmation Commands

"SHOW ACCESS-LIST" on page 1671 and "SHOW INTERFACE ACCESS-GROUP" on page 1673

Examples

This example adds a deny ACL, ID number 3201, that discards all untagged ingress packets from the 149.11.124.0 subnet, on ports 4 and 9:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3201 deny ip 149.11.124.0/24 any
awplus(config)# interface port1.0.4,port1.0.9
awplus(config_if)# access-group 3201
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.4,port1.0.9 access-group
```

This example creates a deny access list, ID number 3095, that discards all untagged ingress packets that have destination addresses in the 149.112.2.0 subnet, on ports 11 to 13:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3095 deny ip any 149.112.2.0/24
awplus(config)# interface port1.0.11-port1.0.13
awplus(config_if)# access-group 3095
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.11-port1.0.13 access-group
```

This example creates a deny access list, ID number 3202, that discards all tagged ingress packets on port 24 that are from the 157.11.21.0 subnet and are going to an end node with the IP address 157.11.21.45. The VID of the tagged packets is 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3202 deny ip 157.11.21.0/24
157.11.21.45/32 vlan 15
awplus(config)# interface port1.0.24
awplus(config_if)# access-group 3202
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.24 access-group
```

This example is the same as the previous example, except the HOST keyword is used to indicate the IP address of the destination node:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3202 deny ip 157.11.21.0/24 host
157.11.21.45 vlan 15
awplus(config)# interface port1.0.24
awplus(config_if)# access-group 3202
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.24 access-group
```

This example configures ports 22 and 23 to accept only untagged ingress packets containing destination addresses in the 149.124.47.0 subnet. This example requires both permit and deny ACLs because the permitted traffic is a subset of all traffic on the ports. The permit ACL, ID number 3011, specifies the 149.124.47.0 subnet and the deny ACL, ID number 3012, defines all traffic. The permit access list is added first to the ports with the ACCESS-GROUP command so that packets are compared against it first, before the deny ACL:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3011 permit ip any 149.124.47.0/
24
awplus(config)# access-list 3012 deny ip any any
awplus(config)# interface port1.0.22,port1.0.23
awplus(config_if)# access-group 3011
awplus(config_if)# access-group 3012
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.22,port1.0.23 access-group
```

This example configures ports 17 and 18 to accept untagged ingress packets from the 149.82.134.0 subnet, and to discard all other packets. As in the previous example, both a permit access list and a deny access list are required. The allowed traffic is defined with a permit ACL, which is given the ID number 3022. The deny ACL, with the ID number 3101, specifies all traffic:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3022 permit ip any 149.82.134.0/
24 vlan 22
awplus(config)# access-list 3010 deny ip any any
awplus(config)# interface port1.0.17,port1.0.18
awplus(config_if)# access-group 3022
awplus(config_if)# access-group 3101
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.17,port1.0.18 access-group
```

ACCESS-LIST PROTO

Syntax

```
access-list id_number action proto protocol_number
src_ipaddress dst_ipaddress [vlan vid]
```

Parameters

id_number

Specifies an ID number for a new ACL. The range is 3000 to 3699. Each access list on the switch must have a unique ID number.

action

Specifies the action of the ACL. Choose from the possible actions:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used in conjunction with the port mirror feature, explained in Chapter 27, “Port Mirror” on page 489.

protocol_number

Specifies a protocol number. You can specify one protocol number. Refer to Table 212, “Protocol Numbers” on page 1611 for the list of protocol numbers.

scr_ipaddress

Specifies the source IP address of the ingress packets the access list should filter. Choose one of the following:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0 would have a mask of “24” for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, “149.11.11.0/24”.

host ipaddress: Matches packets with a source IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific and node and that no mask is required.

dst_ipaddress

Specifies the destination IP address of the ingress packets the access list should filter. Choose one of the following:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a destination IP address of a specific subnet or end node.

host ipaddress: Matches packets with a destination IP address of a specific end node. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

vlan

Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

Global Configuration mode

Confirmation Commands

"SHOW ACCESS-LIST" on page 1671 and "SHOW INTERFACE ACCESS-GROUP" on page 1673

Description

Use this command to create ACLs that identify traffic flows based on protocol numbers and source and destination IP addresses. The protocol numbers are listed in Table 212.

Table 212. Protocol Numbers

Number	Description
1	Internet Control Message (RFC792)
2	Internet Group Management (RFC1112)
3	Gateway-to-Gateway (RFC823)
4	IP in IP (RFC2003)
5	Stream (RFC1190 and RFC1819))
6	TCP (Transmission Control Protocol) (RFC793)
8	EGP (Exterior Gateway Protocol) (RFC888)

Table 212. Protocol Numbers (Continued)

Number	Description
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]
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

Table 212. Protocol Numbers (Continued)

Number	Description
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 - 254	Use for experimentation and testing / RFC3692
255	Reserved / IANA

Confirmation Commands

"SHOW ACCESS-LIST" on page 1671 and "SHOW INTERFACE ACCESS-GROUP" on page 1673

Examples

This example adds a deny access list to port 2 to discard all untagged ingress packets of protocol 28, regardless of the source or destination address. The access list is assigned the ID number 3016:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3016 deny proto 28 any any
awplus(config)# interface port1.0.2
awplus(config_if)# access-group 3016
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.2 access-group
```

This example adds a deny access list to ports 5 and 6 so that they discard all tagged ingress packets that have the protocol 17 number and the VID 12, and are from the 152.12.45.0 subnet. The access list is assigned the ID number 3011:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3011 deny proto 17 152.12.45.0/
24 any vlan 12
awplus(config)# interface port1.0.5,port1.0.6
```

```
awplus(config_if)# access-group 3011
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.5,port1.0.6 access-group
```

This example configures port 18 to accept untagged packets only from the 167.75.89.0 network and that are protocol 54. The permit ACL is assigned the ID number 3014 and the deny ACL, which blocks all protocol 54 packets, is assigned the ID number 3025:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3014 permit proto 54
167.75.89.0/24 any
awplus(config)# access-list 3025 deny proto 54 any any
awplus(config)# interface port1.0.18
awplus(config_if)# access-group 3014
awplus(config_if)# access-group 3025
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.18 access-group
```

ACCESS-LIST TCP

Syntax

```
access-list id_number action tcp src_ipaddress
eq|lt|gt|ne|range src_tcp_port dst_ipaddress
eq|lt|gt|ne|range dst_tcp_port [vlan vid]
```

Parameters

id_number

Specifies an ID number for a new ACL. The range is 3000 to 3699.

action

Specifies the action of the ACL. Choose one of the following:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used in conjunction with the port mirror feature, explained in Chapter 27, "Port Mirror" on page 489.

src_ipaddress

Specifies the source IP address of the ingress packets the access list should filter. Choose one of the following:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0 would have a mask of "24" for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, "149.11.11.0/24".

host ipaddress

Matches packets with a source IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific and node and that no mask is required.

eq

Matches packets that are equal to the TCP port number specified by the SRC_TCP_PORT or DST_TCP_PORT parameter.

lt

Matches packets that are less than the TCP port number specified by the SRC_TCP_PORT or DST_TCP_PORT parameter.

gt

Matches packets that are greater than the TCP port number specified by the SRC_TCP_PORT or DST_TCP_PORT parameter.

ne

Matches packets that are not equal to the TCP port number specified by the SRC_TCP_PORT or DST_TCP_PORT parameter.

range

Matches packets with TCP port numbers within the range. Separate the numbers of the range by a space, for instance:

range 4 10

src_tcp_port

Specifies the source TCP port number. The range is 0 to 65535. Omit this parameter if you are entering a range of TCP port numbers.

dst_ipaddress

Specifies the destination IP address of the ingress packets the access list should filter. Here are the possible options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a destination IP address of a specific subnet or end node.

host ipaddress: Matches packets with a destination IP address of a specific end node. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

dst_tcp_port

Specifies the destination TCP port number. The range is 0 to 65535. Omit this parameter if you are entering a range of port numbers.

vlan

Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

Global Configuration mode

Description

Use this command to create access control lists that filter ingress packets based on TCP port numbers.

Confirmation Commands

"SHOW ACCESS-LIST" on page 1671 and "SHOW INTERFACE ACCESS-GROUP" on page 1673

Examples

This example creates an ACL, ID number 3045, that discards all untagged ingress TCP packets on port 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3045 deny tcp any range 0 65535
any range 0 65535
awplus(config)# interface port1.0.5
awplus(config_if)# access-group 3045
```

This example creates an ACL that discards all untagged ingress packets that have the source and destination TCP port number 165. The ACL is applied to port 1 and assigned the ID number 3078:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3078 deny tcp any eq 165 any eq
165
awplus(config)# interface port1.0.1
awplus(config_if)# access-group 3078
```

This example defines an ACL that causes port 18 to discard all untagged ingress TCP packets that have source and destination TCP port numbers in the range of 12 to 100 and that are going to the 149.123.159.0 subnet. The list is assigned the ID number 3126:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3126 deny tcp any range 12 100
149.123.159.0/24 range 12 100
awplus(config)# interface port1.0.18
awplus(config_if)# access-group 3126
```

This example creates an ACL that causes port 14 to discard all tagged ingress TCP packets with the VID 27, regardless of their source or destination TCP port numbers. The list is assigned the ID number 3255:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3255 deny tcp any any vlan 27
awplus(config)# interface port1.0.14
awplus(config_if)# access-group 3255
```

This example configures port 21 to forward untagged TCP port 67 to 87 packets only if they are from the 154.11.234.0 network and are going to the 154.11.235.0 network. This example requires a permit ACL because the permitted traffic, TCP packets with port numbers in the range of 67 to 87, is a subset of all TCP packets on the port:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3017 permit tcp 154.11.234.0/24
range 67 87 154.11.235.0/24 range 67 87
awplus(config)# access-list 3005 deny tcp any any range 67
87
awplus(config)# interface port1.0.21
awplus(config_if)# access-group 3017
awplus(config_if)# access-group 3005
```

ACCESS-LIST UDP

Syntax

```
access-list id_number action udp src_ipaddress
eq|lt|gt|ne|range src_udp_port dst_ipaddress
eq|lt|gt|ne|range dst_udp_port vlan vid
```

Parameters

id_number

Specifies an ID number for a new ACL. The range is 3000 to 3699.

action

Specifies the action of the ACL. Choose one of the following:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used in conjunction with the port mirror feature, explained in Chapter 27, "Port Mirror" on page 489.

src_ipaddress

Specifies the source IP address of the ingress packets the access list should filter. Here are the possible options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0 would have a mask of "24" for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, "149.11.11.0/24".

host ipaddress: Matches packets with a source IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific and node and that no mask is required.

eq

Matches packets that are equal to the UDP port number specified by the SRC_UDP_PORT or DST_UDP_PORT parameter.

lt

Matches packets that are less than the UDP port number specified by the SRC_UDP_PORT or DST_UDP_PORT parameter.

gt

Matches packets that are greater than the UDP port number specified by the SRC_UDP_PORT or DST_UDP_PORT parameter.

ne

Matches packets that are not equal to the UDP port number specified by the SRC_UDP_PORT or DST_UDP_PORT parameter.

range

Matches packets with UDP port numbers within the range. Separate the numbers of the range by a space. For instance:

range 4 10

src_udp_port

Specifies the source UDP port number. The range is 0 to 65535. Omit this parameter if you are entering a range of UDP port numbers.

dst_ipaddress

Specifies the destination IP address of the ingress packets the access list should filter. Here are the possible options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a destination IP address of a specific subnet or end node.

host ipaddress: Matches packets with a destination IP address of a specific end node. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

dst_udp_port

Specifies the destination UDP port number. The range is 0 to 65535. Omit this parameter if you are entering a range of port numbers.

vlan

Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

Global Configuration mode

Description

Use this command to create access control lists that filter ingress packets based on UDP port numbers.

Confirmation Commands

"SHOW ACCESS-LIST" on page 1671 and "SHOW INTERFACE ACCESS-GROUP" on page 1673

Examples

This example creates a Numbered IPv4 ACL, with an ID number of 3118, that discards all untagged ingress UDP packets on ports 18 and 19:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3118 deny udp any range 0 65535
any range 0 65535
awplus(config)# interface port1.0.18,port1.0.19
awplus(config_if)# access-group 3118
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.18,port1.0.19 access-group
```

This example creates an ACL that discards all tagged ingress packets that have the source and destination UDP port number 10 and the VID 29. The ACL is applied to port 17 and assigned the ID number 3091:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3091 deny udp any eq 10 any eq
10 vlan 29
awplus(config)# interface port1.0.17
awplus(config_if)# access-group 3091
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.17 access-group
```

This example defines an ACL that causes port 18 to discard all untagged ingress packets that have source and destination UDP port numbers in the range of 12 to 100 and that are going to the 149.123.159.0 subnet. The VLAN parameter is also included to restrict the ACL to UDP packets that belong to VLAN 7. The list is assigned the ID number 3078:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3078 deny udp any range 12 100
149.123.159.0/24 range 12 100 vlan 7
awplus(config)# interface port1.0.18
awplus(config_if)# access-group 3078
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.18 access-group
```

This example configures port 21 to forward tagged UDP port 67 to 87 packets only if they are from the 154.11.234.0 network and are going to the 154.11.235.0 network, and have the VID 20. This example requires a permit ACL because the permitted traffic, UDP packets with port numbers in the range of 67 to 87, is a subset of all UDP packets on the port:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3119 permit udp 154.11.234.0/24
range 67 87 154.11.235.0/24 range 67 87 vlan 20
awplus(config)# access-list 3005 deny udp any any range 67
87
awplus(config)# interface port1.0.21
awplus(config_if)# access-group 3119
awplus(config_if)# access-group 3005
awplus(config_if)# end
awplus# show access-list
awplus# show interface port1.0.21 access-group
```

IP ACCESS-LIST

Syntax

```
ip access-list name
```

Parameters

name
Specifies the name of the IP ACL.

Mode

Global Configuration mode

Description

Use this command to create a Named IP ACL and enter the IP ACL mode.

Confirmation Commands

"SHOW ACCESS-LIST" on page 1671 and "SHOW INTERFACE ACCESS-GROUP" on page 1673

Examples

This example creates a Named ICMP ACL, called "icmppermit," and enters the IP ACL mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list icmppermit
awplus(config-ip-acl)#
```

This example creates a Named ICMP ACL, called "icmpdeny," and enters the IP ACL mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list icmpdeny
awplus(config-ip-acl)#
```

IP ACCESS-LIST (ICMP)

Syntax

```
action deny|permit|copy-to-mirror icmp scr_ipaddress
any|host dest_ipaddress any|host time-range [vlan vid]
```

Parameters

action

Specifies the action of the ACL. Choose one of the following:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used in conjunction with the port mirror feature, explained in Chapter 27, “Port Mirror” on page 489.

src_ipaddress

Specifies the source IP address of the ingress packets the access list should filter. Choose one of the following:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0 would have a mask of “24” for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, “149.11.11.0/24.”

host ipaddress: Matches packets with a source IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

dest_ipaddress

Specifies the destination IP address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address.

For example, the subnet address 149.11.11.0 would have a mask of "24" for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, "149.11.11.0/24."

host ipaddress: Matches packets with a destination IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

time-range

Specifies the name of a time range that is created with the TIME-RANGE command. You must create a time range before entering it as a parameter value. See "TIME-RANGE" on page 1676.

vid

Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

IP ACL mode

Description

Use this command to create Named IP ACLs that identify traffic flows based on ICMP packets and source and destination IP addresses.

Confirmation Commands

"SHOW ACCESS-LIST" on page 1671 and "SHOW INTERFACE ACCESS-GROUP" on page 1673

Examples

This example creates a Named ICMP ACL (icmppermit) that permits ICMP packets from any IP source address to any IP destination address on VLAN 12. Then the ACL is assigned to port 21:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list icmppermit
awplus(config-ip-acl)# permit icmp any any vlan 12
awplus(config-ip-acl)# exit
awplus(config)# interface port1.0.21
awplus(config-if)# access-group icmppermit
```

This example creates a Named ICMP ACL, called “icmpdeny,” that denies ICMP packets from source IP source address 190.155.22.1 with a decimal mask of 16 to IP destination address 190.155.22.3 with a decimal mask of 24. Then the ACL is assigned to port 4:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list icmpdeny
awplus(config-ip-acl)# deny icmp 190.155.22.1/16
190.155.22.3/24
awplus(config-ip-acl)# exit
awplus(config)# interface port1.0.4
awplus(config-if)# access-group icmpdeny
```

IP ACCESS-LIST (IP)

Syntax

`action` *`deny`*`|`*`permit`*`|`*`copy-to-mirror`* `ip` *`scr_ipaddress any`*`|`*`host dest_ipaddress any`*`|`*`host time-range`* `[vlan` *`vid`*`]`

Parameters

action

Specifies the action of the ACL. Here are the possible actions:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used in conjunction with the port mirror feature, explained in Chapter 27, "Port Mirror" on page 489.

src_ipaddress

Specifies the source IP address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0 would have a mask of "24" for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, "149.11.11.0/24".

host ipaddress: Matches packets with a source IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

dest_ipaddress

Specifies the destination IP address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address.

For example, the subnet address 149.11.11.0 would have a mask of “24” for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, “149.11.11.0/24.”

host ipaddress: Matches packets with a destination IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

time-range

Specifies the name of a time range that is created with the TIME-RANGE command. You must create a time range before entering it as a parameter value. See “TIME-RANGE” on page 1676.

vlan

Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

IP ACL mode

Description

Use this command to create Named IP ACLs that identify traffic flows based on IP packets as well as source and destination IP addresses.

Confirmation Commands

“SHOW ACCESS-LIST” on page 1671 and “SHOW INTERFACE ACCESS-GROUP” on page 1673

Examples

This example creates a Named IP ACL, called “ipcopytomirror,” that copies all IP ingress packets that match the ACL to the destination port of the mirror port on VLAN 9. Then the ACL is assigned to port 2:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list ipcopy-to-mirror
awplus(config-ip-acl)# copy-to-mirror ip any any vlan 9
awplus(config-ip-acl)# exit
awplus(config)# interface port1.0.2
awplus(config-if)# access-group ipcopy-to-mirror
```

This example creates a Named IP ACL, called "ipdeny," that denies ICMP packets from source IP address 190.155.100.5 with a decimal mask of 16 to destination IP address 190.155.100.7 with a decimal mask of 16. Then the ACL is assigned to port 11:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list ipdeny
awplus(config-ip-acl)# deny ip 190.168.100.5/16
190.168.100.7/16
awplus(config-ip-acl)# exit
awplus(config)# interface port1.0.11
awplus(config-if)# access-group ipdeny
```

IP ACCESS-LIST (MAC)

Syntax

```
action deny|permit|copy-to-mirror mac scr_mac_address
any|host dest_mac_address any|host [vlan vid]
```

Parameters

action

Specifies the action of the ACL. Here are the possible actions:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used in conjunction with the port mirror feature, explained in Chapter 27, “Port Mirror” on page 489.

src_mac_address

Specifies the source MAC address of the ingress packets. Choose from the following options:

any: Matches any source MAC address.

src_mac_address: Specifies the source MAC address of the packets. The address must be entered in hexadecimal in this format:

xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

src_mac_mask

Specifies the source MAC address mask. Enter the mask in the following format:

xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

Assign the “x” variable a value of either “0” or “F.” Specify “0” to indicate the parts of the MAC address the ACL is to filter. Specify “F” for parts of the MAC address the ACL should ignore.

Do not include a mask if you specified ANY as the source MAC address.

dst_mac_address

Specifies the destination MAC address of the ingress packets. Choose from the following options:

any: Matches any destination MAC address.

dst_mac_address: Specifies the destination MAC address of the packets. The address must be entered in hexadecimal in this format:

xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

dst_mac_mask

Specifies the destination MAC address mask. Enter the mask in the following format:

xx:xx:xx:xx:xx:xx or xxxx.xxxx.xxxx

Assign the "x" variable a value of either "0" or "F." Specify "0" to indicate the parts of the MAC address the ACL is to filter. Specify "F" for parts of the MAC address the ACL should ignore.

vlan

Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

IP ACL mode

Description

Use this command to create Named IP ACLs that identify traffic flows based on source and destination MAC addresses.

Confirmation Commands

"SHOW ACCESS-LIST" on page 1671 and "SHOW INTERFACE ACCESS-GROUP" on page 1673

Examples

This example creates a Named IP ACL, called “permitmac,” that permits packets from source MAC address 12:a3:4b:89:10:98 to any destination MAC address (00:00:00:00:00:00) on VLAN 15. Then the ACL is assigned to port 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list permitmac
awplus(config-ip-acl)# permit mac 12:a3:4b:89:10:98
00:00:00:00:00:00
awplus(config-ip-acl)# exit
awplus(config)# interface port1.0.3
awplus(config-if)# access-group permitmac
```

This example creates an ACL called “denymac” that denies packets containing destination MAC addresses starting with a4:54:84:12. Then the ACL is assigned to port 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list denymac
awplus(config-ip-acl)# deny mac any a4:54:86:12:00:00
awplus(config-ip-acl)# exit
awplus(config)# interface port1.0.12
awplus(config-if)# access-group denymac
```

IP ACCESS-LIST (PROTO)

Syntax

action *deny*|*permit*|*copy-to-mirror* proto *protocol_number* *scr_ip_address any*|*host* dest_ipaddress *any*|*host time-range* [vlan *vid*]

Parameters

action

Specifies the action of the ACL. Here are the possible actions:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used in conjunction with the port mirror feature, explained in Chapter 27, "Port Mirror" on page 489.

protocol_number

Specifies a protocol number. You can specify one protocol number. Refer to Table 212, "Protocol Numbers" on page 1611 for the protocol number.

src_ipaddress

Specifies the source IP address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0 would have a mask of "24" for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, "149.11.11.0/24."

host ipaddress: Matches packets with a source IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

dest_ipaddressMask

Specifies the destination IP address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0 would have a mask of “24” for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, “149.11.11.0/24.”

host ipaddress: Matches packets with a destination IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

time-range

Specifies the name of a time range that is created with the TIME-RANGE command. You must create a time range before entering it as a parameter value. See “TIME-RANGE” on page 1676.

vlan

Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

IP ACL mode

Description

Use this command to create Named IP ACLs that identify traffic flows based on protocol numbers as well as source and destination IP addresses. For a list of the protocols supported, see Table 212, “Protocol Numbers” on page 1611.

Confirmation Commands

“SHOW ACCESS-LIST” on page 1671 and “SHOW INTERFACE ACCESS-GROUP” on page 1673

Examples

This example creates a Named IP ACL, called "permitproto8," that permits all EGP packets (protocol 8) from source IP address 152.12.45.2/16 to destination IP address 152.12.45.3/16. Then the ACL is assigned to port 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list permitproto8
awplus(config-ip-acl)# copy-to-mirror proto 8 152.12.45.2/16
152.12.45.3/16
awplus(config-ip-acl)# exit
awplus(config)# interface port1.0.7
awplus(config-if)# access-group permitproto8
```

This example creates a deny access list called "denyproto2" that discards all tagged ingress UDP packets (protocol 17) on VLAN 12 that are from the 152.12.45.0/16 subnet. Then the ACL is assigned to port 27:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list denyproto2
awplus(config-ip-acl)# deny proto 17 152.12.45.0/16 any
awplus(config-ip-acl)# exit
awplus(config)# interface port1.0.27
awplus(config-if)# access-group denyproto2
```

IP ACCESS-LIST (TCP)

Syntax

```
action deny|permit|copy-to-mirror tcp scr_ipaddress any|host
gt|lt|ne|range|eq src_tcp_port dest_ipaddress any|host
gt|lt|ne|range|eq dsp_tcp_port time-range [vlan vid]
```

Parameters

action

Specifies the action of the ACL.Choose from the following options:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used in conjunction with the port mirror feature, explained in Chapter 27, “Port Mirror” on page 489.

src_ipaddress

Specifies the source IP address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0 would have a mask of “24” for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, “149.11.11.0/24.”

host ipaddress: Matches packets with a source IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

eq

Matches packets that are equal to the TCP port number specified by the *src_ipaddress* parameter.

lt

Matches packets that are less than the TCP port number specified by the *src_ipaddress* parameter.

gt

Matches packets that are greater than the TCP port number specified by the *src_ipaddress* parameter.

ne

Matches packets that are not equal to the TCP port number specified by the *src_ipaddress* parameter.

src_tcp_port

Specifies the source TCP port number. The range is 0 to 65535. Omit this parameter if you are entering a range of TCP port numbers.

dest_ipaddress

Specifies the destination IP address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0 would have a mask of "24" for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, "149.11.11.0/24."

host ipaddress: Matches packets with a destination IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

lt

Matches packets that are less than the TCP port number specified by the *dest_ipaddress* parameter.

gt

Matches packets that are greater than the TCP port number specified by the *dest_ipaddress* parameter.

ne

Matches packets that are not equal to the TCP port number specified by the *dest_ipaddress* parameter.

range

Matches packets with TCP port numbers within the range. Separate the numbers of the range with a space, for instance:

range 4 10

eq
: Matches packets that are equal to the TCP port number specified by the *dest_ipaddress* parameter.

dst_tcp_port
: Specifies the destination TCP port number. The range is 0 to 65535. Omit this parameter if you are entering a range of port numbers.

time-range
: Specifies the name of a time range that is created with the TIME-RANGE command. You must create a time range before entering it as a parameter value. See “TIME-RANGE” on page 1676.

vid
: Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

IP ACL mode

Description

Use this command to create Named IP ACLs that identify traffic flows based on TCP packets as well as source and destination IP addresses.

Confirmation Commands

“SHOW ACCESS-LIST” on page 1671 and “SHOW INTERFACE ACCESS-GROUP” on page 1673

Examples

This example creates a Named IP ACL, called “permittcp,” that permits all TCP packets from source IP address 152.12.45.2/16 to destination IP address 152.12.45.3/16 on VLAN 12. Then the ACL is assigned to port 24:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list permittcp
awplus(config-ip-acl)# permit tcp 152.12.45.2/16
152.12.45.3/16 vlan 12
awplus(config-ip-acl)# exit
awplus(config)# interface port1.0.24
awplus(config-if)# access-group permittcp
```

This example creates a deny access list called "denytcp" that discards all tagged ingress TCP packets from the 152.12.45.0/16 subnet. Then the ACL is assigned to port 19:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list denytcp
awplus(config-ip-acl)# deny tcp 152.12.45.0/16 any
awplus(config-ip-acl)# exit
awplus(config)# interface port1.0.19
awplus(config-if)# access-group denytcp
```

This example creates an ACL that discards all untagged ingress packets that have the source and destination TCP port number 150. Then the ACL is assigned to port 6:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list tcpdeny2
awplus(config-ip-acl)# deny tcp any eq 150 any eq 150
awplus(config-ip-acl)# exit
awplus(config)# interface port1.0.6
awplus(config-if)# access-group tcpdeny2
```

IP ACCESS-LIST (UDP)

Syntax

action *deny*|*permit*|*copy-to-mirror udp scr_ipaddress any*|*host gt*|*lt*|*ne*|*range*|*eq src_upd_port dest_ipaddress* any|*host gt*|*lt*|*ne*|*range*|*eq dst_upd_port time-range* [vlan *vid*]

Parameters

action

Specifies the action of the ACL. Here are the possible actions:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used in conjunction with the port mirror feature, explained in Chapter 27, “Port Mirror” on page 489.

src_ipaddress

Specifies the source IP address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0 would have a mask of “24” for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, “149.11.11.0/24.”

host ipaddress: Matches packets with a source IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

eq

Matches packets that are equal to the TCP port number specified by the *src_ipaddress* parameter.

lt

Matches packets that are less than the TCP port number specified by the *src_ipaddress* parameter.

gt

Matches packets that are greater than the TCP port number specified by the *src_ipaddress* parameter.

ne

Matches packets that are not equal to the TCP port number specified by the *src_ipaddress* parameter.

src_udp_port

Specifies the source UDP port number. The range is 0 to 65535. Omit this parameter if you are entering a range of UDP port numbers.

dest_ipaddress

Specifies the destination IP address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IP address.

ipaddress/mask: Matches packets that have a source IP address of a subnet or an end node. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. For example, the subnet address 149.11.11.0 would have a mask of "24" for the twenty-four bits of the network section of the address. The IP address and the mask are separated by a slash (/); for example, "149.11.11.0/24."

host ipaddress: Matches packets with a destination IP address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

lt

Matches packets that are less than the TCP port number specified by the *dest_ipaddress* parameter.

gt

Matches packets that are greater than the TCP port number specified by the *dest_ipaddress* parameter.

ne

Matches packets that are not equal to the TCP port number specified by the *dest_ipaddress* parameter.

range

Matches packets with TCP port numbers within the range. Separate the numbers of the range with a space. For instance:

range 4 10

eq
: Matches packets that are equal to the TCP port number specified by the *dest_ipaddress* parameter.

dst_udp_port
: Specifies the destination UDP port number. The range is 0 to 65535. Omit this parameter if you are entering a range of port numbers.

time-range
: Specifies the name of a time range that is created with the TIME-RANGE command. You must create a time range before entering it as a parameter value. See “TIME-RANGE” on page 1676.

vid
: Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

IP ACL mode

Description

Use this command to create Named IP ACLs that identify traffic flows based on UDP packets as well as source and destination IP addresses.

Confirmation Commands

“SHOW ACCESS-LIST” on page 1671 and “SHOW INTERFACE ACCESS-GROUP” on page 1673

Examples

This example creates a Named IP ACL, called “denyudp,” that denies all UDP packets from source IP address 152.12.45.1/16 to destination IP address 152.12.45.7/16 on VLAN 15. Then the ACL is assigned to port 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list denyudp
awplus(config-ip-acl)# deny udp 152.12.45.1/16 152.12.45.7/
16 vlan 15
awplus(config-ip-acl)# exit
awplus(config)# interface port1.0.5
awplus(config-if)# access-group denyudp
```

This example discards tagged packets from UDP ports 67 to 87 if they are from the 154.11.234.0 network and are going to the 154.11.235.0 network, and have a VID of 20. Then the ACL is assigned to port 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list denyudp2
awplus(config-ip-acl)# deny udp 154.11.234.0/24 range 67 87
154.11.235.0/24 range 67 87 vlan 20
awplus(config-ip-acl)# exit
awplus(config)# interface port1.0.8
awplus(config-if)# access-group denyudp2
```

This example creates a deny access list called "udpdeny" that discards all tagged ingress UDP packets from the 152.12.45.0/16 subnet. Then the ACL is assigned to port 1:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip access-list udpdeny
awplus(config-ip-acl)# deny udp 152.12.45.0/16 any
awplus(config-ip-acl)# exit
awplus(config)# interface port1.0.1
awplus(config-if)# access-group udpdeny
```

IPV6 ACCESS-LIST

Syntax

```
ipv6 access-list <ipv6 access-list>
```

Parameters

ipv6 access-list
Specifies the name of an IPv6 ACL access list.

Mode

Global Configuration mode

Description

Use this command to specify the name of an IPv6 ACL and enter the Configuration IPv6 ACL mode. You must enter the IPV6 ACCESS-LIST command *before* placing filtering conditions on the named IPv6 ACL.

Use the no version of this command, NO IPV6 ACCESS-LIST, to delete the specified IPv6 ACL.

Confirmation Command

“SHOW INTERFACE ACCESS-GROUP” on page 1673

Examples

This example creates an IPv6 ACL named “tcp” and enters the Configuration IPv6 Access mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 access-list tcp
awplus(config-ipv6-acl)#
```

This example deletes an IPv6 ACL named “udp:”

```
awplus> enable
awplus# configure terminal
awplus(config)# no ipv6 access-list udp
```

IPV6 ACCESS-LIST (ICMP)

Syntax

`action` *`deny`*`|`*`permit`*`|`*`copy-to-mirror` `icmp` *`scr_ip_address any`*`|`*`host dest_ipaddress any`*`|`*`host time-range`* [`vlan` *`vid`*]

Parameters

action

Specifies the action of the ACL. Here are the possible actions:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used together with the port mirror feature, explained in Chapter 27, "Port Mirror" on page 489.

src_ipaddress

Specifies the source IPv6 address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IPv6 address.

ipaddress/mask: Matches packets that have a source IPv6 address of a subnet or an end node in the X:X::X:X/mask format. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. The IP address and the mask are separated by a slash (/); for example, 2001:odb8::a2/64.

host ipaddress: Matches packets with a source IPv6 address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

dest_ipaddress

Specifies the destination IPv6 address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IPv6 address.

ipaddress/mask: Matches packets that have a destination IPv6 address of a subnet or an end node in the X:X::X:X/mask format. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. The IP address and the mask are separated by a slash (/); for example, 2001:odb8::a2/64.

host ipaddress: Matches packets with a destination IPv6 address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

time-range

Specifies the name of a time range that is created with the TIME-RANGE command. You must create a time range before entering it as a parameter value. See “TIME-RANGE” on page 1676.

vid

Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

Configuration IPv6 ACL mode

Description

Use this command to create ACLs that identify traffic flows based on ICMP type and source and destination IPv6 addresses.

Confirmation Commands

“SHOW ACCESS-LIST” on page 1671 and “SHOW INTERFACE ACCESS-GROUP” on page 1673

Examples

This example creates an ICMP ACL called "icmpdeny1" that denies ICMP packets from any IPv6 source address to any IPv6 destination address on VLAN 7. Then the ACL is assigned to port 19:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 access-list icmpdeny1
awplus(config-ipv6-acl)# deny icmp any any vlan 7
awplus(config-ipv6-acl)# exit
awplus(config)# interface port1.0.19
awplus(config_if)# ipv6 traffic-filter icmpdeny1
```

This example creates an ICMP ACL called "icmpdeny2" that denies ICMP packets from IPv6 source address 2001:0db8:85a3::8a2e:0370:7335/64 to the IPv6 destination address 2001:0db8:85a3::8a2e:0370:7340/64. Then the ACL "icmpdeny2" is assigned to port 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 access-list icmpdeny2
awplus(config-ipv6-acl)# deny icmp
2001:0db8:85a3::8a2e:0370:7335/64
2001:0db8:85a3::8a2e:0370:7340/64
awplus(config-ipv6-acl)# exit
awplus(config)# interface port1.0.3
awplus(config_if)# ipv6 traffic-filter icmpdeny2
```

This example creates an ICMP ACL, called "icmpcopytomirror1," that copies ICMP packets from source IPv6 address 2001:0db8::a2:1c50/64 to any IPv6 destination address. Then the ACL is assigned to port 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 access-list icmpcopytomirror1
awplus(config-ipv6-acl)# copy-to-mirror icmp
2001:0db8::a2:1c50/64 any
awplus(config-ipv6-acl)# exit
awplus(config)# interface port1.0.7
awplus(config_if)# ipv6 traffic-filter icmpcopytomirror1
```

IPV6 ACCESS-LIST (IP)

Syntax

`action` *`deny|permit|copy-to-mirror`* `ip` *`scr_ip_address any|ipaddress|host dest_ipaddress any|ipaddress|host time-range vlan <vid>`*

Parameters

action

Specifies the action of the ACL. Here are the possible actions:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used together with the port mirror feature, explained in Chapter 27, “Port Mirror” on page 489.

src_ipaddress

Specifies the source IPv6 address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IPv6 address.

ipaddress/mask: Matches packets that have a source IPv6 address of a subnet or an end node in the X:X::X:X/mask format. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. The IP address and the mask are separated by a slash (/); for example, 2001:odb8::a2/64.

host ipaddress: Matches packets with a source IPv6 address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

dest_ipaddress

Specifies the destination IPv6 address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IPv6 address.

ipaddress/mask: Matches packets that have a destination IPv6 address of a subnet or an end node in the X:X::X:X/mask format. The mask is a decimal number that represents the

number of bits in the address, from left to right, that constitute the network portion of the address. The IP address and the mask are separated by a slash (/); for example, 2001:odb8::a2/64.

host ipaddress: Matches packets with a destination IPv6 address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

time-range

Specifies the name of a time range that is created with the TIME-RANGE command. You must create a time range before entering it as a parameter value. See "TIME-RANGE" on page 1676.

vid

Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

Configuration IPv6 ACL mode

Description

Use this command to modify an ACL that identify traffic flows based on the source and destination IPv6 addresses of the packets.

Confirmation Commands

"SHOW ACCESS-LIST" on page 1671 and "SHOW INTERFACE ACCESS-GROUP" on page 1673

Examples

This example creates an IP ACL, called "ipdeny1," that denies IP packets from any IPv6 source address to any IPv6 destination address on VLAN 7. Then the ACL is assigned to port 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 access-list ipdeny1
awplus(config-ipv6-acl)# deny ip any any vlan 7
awplus(config-ipv6-acl)# exit
awplus(config)# interface port1.0.12
awplus(config_if)# ipv6 traffic-filter ipdeny1
```

This example creates an IP ACL, called “ipdeny2,” that denies IP packets from IPv6 source address fe80::202:b3ff:fele:8329/64 to IPv6 destination address fe80::202:b3ff:fele:8330/64 on VLAN 3. Then the ACL is assigned to port 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 access-list ipdeny2
awplus(config-ipv6-acl)# deny ip fe80::202:b3ff:fele:8329/
64 fe80::202:b3ff:fele:8329/64 vlan 3
awplus(config-ipv6-acl)# exit
awplus(config)# interface port1.0.3
awplus(config_if)# ipv6 traffic-filter ipdeny2
```

IPV6 ACCESS-LIST (PROTO)

Syntax

```
action deny|permit|copy-to-mirror proto proto_type
scr_ip_address any|ipaddress|host dest_ipaddress
any|ipaddress|host time-range vlan <vid>
```

Parameters

action

Specifies the action of the ACL. Here are the possible actions:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used together with the port mirror feature, explained in Chapter 27, "Port Mirror" on page 489.

proto_type

Specifies the protocol that is filtered. For a list of protocol numbers, see Table 212 on page 1611.

src_ipaddress

Specifies the source IPv6 address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IPv6 address.

ipaddress/mask: Matches packets that have a source IPv6 address of a subnet or an end node in the X:X::X:X/mask format. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. The IP address and the mask are separated by a slash (/); for example, 2001:odb8::a2/64.

host ipaddress
Matches packets with a source IPv6 address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

dest_ipaddress

Specifies the destination IPv6 address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IPv6 address.

ipaddress/mask: Matches packets that have a destination IPv6 address of a subnet or an end node in the X:X::X:X/mask format. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. The IP address and the mask are separated by a slash (/); for example, 2001:odb8::a2/64.

host ipaddress: Matches packets with a destination IPv6 address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

time-range

Specifies the name of a time range that is created with the TIME-RANGE command. You must create a time range before entering it as a parameter value. See “TIME-RANGE” on page 1676.

vid

Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

Configuration IPv6 ACL mode

Description

Use this command to define an ACL that identifies traffic flows based on source and destination IPv6 addresses and protocol numbers which are listed in Table 212 on page 1611.

Confirmation Commands

“SHOW ACCESS-LIST” on page 1671 and “SHOW INTERFACE ACCESS-GROUP” on page 1673

Examples

This example creates a proto ACL, called “protocopytomirror,” that copies RDP packets from source IPv6 address 2001:0db8::a2:1c50/64 to any IPv6 destination address. Then the ACL is assigned to port 9:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 access-list protocopytomirror
awplus(config-ipv6-acl)# copy-to-mirror proto 27
```

```
2001:0db8::a2:1c50/64 any
awplus(config-ipv6-acl)# exit
awplus(config)# interface port1.0.9
awplus(config_if)# ipv6 traffic-filter protocopytomirror
```

This example creates a proto ACL, called "protodeny1," that copies EGP packets from source IPv6 address 2001:0db8:AC10:FE01::/64 to IPv6 destination address 2001:0db8:AC10:FE02::/64. Then the ACL is assigned to port 22:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 access-list protodeny1
awplus(config-ipv6-acl)# deny proto 8 2001:0db8:AC10:FE01::/
64 2001:0db8:AC10:FE02::/64
awplus(config-ipv6-acl)# exit
awplus(config)# interface port1.0.22
awplus(config_if)# ipv6 traffic-filter protodeny1
```

IPV6 ACCESS-LIST (TCP)

Syntax

```
action deny|permit|copy-to-mirror tcp scr_ip_address
any|host eq|lt|gt|ne src_tcp_port dest_ipaddress
any|host|range eq|lt|gt|ne|range dest_tcp_port time-range
vlan <vid>
```

Parameters

action

Specifies the action of the ACL. Here are the possible actions:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used together with the port mirror feature, explained in Chapter 27, “Port Mirror” on page 489.

src_ipaddress

Specifies the source IPv6 address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IPv6 address.

ipaddress/mask: Matches packets that have a source IPv6 address of a subnet or an end node in the X:X::X:X/mask format. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. The IP address and the mask are separated by a slash (/); for example, 2001:odb8::a2/64.

host ipaddress: Matches packets with a source IPv6 address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

eq

Matches packets that are equal to the TCP port number specified by the *src_ipaddress* parameter.

lt

Matches packets that are less than the TCP port number specified by the *src_ipaddress* parameter.

gt

Matches packets that are greater than the TCP port number specified by the *src_ipaddress* parameter.

ne

Matches packets that are not equal to the TCP port number specified by the *src_ipaddress* parameter.

src_tcp_port

Specifies the source TCP port number. The range is 0 to 65535. Omit this parameter if you are entering a range of TCP port numbers.

dest_ipaddress

Specifies the destination IPv6 address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IPv6 address.

ipaddress/mask: Matches packets that have a destination IPv6 address of a subnet or an end node in the X:X::X:X/mask format. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. The IP address and the mask are separated by a slash (/); for example, 2001:odb8::a2/64.

host ipaddress: Matches packets with a destination IPv6 address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

lt

Matches packets that are less than the TCP port number specified by the *dest_ipaddress* parameter.

gt

Matches packets that are greater than the TCP port number specified by the *dest_ipaddress* parameter.

ne

Matches packets that are not equal to the TCP port number specified by the *dest_ipaddress* parameter.

range

Matches packets with TCP port numbers within the range. Separate the numbers of the range with a space. For instance:

range 4 10

eq
: Matches packets that are equal to the TCP port number specified by the *dest_ipaddress* parameter.

dst_tcp_port
: Specifies the destination TCP port number. The range is 0 to 65535. Omit this parameter if you are entering a range of port numbers.

time-range
: Specifies the name of a time range that is created with the TIME-RANGE command. You must create a time range before entering it as a parameter value. See “TIME-RANGE” on page 1676.

vid
: Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

Configuration IPv6 ACL mode

Description

Use this command to create IPv6 access control lists that filter ingress packets based on TCP port numbers.

Examples

This example creates a TCP-based IPv6 ACL list, named “tcpdeny,” that denies TCP packets on any source IPv6 address and any destination IPv6 address to VLAN 4. Then the ACL is assigned to port 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 access-list tcpdeny
awplus(config-ipv6-acl)# deny tcp any any eq vlan 4
awplus(config-ipv6-acl)# exit
awplus(config)# interface port1.0.8
awplus(config_if)# ipv6 traffic-filter tcpdeny
```

This example creates an ACL that discards all untagged ingress packets that have the source and destination TCP port number 275. Then the ACL is assigned to port 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 access-list tcpdeny2
awplus(config-ipv6-acl)# deny tcp any eq 275 any eq 275
awplus(config-ipv6-acl)# exit
awplus(config)# interface port1.0.5
awplus(config_if)# ipv6 traffic-filter tcpdeny2
```

IPV6 ACCESS-LIST (UDP)

Syntax

```
action deny|permit|copy-to-mirror udp scr_ip_address
any|host eq|lt|gt|ne|range dest_ipaddress any|host|range
eq|lt|gt|ne|range time-range vlan <vid>
```

Parameters

action

Specifies the action of the ACL. Here are the possible actions:

permit: Forwards all ingress packets that match the ACL.

deny: Discards all ingress packets that match the ACL.

copy-to-mirror: Copies all ingress packets that match the ACL to the destination port of the mirror port. This action must be used together with the port mirror feature, explained in Chapter 27, “Port Mirror” on page 489.

src_ip_address

Specifies the source IPv6 address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IPv6 address.

ipaddress/mask: Matches packets that have a source IPv6 address of a subnet or an end node in the X:X::X:X/mask format. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. The IP address and the mask are separated by a slash (/); for example, 2001:odb8::a2/64.

host ipaddress: Matches packets with a source IPv6 address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

eq

Matches packets that are equal to the UDP port number specified by the *src_ipaddress* parameter.

lt

Matches packets that are less than the UDP port number specified by the *src_ipaddress* parameter.

gt

Matches packets that are greater than the UDP port number specified by the *src_ipaddress* parameter.

ne

Matches packets that are not equal to the UDP port number specified by the *src_ipaddress* parameter.

range

Matches packets with UDP port numbers within the range. Separate the numbers of the range by a space. For instance:

dest_ipaddress

Specifies the destination IPv6 address of the ingress packets the access list should filter. Choose from the following options:

any: Matches any IPv6 address.

ipaddress/mask: Matches packets that have a destination IPv6 address of a subnet or an end node in the X:X::X:X/mask format. The mask is a decimal number that represents the number of bits in the address, from left to right, that constitute the network portion of the address. The IP address and the mask are separated by a slash (/); for example, 2001:odb8::a2/64.

host ipaddress: Matches packets with a destination IPv6 address and is an alternative to the IPADRESS/MASK variable for addresses of specific end nodes. The HOST keyword indicates that the address is of a specific end node and that no mask is required.

lt

Matches packets that are less than the UDP port number specified by the *dest_ipaddress* parameter.

gt

Matches packets that are greater than the UDP port number specified by the *dest_ipaddress* parameter.

ne

Matches packets that are not equal to the UDP port number specified by the *dest_ipaddress parameter.*

range

Matches packets with UDP port numbers within the range. Separate the numbers of the range by a space. For instance:

range 4 10

eq

Matches packets that are equal to the TCP port number specified by the *dest_ipaddress* parameter.

time-range

Specifies the name of a time range that is created with the TIME-RANGE command. You must create a time range before entering it as a parameter value. See “TIME-RANGE” on page 1676.

vid

Indicates a VLAN identifier. Specify a VLAN if you want the ACL to filter tagged packets. Omit a VLAN if you want the ACL to filter untagged packets. Specify a value between 1 and 4094. You can enter only one VID.

Mode

Configuration IPv6 ACL mode

Description

Use this command to create IPv6 access control lists that filter ingress packets based on UDP port numbers.

Examples

This example creates a UDP-based IPv6 ACL list that discards UDP packets from any source IP address and to any destination IP address. Then the ACL is assigned to port 6:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 access-list udpdeny
awplus(config-ipv6-acl)# deny udp any any
awplus(config-ipv6-acl)# exit
awplus(config)# interface port1.0.6
awplus(config_if)# ipv6 traffic-filter udpdeny
```

This example creates a UDP-based IPv6 ACL list, named “udpcopytomirror,” that copies all ingress UDP packets that match the ACL to the destination port of the mirror port. Then the ACL is assigned to port 20:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 access-list udpcopytomirror
awplus(config-ipv6-acl)# copy-to-mirror udp any any
awplus(config-ipv6-acl)# exit
awplus(config)# interface port1.0.20
awplus(config_if)# ipv6 traffic-filter udpcopytomirror
```

This example discards tagged packets from UDP ports 67 to 87 if they are from the 154.11.234.0/64 network and are going to the 154.11.234.1/64 network. Then the ACL is assigned to port 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# ipv6 access-list denyudp2
awplus(config-ip-acl)# deny udp 154.11.234.0/64 range 67 87
154.11.234.1/64 range 67 87
awplus(config-ipv6-acl)# exit
awplus(config)# interface port1.0.23
awplus(config_if)# ipv6 traffic-filter denyudp2
```

IPV6 TRAFFIC-FILTER

Syntax

```
ipv6 traffic-filter <ipv6_access_list>
```

Parameters

<ipv6_access_list>
Specifies the name of an IPv6 access control list.

Mode

Port Interface mode

Description

Use this command to assign an IPv6 ACL to an interface. You must create a Named IPv6 ACL before you assign it to a port with the IPV6 TRAFFIC-FILTER command.

Use the no version of this command, NO IPV6 TRAFFIC-FILTER, to remove an IPv6 ACL from a port.

Confirmation Command

“SHOW INTERFACE ACCESS-GROUP” on page 1673

Examples

This example adds an IPv6 ACL named “tcpdeny” to port 20:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.20
awplus(config-if)# ipv6 traffic-filter tcpdeny
```

This example adds an IPv6 ACL named “protopermit” to port 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# ipv6 traffic-filter protopermit
```

MAC ACCESS-GROUP

Syntax

```
mac access-group id_number
```

Parameters

id_number
Specifies the ID number of a MAC address access control list you want to add to a port. The range is 4000 to 4699.

Mode

Port Interface mode

Description

Use this command to add MAC address ACLs to ports on the switch. Ports begin to filter packets as soon as they are assigned ACLs. You can add one ACL to a port at a time with this command.

Use the no version of this command, NO MAC ACCESS-LIST, to remove a MAC address ACL from a switch.

Note
If a port is to have both permit and deny ACLs, you must add the permit ACLs first because ingress packets are compared against the ACLs in the order in which they are added to a port. If you add the deny ACLs before the permit ACLs, a port is likely to block traffic you want it to forward.

Confirmation Command

"SHOW INTERFACE ACCESS-GROUP" on page 1673

Example

This example adds the ACL 4022 to port 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# mac access-group 4022
awplus(config-if)# end
awplus# show interface port1.0.15 access-group
```

NO ACCESS-LIST

Syntax

```
no access-list id_number
```

Parameters

id_number
: Specifies the ID number of an access list you want to delete from the switch. You can delete one access list at a time with this command.

Mode

Global Configuration mode

Description

Use this command to delete ACLs from the switch. ACLs must first be removed from their port assignments before they can be deleted. For instructions, refer to “NO ACCESS-GROUP” on page 1665 and “NO MAC ACCESS-GROUP” on page 1666.

Confirmation Command

“SHOW ACCESS-LIST” on page 1671

Example

This example deletes the access list with the ID number 3015 from the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# no access-list 3015
awplus(config-if)# end
awplus# show access-list
```

NO ACCESS-GROUP

Syntax

```
no access-group id_number
```

Parameters

id_number
: Specifies the ID number of an access list. The range is 3000 to 3699. You can remove one ACL from a port at a time with this command.

Mode

Port Interface mode

Description

Use this command to remove ACLs from ports on the switch. This command works for all ACLs, except for MAC address ACLs, which are removed with "NO MAC ACCESS-GROUP" on page 1666.

Confirmation Command

"SHOW INTERFACE ACCESS-GROUP" on page 1673

Example

This example removes the ACL with the ID number 3121 from port 23:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.23
awplus(config-if)# no access-group 3121
awplus(config-if)# end
awplus# show interface port1.0.23 access-group
```

NO MAC ACCESS-GROUP

Syntax

```
no mac access-group id_number
```

Parameters

id_number
: Specifies the ID number of a MAC address access list to be removed from a port. The range is 4000 to 4699 You can remove one ACL from a port at a time with this command.

Mode

Port Interface mode

Description

Use this command to remove MAC address ACLs from ports on the switch.

Confirmation Command

“SHOW INTERFACE ACCESS-GROUP” on page 1673

Example

This example removes a MAC address ACL with the ID number 4014 from port 16:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.16
awplus(config-if)# no mac access-group 4014
awplus(config-if)# end
awplus# show interface port1.0.16 access-group
```

PERIODIC

Syntax

periodic *day days-of-the-week time (hh:mm:ss)* to *day days-of-the-week time (hh:mm:ss)*

Parameters

day

Specifies a day of the week. The first occurrence of this parameter specifies the starting day that the associated time range begins. The second occurrence of this parameter specifies the ending day. Enter one of the following for the beginning day and another for the ending day:

- Monday
- Tuesday
- Wednesday
- Thursday
- Friday

time

Indicates the time of day which is expressed in a 24-hour clock and specified in hours:minutes:seconds. The first occurrence of this parameter specifies the starting time. The second occurrence of this parameter specifies the ending time.

Mode

Time-Range mode

Description

Use this command to set the date and time range for Access Control List filtering. The PERIOD command allows you to set reoccurring days of the week and time of day for filtering.

To remove the date and time range, use the NO PERIODIC command.

Confirmation Command

"SHOW INTERFACE ACCESS-GROUP" on page 1673

Examples

This example sets the date and time range from Monday at 12:01 am to Thursday at 4:00 pm:

```
awplus> enable
awplus# configure terminal
awplus(config)# time-range
awplus(config-time-range)# periodic Monday 00:00:01 to
Thursday 16:00:00
```

This example sets the date and time range from Monday at 8 am to Wednesday at 7:00 pm:

```
awplus> enable
awplus# configure terminal
awplus(config)# time-range
awplus(config-time-range)# periodic Monday 08:00:00 to
Wednesday 19:00:00
```

PERIODIC (DAILY)

Syntax

```
periodic day (daily|weekdays|weekend) time (hh:mm:ss) to
time (hh:mm:ss)
```

Parameters

day

Specifies a range of days. Enter one of the following:

daily (Monday through Sunday)

weekdays (Monday through Friday)

weekend (Saturday and Sunday)

time

Indicates the time of day which is expressed in a 24-hour clock and specified in hours:minutes:seconds.

Mode

Time-Range mode

Description

Use this command to set a daily, weekday, or weekend time range for ACL filtering.

To remove the date and time range, use the NO PERIODIC command.

Confirmation Command

"SHOW INTERFACE ACCESS-GROUP" on page 1673

Examples

This example sets the date and time range from 9 am Monday morning to 5 pm Friday evening:

```
awplus> enable
awplus# configure terminal
awplus(config)# time-range
awplus(config-time-range)# periodic daily 09:00:00 to
17:00:00
```

This example sets the date and time range from 9 am Monday morning to 5 pm Friday evening:

```
awplus> enable
awplus# configure terminal
awplus(config)# time-range
awplus(config-time-range)# periodic weekdays 09:00:00 to
17:00:00
```

This example sets the date and time range from 7 am Saturday morning to 6 pm Sunday evening:

```
awplus> enable
awplus# configure terminal
awplus(config)# time-range
awplus(config-time-range)# periodic weekend 07:00:00 to
18:00:00
```

SHOW ACCESS-LIST

Syntax

```
show access-list [<3000-3699>|<4000-4699>|<list-name>]
```

Parameters

<3000-3699>
Indicates a Numbered IP ACL.

<4000-4699>
Indicates a MAC ACL.

list-name
Indicates a Named IP ACL.

Mode

Privileged Exec mode

Description

Use this command to display the configurations of the Numbered IPv4, MAC, and Named IPv4 ACLs on the switch. If you do not specify an option, all three ACL types are displayed.

To display the Named IPv6 ACLs, use the SHOW IPV6 ACCESS-LIST commands. See "SHOW IPV6 ACCESS-LIST" on page 1674.

To display the port assignments of the ACLs, refer to "SHOW INTERFACE ACCESS-GROUP" on page 1673.

Example

This example displays Numbered IP, MAC, and Named IP ACLs:

```
awplus# show access-list
```

```
IP access-list 3104
   deny 149.87.201.1 mask 255.255.255.0 any
MAC access-list 4400
   permit any any
IP access-list icmppermit
   ICMP permit an any time-range daily
IP access-list denytcp
   TCP deny 149.55.65.0 mask 255.255.255.0 any time-range NONE

Total number of access-lists= 4
```

Figure 258. SHOW ACCESS-LIST Command

SHOW INTERFACE ACCESS-GROUP

Syntax

```
show interface port access-group
```

Parameters

port

Specifies a port number. You can specify more than one port at a time.

Mode

Privileged Exec mode

Description

Use this command to display the port assignments of the ACLs. Here is an example of the information.

```
Interface port1.0.18

   access-group 3022

   access-group 3022

Interface port1.0.19

   access-group 3228
```

Figure 259. SHOW INTERFACE ACCESS-GROUP Command

Example

This example displays the ID numbers of the ACLs assigned to ports 1 and 2:

```
awplus# show interface port1.0.1,port1.0.2 access-group
```

SHOW IPV6 ACCESS-LIST

Syntax

```
show ipv6 access-list <list-name>
```

Parameters

<list-name>
Specifies the name of an IPv6 access control list.

Mode

Privileged Exec mode

Description

Use this command to display the contents of the IPv6 ACLs. See Figure 260 for an example of the information.

```
IPv6 access-list udp
   deny ip any any
```

Figure 260. SHOW IPV6 ACCESS-LIST Command

Example

This command displays the contents of the IPv6 access list called “udp:”

```
awplus# show ipv6 access-list udp
```

SHOW TIME-RANGE

Syntax

```
show time-range
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the time settings which are set with the TIME-RANGE, ABSOLUTE, PERIODIC, and PERIODIC (Daily) commands. See "TIME-RANGE" on page 1676, "ABSOLUTE START" on page 1594, "PERIODIC" on page 1667, and "PERIODIC (DAILY)" on page 1669.

See Figure 261 for an example of the SHOW TIME-RANGE display. This display shows that time-range t1 has an absolute start (immediately effective start) time of 9 pm on June 5, 2012 and time-range t2 has an absolute end (immediately effective end) time of 3 pm on August 11, 2012.

```
awplus# show time-range
Time-Range        t1
        absolute start 21:00:00 05 June 11
Time-Range        t2
        absolute end 15:00:00 05 August 11
```

Figure 261. SHOW TIME-RANGE Command

Example

This command displays the time settings:

```
awplus# show time-range
```

TIME-RANGE

Syntax

```
time-range <time-range-name>
```

Parameters

time-range-name
Specifies a name of a time range.

Mode

Global Configuration mode

Description

This command allows you to define the name of a time range and enter the Configuration Time-Range mode. Time ranges are supported by both IP and IPv6 addresses.

Use the no form of this command, NO TIME-RANGE, to remove a time range.

Examples

This example enters the Configuration Time-range mode with a time-range called “tcp”:

```
awplus> enable
awplus# configure terminal
awplus(config)# time-range tcp
awplus(config-time-range)#
```

This example exits the Configuration Time-range mode with a time-range called “udp:”

```
awplus> enable
awplus# configure terminal
awplus(config)# time-range udp
awplus(config-time-range)# no time-range udp
```

Chapter 102

Quality of Service (QoS)

This chapter describes the following topics:

Overview

Quality of Service (QoS) refers to the latency, bandwidth, jitter, and loss settings that high-bandwidth traffic, such as voice traffic, require to maintain traffic quality. As more companies convert their phone systems to VoIP, QoS becomes even more important because this feature allows you to prioritize traffic to ensure voice quality. By default, QoS is disabled on the switch.

At the core of the QoS is the policy map. The policy map contains one or more class maps that filter traffic based on matching criterion, including Cost of Service (CoS), Diffserv Code Point (DSCP), VLAN ID, or MAC address. DSCP is used as a match criterion for Layer 3 packets while Cost of Service (CoS) is used as a match criterion for Layer 2 frames. You can add multiple class maps, typically each with unique matching criterion, to one policy map. It is important to note that class map settings apply to *ingress* traffic only.

A policy map allows you to set actions on traffic that meet all of the match criterion contained in the class maps. In other words, once you have defined the traffic that you want to filter, you decide what you want to do with that traffic. There are three choices, you can permit the specified traffic, you can deny the specified traffic, or you can monitor the specified traffic by copying it to a port mirror. The classified traffic in a policy map is denied by default. After you have added the desired class maps to a policy map, you associate the policy map with an interface to make the filter active.

In addition, a default class map is provided to save time when configuring QoS. A default class map enables you to specify the action that applies to *all* unclassified traffic within a policy map. You can choose from permit, deny, or copy to a mirror port.

Once you create a policy map populated with one or more class maps, you can apply other QoS settings to traffic, as described in the following sections.

Single-rate and Twin-rate Policer

There are two types of policers available in QoS, single-rate and twin-rate. If traffic does not conform to the conditions set in a policer command, both the single-rate and twin-rate policer can either drop or remark traffic. A single-rate policer allows you to determine the following:

- Committed Information Rate (CIR)
- Committed burst size (CBS)
- Excess Burst Size (EBS)

A twin-rate policer allows you to determine the CIR and CBS as well as two additional values:

- Peak Information Rate (PIR)
- Peak Burst Size (PBS)

Aggregate Policer

An aggregate policer is a named policer with an aggregate, or collective, name that you can assign to multiple policy maps.There are two types of police aggregators, single-rate and twin-rate. The single-rate and twin-rate aggregate policers have the same settings as described in the previous section.

Egress Queues

In addition to setting filtering on ingress queues, you can set QoS egress queues on a port. The egress queue settings include classifying data and marking it according to its priority and, finally, how metering is applied. After the data packets have been appropriately filtered, classified, and policed, they travel across the switch's internal paths carrying their assigned QoS tag markers— DSCP, CoS, and bandwidth color. At the egress port, these markers are read and used to determine which queue each data packet is forwarded to.

There are eight egress queues allocated to each egress port. By default, all queues on all ports are serviced in strict priority order. This means that the highest numbered priority queue, queue 7, is emptied first. When queue 7 is completely empty, the next highest priority queue, queue 6, is processed. This process is continued until you reach queue 0. For a strict priority queue to be processed, all higher priority queues must be empty.

In addition, you can configure the egress queues to the Weighted Round Robin (WRR) scheduling method. With this method, you define the number of packets transmitted from each queue before going on to the next queue, so that each queue has the opportunity to transmit traffic. Usually, you give a greater weight to the higher priority queues.

Auto-QoS

Auto-QoS support is an intelligent macro that permits you to enter one command that enables the recommended QoS settings on edge and uplink ports automatically. This feature permits you to enable QoS on a port without having to enter the individual commands; consequently, saving you time. There are two types of Auto-QoS scenarios, without LLDP-MED phone-port support and with LLDP-MED phone-port support. Both Auto-QoS configuration and manual QoS configuration can coexist on the switch as long as their settings do not conflict.

Enabling QoS on the Switch

By default, the QoS feature is disabled on the switch. You must enable the QoS feature before you attempt any QoS configuration.

To enable the QoS feature on the switch, do the following:

Table 213. Enabling QoS on the Switch

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# mls qos enable`	Enable the QoS feature on the switch.

Creating a Class Map

To define filtering criteria, you need to create a class map. You create a class map and then add it to a policy map to define an action for the matched traffic. (This is the example shown in this section.) Or, you can create a class map after you create a policy map. It is important to understand that class maps filter incoming packets only.

For more information about the CLASS-MAP command, see "CLASS-MAP" on page 1737.

The following example creates a class map named "cmap1" and enters the Class Map mode. It is only within the Class Map mode that you can add filters to the class map.

Table 214. Creating a Class Map

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# class-map cmap1`	Creates a class map called "cmap1" and enters the Configuration Class mode.
`awplus(config-cmap)#`	Displays the Class Map mode prompt.

The following sections describe the extensive list of filtering options available within a class map and provide configuration examples:

- "Filtering Incoming Traffic" on page 1681
- "Filtering Procedures" on page 1682

Filtering Incoming Traffic

After you create a class map, you want to filter incoming traffic by placing matching criteria on the class map. All of the QoS filtering commands begin with "MATCH." There are ten commands that allow you to set matching criteria for a class map. See Table 215.

Table 215. Class-Map Metering Commands

To Do this Task	Use this Command
Use an ACL group name or group number as a matching criterion for IPv4 ACLs only.	`match access-group` *`name`*`/group-`*`number`*
Use the specified CoS value as a matching criterion.	`match cos <0-7>`

Table 215. Class-Map Metering Commands (Continued)

To Do this Task	Use this Command
Use the specified DSCP value as a matching criterion.	`match dscp <0-63>`
Use the specified IP precedence as a matching criterion.	`match ip-precedence <0-7>`
Set the MAC type as a matching criteria for a class-map.	`match mac-type <l2bcast|l2mcast|l2ucast>`
Set an Ethernet format and/ or protocol as a matching criteria.	`match eth-format layer-two-format protocol layer-three-protocol`
Set one or more TCP flags as a matching criteria.	`match tcp-flags ack|fin|rst|syn|urg`
Define the VLAN ID used as a matching criteria.	`match vlan <1-4094>`

Note
If a conflict occurs between the settings in two class maps assigned to the same policy map, priority is given to the class map that was attached to the policy map first. An example of this type of conflict occurs when a packet meets the classification requirements of two class maps each configured to the same policy map and set to apply two different priority settings to the packets.

Filtering Procedures

The following QoS filtering procedures are provided:

- “Adding an Access Control List to a Class Map” on page 1682
- “Adding a CoS Value to a Class Map” on page 1684
- “Adding a DSCP Value to a Class Map” on page 1685
- “Adding IPv4 Precedence to a Class Map” on page 1685
- “Adding MAC-Type to a Class Map” on page 1686
- “Adding an Ethernet Format and Protocol to a Class Map” on page 1686
- “Adding a TCP Flag to a Class Map” on page 1687
- “Adding a VLAN to a Class Map” on page 1687

Adding an Access Control List to a Class Map

You can add an Access Control list to a class map by specifying an ACL group name or group number. The MATCH ACCESS-GROUP command with the group-name parameter allows you to add an IPv4 ACL name to a class map. The MATCH ACCESS-GROUP command with the group-

number parameter allows you to add an access group to a class map by specifying an ACL number.

For more information about this command, see "MATCH ACCESS-GROUP" on page 1742.

The following example adds the group name "icmppermit" to a class map named "cmap3:"

Table 216. Adding an ACL Group Name to a Class Map

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# class-map cmap3`	Creates a class map cmap3 and enters the Class Map mode.
`awplus(config-cmap)# match access-group icmppermit`	Adds the ACL name "icmppermit" to class map cmap3.

The following example adds ACL group number 3015 to a class map named "cmap7:"

Table 217. Adding an ACL Group Number to a Class Map

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# class-map cmap7`	Creates a class map called cmap7 and enters the Class Map mode.
`awplus(config-cmap)# match access-group 3015`	Adds the ACL group number 3015 to class map cmap7.

Adding a CoS Value to a Class Map

Choosing the CoS value allows you to add the user priority level to a class map as a matching criterion. You assign a CoS value according to the type of traffic that you want to filter, such as voice traffic. Then you add the CoS value to a class map with the MATCH COS command. For more information about this command, see “MATCH COS” on page 1745.

Table 218 provides a summary of guidelines from the IEEE Standard 802.1d on applying priorities to traffic types.

Table 218. CoS Traffic Mapping Guidelines

User Priority	Traffic Types
1	Background
2	Spare
0	Best Effort
3	Excellent Effort
4	Controlled Load
5	Video < 100 latency and jitter
6	Voice < 10 latency and jitter
7	Network Control

The following example creates a class map, “cmap7,” which matches all traffic with a user-priority level equal to 5:

Table 219. Adding a CoS Value to a Class Map

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# class-map cmap7`	Creates a class map called cmap7 and enters the Class Map mode.
`awplus(config-cmap)# match cos 5`	Adds the CoS value of 5 as a matching criteria to class map “cmap7.”

Adding a DSCP Value to a Class Map

You can specify a DSCP value level of 0, which is the lowest priority, to 63, which is the highest priority. Use the MATCH DSCP command to add a DSCP value as a matching criteria to a class map. For more information, see "MATCH DSCP" on page 1747.

The following example adds a DSCP value of 63 as a match criteria to the class map named "cmap5:"

Table 220. Adding an DSCP Value to a Class Map

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# class-map cmap5`	Creates a class map called cmap5 and enters the Class Map mode.
`awplus(config-cmap)# match dscp 63`	Adds the DSCP value of 63 as a matching criteria to class map cmap5.

Adding IPv4 Precedence to a Class Map

To identify the precedence values of all IPv4 packets as match criteria for a class map, use the MATCH IP-PRECEDENCE command. For more information about this command, see "MATCH IP-PRECEDENCE" on page 1748.

In this example, a class map, named "cmap2," evaluates all IPv4 packets for a precedence value of 5:

Table 221. Adding IPv4 Precedence to a Class Map

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# class-map cmap2`	Creates a class map called "cmap2" and enters the Class Map mode.
`awplus(config-cmap)# match ip-precedence 5`	Adds an IP precedence value of 5 as a matching criteria to the class map "cmap2."

Adding MAC-Type to a Class Map

To add the destination MAC address type, or MAC-type, to a class map, use the MATCH MAC-TYPE command. With this command, you can specify broadcast, multicast, or unicast MAC-types. For more information about this command, see “MATCH MAC-TYPE” on page 1749.

In this example, a class map, named “cmap7” evaluates destination MAC addresses with the broadcast MAC-type:

Table 222. Adding a MAC-type to a Class Map

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# class-map cmap7`	Creates a class map called cmap7 and enters the Class Map mode.
`awplus(config-cmap)# match mac-type l2bcast`	Adds Layer 2 broadcast packets as a matching criteria to the class map.

Adding an Ethernet Format and Protocol to a Class Map

To add an Ethernet format and a protocol as a matching criteria to a class map, use the MATCH PROTOCOL command. The packets from the specified Ethernet format and frames from the specified protocol that you add to the class map are filtered. For more information about this command, see “MATCH PROTOCOL” on page 1751.

In this example, a class map, named “cmap7,” is set to match incoming 802.2 untagged packets and IP frames:

Table 223. Adding a Protocol to a Class Map

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# class-map cmap7`	Creates a class map called cmap7 and enters the Class Map mode.
`awplus(config-cmap)# match eth-format 802dot2-untagged protocol ip`	Adds the 802.2 untagged packets in Ethernet format and the IP protocol as matching criteria to the class map.

Adding a TCP Flag to a Class Map

To set TCP flags for a class map which are used as matching criteria, use the MATCH TCP-FLAGS command. For more information about this command, see "MATCH TCP-FLAGS" on page 1756.

In this example, a class map, named "cmap7," matches incoming packets that contain both the Acknowledge and Reset TCP flags:

Table 224. Adding a TCP Flag to a Class Map

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# class-map cmap7`	Creates a class map called cmap7 and enters the Class Map mode.
`awplus(config-cmap)# match tcp-flags ack`	Add the Acknowledge flag to class map "cmap7."
`awplus(config-cmap)# match tcp-flags res`	Add the Reset flag to class map "cmap7."

Adding a VLAN to a Class Map

To create a class-map called "cmap7" and add VLAN 3 as a match criteria for incoming traffic, do the following:

Table 225. Adding a VLAN to a Class Map

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# class-map cmap1`	Creates a class map called "cmap1" and enters the Configuration Class mode.
`awplus(config-cmap)# match vlan 3`	Adds VLAN 3 as a match criterion for incoming traffic.

Creating a Policy Map

After you have created one or more class maps, you need to create a policy map which allows you to group class maps together. A policy map allows you to set actions on traffic that meet all of the match criterion contained in the class maps. Typically, you create a policy map that contains class maps with uniquely defined criterion.

In the case of conflicting match criterion, the precedence value of the class maps is determined by the order they are assigned to the policy map. The first class map assigned to a policy map has precedence over the second class map added to the policy map and so on. To display the order that class maps are assigned to a policy map, use the SHOW POLICY MAP command. See “SHOW POLICY-MAP” on page 1797.

Another important aspect of a policy map is that you can assign it to a port. (You cannot assign a class map directly to a port.) When you assign a policy map to a port, you apply all of the match criterion contained in the class maps to the port.

You can assign up to 5 class maps to one policy map with the POLICY-MAP command. For more information about this command, see “POLICY-MAP” on page 1789.

The following example creates a policy map called “pmap1”, enters the Policy Map Configuration mode, and adds a description of “Video traffic” to this policy.

Table 226. Creating a Policy Map

Command	Description
`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# policy-map pmap1`	Create a policy called “pmap1.”
`awplus(config-pmap)# description Video traffic`	Add a description of “Video traffic” to the policy map.

Associating a Class Map With a Policy Map

To associate a class map to a policy map, use the CLASS command. For more information about this command, see "CLASS" on page 1735.

The following example creates a policy map called pmap1, then associates pmap1 to a class map called "cmap1:"

Table 227. Associating a Class Map with a Policy Map

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# policy-map pmap1`	Creates a policy map called "pmap1" and enters the Policy Map Class Configuration mode.
`awplus(config-pmap)# class cmap1`	Creates a class map called "cmap1" and enters the Policy Map Class Configuration mode.
`awplus(config-pmap-c)#`	Indicates the Policy Map Class Configuration mode prompt.

Assigning a Policy Map to a Port

A policy map can be applied to one or more ports. Please note that AT-FS970M switches accept only one policy map per each port.

You assign a policy map to a port with the SERVICE-POLICY INPUT command. For more information about this command, see "SERVICE-POLICY INPUT" on page 1795.

The following example assigns policy map "pmap1" to port 5:

Table 228. Assigning a Class a Policy Map to a Port

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# interface port1.0.5`	Enters the Interface Configuration mode for port 5.
`awplus(config-if)# service-policy input pmap1`	Assigns the policy map "pmap1" to port 5.

Configuring Default Class Maps

Each time you create a new policy map, a new class map called *default* is created automatically and assigned to the policy map. A default class map enables you to specify the action that applies to all unclassified traffic within a policy map. This unclassified traffic is comprised of all traffic within a policy-map that is independent of the class maps within a policy map.

Using default class maps simplifies QoS configuration. First, specify what you want to filter in the class maps. Then, configure the default class map with one of the following settings:

- Permit unspecified traffic. This is the default setting.
- Deny unspecified traffic.
- Copy unspecified traffic to the mirrored port.

You configure the default action of the default class map with the DEFAULT-ACTION command. For more information about this command, see “DEFAULT-ACTION” on page 1738.

The following example sets the action of the default class map to deny packets of unclassified data within a policy map.

Table 229. Creating a Default Class Map

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# policy-map pmap1`	Creates a policy map “pmap1” and enters the Policy Map Configuration mode.
`awplus(config-pmap)# default-action deny`	Specifies all unclassified data is denied.

Prioritizing CoS and DSCP

By default, the DSCP field in Layer 3 packets and the CoS field in Layer 2 frames are ignored by the software. In addition, Trust CoS is enabled by default. To map a DSCP value to a queue on an egress port, use the TRUST DSCP command, which is located in the Class Map mode. See Table 230 and Table 231 for the default mappings. As you can see from the tables, the highest egress queue is seven, which is assigned the highest, CoS or DSCP, value.

Table 230. CoS Default Mapping

Egress Queue	CoS Value
2	0
0	1
1	2
3	3
4	4
5	5
6	6
7	7

Table 231. DSCP Default Mapping

Egress Queue	DSCP Value
0	0 - 7
1	8 - 15
2	16 - 23
3	24 - 31
4	32 - 39
5	40 - 47
6	48 - 55
7	56 - 63

Allied Telesis recommends using the default mappings listed in Table 230 on page 1691 and Table 231, “DSCP Default Mapping” on page 1691. However, you can change them using the MLS QOS MAP COS-QUEUE or MLS QOS MAP DSCP-QUEUE commands. For more information about these commands, see “MLS QOS MAP COS-QUEUE” on page 1768 or “MLS QOS MAP DSCP-QUEUE” on page 1770.

When you set a port to trust DSCP frames, the CoS value in the VLAN tag field is remarked. This occurs only if the egress port is tagged. For example, using the default DSCP settings in Table 231 on page 1691, a trust DSCP value of 46 on the ingress port causes it to egress on queue 5. As a result, the CoS frame will be remarked to 5. This switch behavior exists so a packet carries both Layer 2 CoS packets and Layer 3 DSCP frames as it is passed downstream through the network.

Note
If the frame is not set to egress as a tagged frame, the CoS value is not an issue, because in this case, the entire VLAN tag is stripped off the frame.

The procedure to enable DSCP frames is provided below. For more information about these commands, see “TRUST DSCP” on page 1810.

This example enables the DSCP-queue map lookup for prioritization by setting TRUST DSCP within a policy map named “pmap1” and a class map named “cmap1:”

Table 232. Enabling the Premark-DSCP Map Lookup

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# policy-map pmap1`	Creates a policy map “pmap1” and enters the Policy Map Configuration mode.
`awplus(config-pmap)# class cmap1`	Associates an existing class map “cmap1” to the policy map and enters the Policy Map Class Configuration mode.
`awplus(config-pmap-c)# trust dscp`	Enables DSCP-queue map lookup within policy map “pmap1” for prioritization.

Creating Single-rate and Twin-rate Policers

A policer can be used to meter the traffic classified by a class map and, as a result, non-conforming traffic is given a red bandwidth class:

There are two types of policers, single-rate and twin-rate. A single-rate policer allows you to determine the following:

- Committed Information Rate (CIR)
- Committed burst size (CBS)
- Excess Burst Size (EBS)

A twin-rate policer allows you to determine the CIR and CBS as well as two additional values:

- CIR
- CBS
- Peak Information Rate (PIR)
- Peak Burst Size (PBS)

If traffic does not conform to the conditions set in the command, both the single-rate and twin-rate policer can either drop or remark traffic. There are two commands that allow you create policers, POLICE SINGLE-RATE ACTION and POLICE TWIN-RATE ACTION. See Table 233.

Table 233. Single-rate and Twin-rate Policer Commands

To Do this Task	Use this Command
Sets a single-rate policer for a class-map.	`police single-rate <cir> <cbs> <ebs> action [drop-red|policed-dscp-transmit]`
Sets a twin-rate policer for a class-map.	`police twin-rate <cir> <cbs> <pir> <pbs> action [drop-red|policed-dscp-transmit]`

For more information about these commands, see "POLICE SINGLE-RATE ACTION" on page 1785 and "POLICE TWIN-RATE ACTION" on page 1787.

Creating a Single-rate Policer

The following example configures a single-rate policer requiring traffic to conform to a CIR of 10,000 Kbps, a CBS of 14,000 bytes, and an Excess burst size of 20,000 bytes. This policer drops traffic that does not conform to the set conditions.

Table 234. Configuring a Single-rate Policer

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# policy-map pmap2`	Creates a policy map “pmap2” and enters the Policy Map Configuration mode.
`awplus(config-pmap)# class cmap3`	Associates an existing class map “cmap3” to the policy map and enters the Policy Map Class Configuration mode.
`awplus(config-pmap-c)# police single-rate 10000 14000 20000 action drop-red`	Configures a single-rate meter measuring traffic at 10,000 Kbps and a Committed Burst Size (CBS) of 14,000 bytes that drops traffic bursting over 20,000 bytes.

Creating a Twin-rate Policer

The following example configures a twin-rate policer requiring traffic to conform to a CIR of 10,000 Kbps, a PIR of 20,000 Kbps, a CBS of 30,000 bytes, and a PBS of 50,000 bytes. This policer remarks traffic if it does not conform to the set conditions.

Table 235. Configuring a Twin-rate Policer

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# policy-map pmap3`	Creates a policy map “pmap3” and enters the Policy Map Configuration mode.
`awplus(config-pmap)# class cmap4`	Associates an existing class map “cmap4” to the policy map and enters the Policy Map Class Configuration mode.

Table 235. Configuring a Twin-rate Policer (Continued)

Command	Description
`awplus(config-pmap-c)# police twin-rate 10000 2000 30000 50000 action policed-dscp-transmit`	Configures a twin-rate meter requiring traffic to conform to a CIR of 10,000 Kbps, a PIR of 20,000 Kbps, a CBS of 30,000 bytes, and a PBS of 50,000 bytes.

Creating an Aggregate Policer

An aggregate policer is a named policer with an aggregate name that you can assign to multiple policy maps. You can create either a single-rate or twin-rate aggregate policer in the Policy Map Configuration mode. There are three commands that allow you to set the aggregator policer. See Table 236.

Table 236. Aggregate Policer Commands

To Do this Task	Use this Command
Configures a single-rate policer for a class-map and create a police aggregator.	`mls qos aggregate-police <name> single-rate <cir> <cbs> <ebs> action [drop-red|policed-dscp-transmit]`
Configures a twin-rate policer for a class-map.	`mls qos aggregate-police <name> twin-rate <cir> <cbs> <pir> <pbs> action [drop-red|policed-dscp-transmit]`
Associates an aggregate name with a class map.	`police aggregate name`

For more information about these commands, see:

- ❒ “MLS QOS AGGREGATE-POLICE SINGLE-RATE” on page 1759.
- ❒ “MLS QOS AGGREGATE-POLICE TWIN-RATE” on page 1762
- ❒ “POLICE AGGREGATE” on page 1783

In the following example, a single-rate aggregate policer, “policyagg1,” is created with the MLS QOS AGGREGATE-POLICE SINGLE-RATE command. Within this command, the CIR is 125 Kbps, the CBS is 30,000 bytes, and the EBS is 60,000 bytes. The action is set to policed-dscp-transmit which modifies packets using the policed-dscp map and then sends the packets. Then the aggregate policer name is associated with class maps “cmap1” and “cmap2” with the POLICE AGGREGATE command:

Table 237. Creating a Police Aggregator

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# mls qos enable`	Activates the QoS feature on the switch.

Table 237. Creating a Police Aggregator (Continued)

Command	Description
`awplus mls qos aggregate-police policyagg1 single-rate 125 30000 60000 action policed-dscp-transmit`	Creates an aggregate name called "policyagg1" with a CIR of 125 Kbps, a CBS of 30,000 bytes, an EBS of 60,000 bytes, and an action of modifying packets and then sending them.
`awplus(config)# class-map cmap1`	Creates a class map called "cmap1" and enters the Configuration Class-map mode.
`awplus(config-cmap)# match protocol ip`	Assigns the IP protocol as a matching criteria to class map "cmap1."
`awplus(config-cmap)# exit`	Exits the Configuration Class-map mode.
`awplus(config)# class-map cmap2`	Creates a class map called "cmap2" and enters the Configuration Class-map mode.
`awplus(config-cmap)# match vlan 7`	Assigns VLAN 7 to class map "cmap2" so traffic from VLAN 7 is included in this class map.
`awplus(config-cmap)# exit`	Exits the Configuration Class-map mode.
`awplus(config)# policy-map pmap1`	Creates a policy map "pmap1" and enters the Policy Map Configuration mode.
`awplus(config-pmap)# class cmap1`	Associates an existing class map "cmap1" to the policy map and enters the Policy Map Class Configuration mode.
`awplus(config-pmap-c)# exit`	Exits the Policy Map Class Configuration mode.
`awplus(config-pmap)# class cmap2`	Associates an existing class map "cmap2" to the policy map and enters the Policy Map Class Configuration mode.
`awplus(config-pmap-c)# exit`	Exits the Policy Map Class Configuration mode.
`awplus(config-pmap)# exit`	Exits the Policy Map Configuration mode.
`awplus(config)# policy-map pmap1`	Enters the Policy Map Configuration mode for a policy map "pmap1."
`awplus(config-pmap)# class cmap1`	Enters the Policy Map Class Configuration mode for a class map "cmap1."
`awplus(config-pmap-c)# police aggregate policyagg1`	Associates aggregate name "policyagg1" with class map "cmap1."
`awplus(config-pmap-c)# exit`	Exits the Policy Map Class Configuration mode.
`awplus(config-pmap)# class cmap2`	Enters the Policy Map Class Configuration mode for a class map "cmap2."

Table 237. Creating a Police Aggregator (Continued)

Command	Description
`awplus(config-pmap-c)# police aggregate policyagg1`	Associates an aggregate name “policyagg1” with class map “cmap2.”

Configuring the Egress Queues

This section discusses a port's *egress* queues, including how incoming data are classified and marked according to priority and allocated to an egress queue and, finally, how metering is applied. After the data packets have been appropriately filtered, classified, and policed, they travel across the switch's internal paths carrying their assigned QoS tag markers—DSCP, CoS, and bandwidth color. At the egress port, these markers are read and used to determine which queue each data packet is forwarded to.

There are eight egress queues allocated to each egress port. By default, all queues on all ports are serviced in strict priority order. This means that the highest numbered priority queue, queue 7, is emptied first. When queue 7 is completely empty, the next highest priority queue, queue 6, is processed. This process is continued until you reach queue 0. For a strict priority queue to be processed, all higher priority queues must be empty.

In addition, you can configure the egress queues to the Weighted Round Robin (WRR) scheduling method. With this method, you define the number of packets transmitted from each queue before going on to the next queue, so that each queue has the opportunity to transmit traffic. In most instances, you give a greater weight to the higher priority queues.

For example, if you enable the WRR method and set the number of packets transmitted from each queue to ten, the following scenario occurs. First, queue 7 transmits ten packets, and then queue 6 transmits ten packets. This is followed by queue 5 transmitting ten packets and continues to queue 0. Then the process starts over with queue 7 transmitting ten packets. This process continues until all of the packets are transmitted.

A second scenario occurs when the data packet transmitted is very small. For example, a data packet that consists of 9 packets: The first queue, in this case queue 7, is set to a weight of 15. When the 9 packets are transmitted from queue, the transmission is completed. As a result, the next data transmission is from queue 6.

The following subsections discuss how to set egress queues on a port and how to do egress queue shaping on a port:

- ❒ "Determining the Egress Queues" on page 1700
- ❒ "Egress Queue Shaping" on page 1704

Determining the Egress Queues

There are eight egress queues allocated to each egress port. The egress queue that a packet passes through is determined by whether or not the QoS feature is enabled or disabled. When the QoS feature is enabled, there are three commands that you can configure to determine which egress queue classified traffic is transmitted on. See the three commands listed in Table 238. When the QoS feature is disabled, all packets egress on queue 2 by default.

Table 238. Egress Queue Commands

To Do this Task	Use this Command
Maps the CoS value to port egress queues. (This method requires the TRUST COS command.)	`mls qos map cos-queue cos_`*`priority`* `<0-7> to` *`egress_queue`* `<0-7>`
Maps the DSCP value to port egress queues. (This method requires the TRUST DSCP command.)	`mls qos map dscp-queue` *`dscp_priority`* `to` *`egress_queue`*
Determines which egress queue the classified traffic is transmitted on.	`set queue <0-7>`

For more information about these commands, see:

- “MLS QOS MAP COS-QUEUE” on page 1768
- “MLS QOS MAP DSCP-QUEUE” on page 1770
- “SET QUEUE” on page 1793

Note
You cannot set the SET QUEUE command and the SET COS command as policy map actions for the same class map.

The following example sets ingress traffic with a CoS value of 5 to egress on queue 7 of port 8:

Table 239. Setting Egress CoS Queues Example

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus(config)# class-map trustcos`	Creates a class map called "trustcos" and enters the Class Map mode.
`awplus(config-cmap)# exit`	Exits the Class Map mode.
`awplus(config)# policy-map pmap1`	Creates a policy map called "pmap1."
`awplus(config-pmap)# class trustcos`	Adds class map "trustcos" to policy map "pmap1."
`awplus(config-pmap-c)# exit`	Exits the Policy Map Class mode.
`awplus(config-pmap)# exit`	Exits the Policy Map mode.
`awplus(config)# interface port1.0.8`	Enters the Port Interface mode for port 8.
`awplus(config-if)# service-policy input pmap1`	Attaches policy map "pmap1" to port 8.
`awplus(config-if)# mls qos map cos-queue 5 to 7`	Maps priority 5 to queue 7 on port 8.
`awplus(config-if)# end`	Exits the Port Interface mode.

`awplus# show mls qos maps cos-queue interface port 1.0.8`	Displays the CoS mapping for port 8. See below.
	`COS:01 2 34567`
	`---`
	`QUEUE:20 1 34567`

The following example sets ingress traffic with a DSCP value of 5 to egress on queue 7 of port 5:

Table 240. Setting Egress DSCP Queues Example

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus(config)# class-map trustdscp`	Creates a class map called “trustdscp” and enters the Class Map mode.
`awplus(config-cmap)# exit`	Exits the Class Map mode.
`awplus(config)# policy-map pmap1`	Creates a policy map called “pmap1.”
`awplus(config-pmap)# class trustdscp`	Adds class map “trustdscp” to policy map “pmap1.”
`awplus(config-pmap-c)# trust dscp`	Trusts DSCP value of ingress IP packets.
`awplus(config-pmap-c)# exit`	Exits the Policy Map Class mode.
`awplus(config-pmap)# exit`	Exits the Policy Map mode.
`awplus(config)# interface port1.0.5`	Enters the Port Interface mode for port 5.
`awplus(config-if)# service-policy input pmap1`	Attaches policy map “pmap1” to port 5.
`awplus(config-if)# mls qos map dscp-queue 5 to 7`	Maps priority 5 to queue 7 on port 5.
`awplus(config-if)# end`	Exits the Port Interface mode.

Table 240. Setting Egress DSCP Queues Example (Continued)

Command	Description
`awplus# show mls qos maps dscp-queue interface port 1.0.5`	Displays the DSCP mapping for port 5. See below.

```
Interface port1.0.5
DSCP-TO-QUEUE-MAP:

---------------------
Queue: 0
DSCP: 0-4, 6-7
---------------------

---------------------
Queue: 1
DSCP: 8-15
---------------------

---------------------
Queue: 2
DSCP: 16-23
---------------------

---------------------
Queue: 3
DSCP: 24-31
---------------------

---------------------
Queue: 4
DSCP: 32-39
---------------------

---------------------
Queue: 5
DSCP: 40-47
---------------------

---------------------
Queue: 6
DSCP: 48-55
---------------------

---------------------
Queue: 7
DSCP: 5, 56-63
---------------------
```

The following example uses the SET QUEUE command to set the traffic classified by class map “cmap4” to queue 6 within policy map “pmap3:”

Table 241. Using the SET QUEUE Command

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus(config)# class-map cmap4`	Creates a class map called “cmap4” and enters the Class Map mode.
`awplus(config-cmap)# exit`	Exits the Class Map mode.
`awplus(config)# policy-map pmap3`	Creates a policy map called “pmap3.”
`awplus(config-pmap)# class cmap4`	Adds class map “cmap4” to policy map “pmap3.”
`awplus(config-pmap-c)# set queue 6`	Sets traffic classified by class map “cmap4” to queue 6.

Egress Queue Shaping

In addition to setting egress port queues, you may want to configure egress queue shaping to further refine the queues. This section discusses how to set the following values on an egress queue:

- Bandwidth transmission rate
- Scheduling method
- Transmission limit

There are two commands that allow you to set egress queue shaping on a port. See Table 242.

Table 242. Egress Queue Shaping Commands

To Do this Task	Use this Command
Sets a limit on Kbits per second that are sent from the specified queue or queues.	`wrr-queue egress-rate-limit` *`bandwidth`* `queues [0|1|2|3|4|5|6|7]`
Sets the egress scheduling method on the ports to weighted round robin (WRR). In addition, this command specifies the maximum number of packets a port transmits from a queue before moving to the next queue.	`wrr-queue weight` *`<0-15>`*

Both of these commands are set on a port. For more information about these commands, see "WRR-QUEUE EGRESS-RATE-LIMIT QUEUES" on page 1812 and "WRR-QUEUE WEIGHT" on page 1814.

The following example sets the egress rate limiting on queues 2, 3, and 4 to 700 Kbits/second and sets the scheduling method to Weighted Round Robin. In addition, weights of 15, 14, 13, 12, 11, 10, 9, and 8 are set for queues 0, 1, 2, 3, 4, 5, 6, and 7 (respectively) on port 17:

Table 243. Setting Egress Queue Shaping

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus(config)# interface port1.0.17`	Enters the Interface mode for port 17.
`awplus(config-if)# wrr-queue egress-rate-limit 700 queues 2,3,4`	Sets the egress rate limiting on queues 2, 3, and 4 to 700 Kbits/second for port 17.

Table 243. Setting Egress Queue Shaping (Continued)

Command	Description

`awplus(config-if)# wrr-queue weight 15,14,13,12,11,10,9,8`	Sets port 17 to the Weighted Round Robin scheduling method with the new weights as displayed by the SHOW MLS QOS INTERFACE command.
	`COS:  0`
	`Queue:  2`
	`Number of Egress queues: 8`
	`Egress Queue: 0`
	`Scheduler: Weighted Round Robin`
	`Weight: 15`
	`Egress Queue: 1`
	`Scheduler: Weighted Round Robin`
	`Weight: 14`
	`Egress Queue: 2`
	`Scheduler: Weighted Round Robin`
	`Weight: 13`
	`Egress Queue: 3`
	`Scheduler: Weighted Round Robin`
	`Weight: 12`
	`Egress Queue: 4`
	`Scheduler: Weighted Round Robin`
	`Weight: 11`
	`Egress Queue: 5`
	`Scheduler: Weighted Round Robin`
	`Weight: 10`
	`Egress Queue: 6`
	`Scheduler: Weighted Round Robin`
	`Weight: 9`
	`Egress Queue: 7`
	`Scheduler: Weighted Round Robin`
	`Weight: 8`

Enabling Auto-QoS Support on the Switch

Note
QoS and LLDP must be manually enabled globally before the Auto-QoS macro can be run. Once QoS is enabled globally, the switch will automatically trust CoS, unless you specify trust DSCP.

Auto-QoS is an intelligent macro that permits you to enter one command that enables all the appropriate features for the recommended QoS settings on edge and uplink ports. There are two types of Auto-QoS scenarios: without LLDP-MED phone-port support and with LLDP-MED phone-port support. You configure the Auto-QoS scenarios on a port.

Before configuring Auto QoS, Allied Telesis recommends that there are no voice VLAN or QoS settings on the switch. These settings may interfere with the commands automatically generated when enabling the Auto-QoS macros. For information about the voice VLAN commands, see Chapter 70, "Voice VLAN Commands" on page 1055. However, both Auto-QoS configuration and manual QoS configuration can coexist on the switch, as long as their settings do not conflict.

Note
The term *manual QoS configuration* refers to entering the QoS commands individually at the command line.

See Table 244 for the list of the two commands that allow you to configure the Auto-QoS macros.

Table 244. Auto QoS Commands

To Do this Task	Use this Command
Enable Auto-QoS support for a voice VLAN for a non-LLDP-MED phone port and optionally specify to trust DSCP, instead of CoS, ingress traffic on the switch.	`auto-qos [voice <VLANID> | trust dscp]`
Enable Auto-QoS-MED support for a voice VLAN for a LLDP-MED phone port and optionally specify to trust DSCP, instead of CoS, ingress traffic on the switch.	`auto-qos-med [voice <VLANID> | trust dscp]`

For examples of these commands, see the following sections:

- "Auto-QoS Macro Examples" on page 1708
- "Auto-QoS-MED Macro Examples" on page 1713

Auto-QoS Macro Examples

You can use the AUTO-QOS command to support a voice VLAN and optionally specify to trust DSCP ingress traffic on the switch. In addition, you can set this command to optionally specify to trust DSCP ingress traffic on the switch without assigning a voice VLAN to the switch.

With the AUTO-QOS command, you can create the following scenarios:

- “Auto-QoS Functionality and Voice VLAN Support” on page 1708
- “Auto-QoS with Trust DSCP Functionality and Voice VLAN Support” on page 1710
- “Auto-QoS Functionality” on page 1711
- “Auto-QoS with Trust DSCP Functionality” on page 1712

For more information about this command, see “AUTO-QOS” on page 1731.

Note
Unlike the other procedures in this chapter, the Auto-QoS examples provide a list of commands, but do not include all of the commands that allow you to go from one command mode to another. The commands listed in the following example are executed in the background and may not be seen in the running configuration file.

Auto-QoS Functionality and Voice VLAN Support

In the following example, VLAN 100 becomes the voice VLAN on port 1:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# auto-qos voice 100
```

See Table 245 for a list of commands that are contained in this macro.

Table 245. Auto-QoS Functionality and Voice VLAN Support Example

Command	Description
`awplus (config-vlan) # vlan 100`	Creates a VLAN with a VID of 100.
`awplus (config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus (config)# class-map trustcos`	Creates a class map called “trustcos.”
`awplus (config)# policy-map AutoQos`	Creates a policy map called AutoQoS and enters the Policy Map Configuration mode.
`awplus (config-pmap)# class trustcos`	Enters the “trustcos” class map.

Table 245. Auto-QoS Functionality and Voice VLAN Support Example (Continued)

Command	Description
`awplus (config)# mls qos map cos-queue 0 to 1`	Maps CoS priority 0 to egress queue 1.
`awplus (config)# mls qos map cos-queue 1 to 1`	Maps CoS priority 1 to egress queue 1.
`awplus (config)# mls qos map cos-queue 2 to 1`	Maps CoS priority 2 to egress queue 1.
`awplus (config)# mls qos map cos-queue 4 to 1`	Maps CoS priority 4 to egress queue 1.
`awplus (config)# mls qos map cos-queue 3 to 5`	Maps CoS priority 3 to egress queue 5.
`awplus (config)# mls qos map cos-queue 6 to 5`	Maps CoS priority 6 to egress queue 5.
`awplus (config)# mls qos map cos-queue 7 to 5`	Maps CoS priority 7 to egress queue 5.
`awplus (config)# mls qos map cos-queue 5 to 7`	Maps CoS priority 5 to egress queue 7.
`awplus (config-if)# wrr-queue weight 3,3,1,1,2,0,0,0`	Assigns a weight to the eight default CoS queues where weight specifies the number of packets a port transmits from a queue before going to the next queue. By default, the CoS queues start with queue 0. CoS queues 0 and 1 are assigned a weight of 3. CoS queues 2 and 3 are assigned a weight of 1. CoS queue 4 is assigned a weight of 2. CoS queues 5 through 7 are assigned a weight of 0.
`awplus (config-if)# service-policy input AutoQos`	Associates policy map "AutoQoS" to the given port number.
`awplus (config-if)# switchport voice vlan 100`	Sets given port number as a tagged member of voice VLAN 100.

Auto-QoS with Trust DSCP Functionality and Voice VLAN Support

In the following example, VLAN 100 becomes the voice VLAN and DSCP is specified as the trusted-traffic type on port 1:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# auto-qos voice 100 trust dscp
```

See Table 246 for a list of commands that are contained in this macro.

Table 246. Auto-QoS with Trust DSCP Functionality and Voice VLAN Support Example

Command	Description
`awplus (config-vlan) # vlan 100`	Creates a VLAN with a VID of 100.
`awplus (config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus (config)# class-map trustdscp`	Creates a class map called “trustdscp.”
`awplus (config)# policy-map AutoQos`	Creates a policy map called AutoQoS and enters the Policy Map Configuration mode.
`awplus (config-pmap)# class trustdscp`	Enters the “trustdscp” class map.
`awplus (config-if)# trust dscp`	Enables class map “trustdscp” to trust DSCP ingress IP packet header for prioritization.
`awplus (config-if)# wrr-queue weight 3,3,1,1,12,0,0,0`	Assigns a weight to the eight default CoS queues where weight specifies the number of packets a port transmits from a queue before going to the next queue. By default, the CoS queues start with queue 0. CoS queues 0 and 1 are assigned a weight of 3. CoS queues 2 and 3 are assigned a weight of 1. CoS queue 4 is assigned a weight of 12. CoS queues 5 through 7 are assigned a weight of 0.
`awplus (config-if)# service-policy input AutoQos`	Associates policy map “AutoQoS” with the given port number. In this example, it is port 1.
`awplus (config-if)# switchport voice vlan 100`	Sets the given port number as a tagged member of voice VLAN 100.

Auto-QoS Functionality

In the following example, the CoS value of ingress traffic is trusted:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# auto-qos trust cos
```

See Table 247 for a list of commands that are contained in this macro.

Table 247. Auto-QoS with Trust CoS Functionality Example

Command	Description
`awplus (config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus (config)# class-map trustcos`	Creates a class map called "trustcos."
`awplus (config)# policy-map AutoQos`	Creates a policy map called "AutoQoS" and enters the Policy Map Configuration mode.
`awplus (config-pmap)# class trustcos`	Enters the "trustcos" class map.
`awplus (config)# mls qos map cos-queue 0 to 1`	Maps CoS priority 0 to egress queue 1.
`awplus (config)# mls qos map cos-queue 1 to 1`	Maps CoS priority 1 to egress queue 1.
`awplus (config)# mls qos map cos-queue 2 to 1`	Maps CoS priority 2 to egress queue 1.
`awplus (config)# mls qos map cos-queue 4 to 1`	Maps CoS priority 4 to egress queue 1.
`awplus (config)# mls qos map cos-queue 3 to 5`	Maps CoS priority 3 to egress queue 5.
`awplus (config)# mls qos map cos-queue 6 to 5`	Maps CoS priority 6 to egress queue 5.
`awplus (config)# mls qos map cos-queue 7 to 5`	Maps CoS priority 7 to egress queue 5.
`awplus (config)# mls qos map cos-queue 5 to 7`	Maps CoS priority 5 to egress queue 7.

Table 247. Auto-QoS with Trust CoS Functionality Example (Continued)

Command	Description
`awplus (config-if)# wrr-queue weight 3,3,1,1,12,0,0,0`	Assigns a weight to the eight default CoS queues where weight specifies the number of packets a port transmits from a queue before going to the next queue. By default, the CoS queues start with queue 0. CoS queues 0 and 1 are assigned a weight of 3. CoS queues 2 and 3 are assigned a weight of 1. CoS queue 4 is assigned a weight of 12. CoS queues 5 through 7 are assigned a weight of 0.
`awplus (config-if)# service-policy input AutoQos`	Associates policy map “AutoQoS” with the given port which in this example is port 1.

Auto-QoS with Trust DSCP Functionality

In the following example, VLAN 100 becomes the voice VLAN, and trust DSCP ingress traffic is specified:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# auto-qos trust dscp
```

See Table 248 for a list of commands that are contained in this macro.

Table 248. Auto-QoS Trust DSCP Functionality Example

Command	Description
`awplus (config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus (config)# class-map trustdscp`	Creates a class map called “trustdscp.”
`awplus (config)# policy-map AutoQos`	Creates a policy map called AutoQoS and enters the Policy Map Configuration mode.
`awplus (config-pmap)# class trustdscp`	Enters the “trustdscp” class map.
`awplus (config-pmap-c)# trust dscp`	Enables class map “trustdscp” to trust DSCP ingress IP packet headers for prioritization.

Table 248. Auto-QoS Trust DSCP Functionality Example (Continued)

Command	Description
`awplus (config-if)# wrr-queue weight 3,3,1,1,2,0,0,0`	Assigns a weight to the eight default DSCP queues where weight specifies the number of packets a port transmits from a queue before going to the next queue. By default, the DSCP queues start with queue 0. DSCP queues 0 and 1 are assigned a weight of 3. DSCP queues 2 and 3 are assigned a weight of 1. DSCP queue 4 is assigned a weight of 2. DSCP queues 5 through 7 are assigned a weight of 0.
`awplus (config-if)# service-policy input autoqos`	Associates policy map "AutoQoS" with the given port which, in this case, is port 1.

Auto-QoS-MED Macro Examples

Note
LLDP must be enabled globally before Auto-QoS-MED configuration.

Link Layer Discovery Protocol (LLDP) and Link Layer Discovery Protocol for Media Endpoint Devices (LLDP-MED) allow Ethernet network devices, such as switches and routers, to receive and transmit device-related information to directly-connected devices. LLDP-MED is used between a LAN network connectivity device, such the AT-FS970M switch, and media endpoint device, such as an IP phone. For more information about LLDP-MED, see Chapter 80, "LLDP and LLDP-MED" on page 1255.

You can use the AUTO-QOS-MED command to support a voice VLAN and optionally specify to trust DSCP (instead of CoS) ingress traffic on a port. This command also enables LLDP-MED support. In addition, you can set the AUTO-QOS-MED command to specify the type of trusted traffic without assigning a voice VLAN to the switch.

With the AUTO-QOS-MED command, you can create the following scenarios:

- "Auto-QoS-MED Functionality and Voice VLAN Support" on page 1714
- "Auto-QoS-MED with Trust DSCP Functionality and Voice VLAN Support" on page 1715
- "Auto-QoS Functionality" on page 1711
- "Auto-QoS with Trust DSCP Functionality" on page 1712

For more information about this command, see "AUTO-QOS-MED" on page 1733.

Note
Unlike the other procedures in this chapter, the Auto-QoS-MED examples provide a list of commands, but do not include all of the commands that allow you to go from one command mode to another. The commands listed in the following example are executed in the background and may not be seen in the running configuration file.

Auto-QoS-MED Functionality and Voice VLAN Support

In the following example, VLAN 100 becomes the voice VLAN:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# auto-qos-med voice 100
```

See Table 249 for a list of commands that are contained in this macro.

Table 249. Auto-QoS MED Functionality and Voice VLAN Support Example

Command	Description
`awplus (config-vlan) # vlan 100`	Creates a VLAN with a VID of 100.
`awplus (config) # lldp run`	Activates LLDP on the switch which allows the switch to transmit and accept LLDP advertisements on its ports.
`awplus (config-if)# switchport voice vlan 100`	Sets port 1 as a tagged member of voice VLAN 100.
`awplus (config-if)# switchport voice dscp 46`	Assigns the DSCP value of 46 to port 1.
`awplus (config-if)# switchport voice vlan priority 5`	Assigns the CoS priority value of 5 to port 1. The port transmits this value in the LLDP-MED network policy TLV to an IP phone which, in turn, sends its packets using this CoS value.
`awplus (config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus (config)# class-map trustcos`	Creates a class map called “trustcos.”
`awplus (config)# policy-map AutoQos`	Creates a policy map called AutoQoS and enters the Policy Map Configuration mode.
`awplus (config-pmap)# class trustcos`	Enters the “trustcos” class map.
`awplus (config)# mls qos map cos-queue 0 to 1`	Maps CoS priority 0 to egress queue 1.

Table 249. Auto-QoS MED Functionality and Voice VLAN Support Example (Continued)

Command	Description
`awplus (config)# mls qos map cos-queue 1 to 1`	Maps CoS priority 1 to egress queue 1.
`awplus (config)# mls qos map cos-queue 2 to 1`	Maps CoS priority 2 to egress queue 1.
`awplus (config)# mls qos map cos-queue 4 to 1`	Maps CoS priority 4 to egress queue 1.
`awplus (config)# mls qos map cos-queue 3 to 5`	Maps CoS priority 3 to egress queue 5.
`awplus (config)# mls qos map cos-queue 6 to 5`	Maps CoS priority 6 to egress queue 5.
`awplus (config)# mls qos map cos-queue 7 to 5`	Maps CoS priority 7 to egress queue 5.
`awplus (config)# mls qos map cos-queue 5 to 7`	Maps CoS priority 5 to egress queue 7.
`awplus (config-if)# wrr-queue weight 3,3,1,1,12,0,0,0`	Assigns a weight to the eight default CoS queues where weight specifies the number of packets a port transmits from a queue before going to the next queue. By default, the CoS queues start with queue 0. CoS queues 0 and 1 are assigned a weight of 3. CoS queues 2 and 3 are assigned a weight of 1. CoS queue 4 is assigned a weight of 12. CoS queues 5 through 7 are assigned a weight of 0.
`awplus (config-if)# service-policy input AutoQos`	Associates policy map "AutoQoS" with the given port number. In this example, it is port 1.

Auto-QoS-MED with Trust DSCP Functionality and Voice VLAN Support

In the following example, VLAN 100 becomes the voice VLAN, and DSCP is the trusted-traffic type:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# auto-qos-med voice 100 trust dscp
```

See Table 250 on page 1716 for a list of commands that are contained in this macro.

Table 250. Auto-QoS MED with Trust DSCP Functionality & Voice VLAN Support Example

Command	Description
`awplus (config-vlan) # vlan 100`	Creates a VLAN with a VID of 100.
`awplus (config) # lldp run`	Activates LLDP on the switch which allows the switch to transmit and accept LLDP advertisements on its ports.
`awplus (config-if)# switchport voice vlan 100`	Sets port 1 as a tagged member of voice VLAN 100.
`awplus (config-if)# switchport voice dscp 46`	Assigns the DSCP value of 46 to LLDP-MED network policy.
`awplus (config-if)# switchport voice vlan priority 5`	Assigns the DSCP priority value of 5 to port 1. The port transmits this value in the LLDP-MED network policy TLV to an IP phone which, in turn, sends its packets using this CoS value.
`awplus (config) # mls qos enable`	Enables the QoS feature on the switch.
`awplus (config)# class-map trustdscp`	Creates a class map called “trustdscp.”
`awplus (config)# policy-map AutoQos`	Creates a policy map called AutoQoS and enters the Policy Map Configuration mode.
`awplus (config-pmap)# class trustdscp`	Enters the “trustdscp” class map.
`awplus (config-pmap-c)# trust dscp`	Enables class map “trustdscp” to trust DSCP ingress IP packet headers for prioritization.
`awplus (config-if)# wrr-queue weight 3,3,1,1,12,0,0,0`	Assigns a weight to the eight default DSCP queues where weight specifies the number of packets a port transmits from a queue before going to the next queue. By default, the DSCP queues start with queue 0. DSCP queues 0 and 1 are assigned a weight of 3. DSCP queues 2 and 3 are assigned a weight of 1. DSCP queue 4 is assigned a weight of 12. DSCP queues 5 through 7 are assigned a weight of 0.
`awplus (config-if)# service-policy input AutoQoS`	Associates policy map “AutoQoS” with the given port. In this example, it is port 1.

Auto-QoS-MED Functionality Example

In the following example, the CoS value of ingress traffic is trusted:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# auto-qos-med trust cos
```

See Table 251 for a list of commands that are contained in this macro.

Table 251. Auto-QoS-MED Traffic Example

Command	Description
`awplus (config)# lldp run`	Activates LLDP on the switch which allows the switch to transmit and accept advertisements on its ports.
`awplus (config-if)# switchport voice dscp 46`	Assigns the DSCP value of 46 to the LLDP-MED network policy.
`awplus (config-if)# switchport voice vlan priority 5`	Assigns the CoS priority value of 5 to the given port. The port transmits this value in the LLDP-MED network policy TLV to an IP phone which, in turn, sends its packets using this CoS value.
`awplus (config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus (config)# class-map trustcos`	Creates a class map called "trustcos."
`awplus (config)# policy-map AutoQos`	Creates a policy map called "AutoQoS" and enters the Policy Map Configuration mode.
`awplus (config-pmap)# class trustcos`	Enters the "trustcos" class map.
`awplus (config)# mls qos map cos-queue 0 to 1`	Maps CoS priority 0 to egress queue 1.
`awplus (config)# mls qos map cos-queue 1 to 1`	Maps CoS priority 1 to egress queue 1.
`awplus (config)# mls qos map cos-queue 2 to 1`	Maps CoS priority 2 to egress queue 1.
`awplus (config)# mls qos map cos-queue 4 to 1`	Maps CoS priority 4 to egress queue 1.
`awplus (config)# mls qos map cos-queue 3 to 5`	Maps CoS priority 3 to egress queue 5.
`awplus (config)# mls qos map cos-queue 6 to 5`	Maps CoS priority 6 to egress queue 5.
`awplus (config)# mls qos map cos-queue 7 to 5`	Maps CoS priority 7 to egress queue 5.

Table 251. Auto-QoS-MED Traffic Example (Continued)

Command	Description
awplus (config)# mls qos map cos-queue 5 to 7	Maps CoS priority 5 to egress queue 7.
awplus (config-if)# wrr-queue weight 3,3,1,1,12,0,0,0	Assigns a weight to the eight default CoS queues where weight specifies the number of packets a port transmits from a queue before going to the next queue. By default, the CoS queues start with queue 0. CoS queues 0 and 1 are assigned a weight of 3. CoS queues 2 and 3 are assigned a weight of 1. CoS queue 4 is assigned a weight of 12. CoS queues 5 through 7 are assigned a weight of 0.
awplus (config-if)# service-policy input AutoQoS	Associates policy map “AutoQoS” with the given port which, in this example, is port 1.

Auto-QoS-MED with Trust DSCP Functionality

In the following example, the DSCP value of ingress traffic is trusted:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.1
awplus(config-if)# auto-qos-med trust dscp
```

See Table 252 for a list of commands that are contained in this macro.

Table 252. Auto-QoS MED with Trust DSCP Functionality Example

Command	Description
awplus (config)# lldp run	Activates LLDP on the switch which allows the switch to transmit and accept LLDP advertisements on its ports.
awplus (config-if)# switchport voice dscp 46	Assigns the DSCP value of 46 to the LLDP-MED network policy.
awplus (config-if)# switchport voice vlan priority 5	Assigns the DSCP priority value of 5 to the LLDP-MED network policy which transmits this value to an IP phone. The IP phone, in turn, sends its packets using this DSCP value.
awplus (config)# mls qos enable	Activates the QoS feature on the switch.
awplus (config)# class-map trustdscp	Creates a class map called “trustdscp.”
awplus (config)# policy-map AutoQos	Creates a policy map called AutoQoS and enters the Policy Map Configuration mode.

Table 252. Auto-QoS MED with Trust DSCP Functionality Example (Continued)

Command	Description
`awplus (config-pmap)# class trustdscp`	Enters the "trustdscp" class map.
`awplus (config-pmap-c)# trust dscp`	Enables the "trustdscp" class map to trust DSCP ingress packets for prioritization.
`awplus (config-if)# wrr-queue weight 3,3,1,1,12,0,0,0`	Assigns a weight to the eight default DSCP queues where weight specifies the number of packets a port transmits from a queue before going to the next queue. By default, the DSCP queues start with queue 0. DSCP queues 0 and 1 are assigned a weight of 3. DSCP queues 2 and 3 are assigned a weight of 1. DSCP queue 4 is assigned a weight of 12. DSCP queues 5 through 7 are assigned a weight of 0.
`awplus (config-if)# service-policy input AutoQoS`	Associates policy map "AutoQoS" with the given port.

Displaying QoS Settings

There are eight commands that display the QoS settings. See Table 253 for a description of these commands. The following sections provide additional descriptions of the commands, as well as examples of the displays:

Note
To display information about QoS Storm Control, see “Displaying Port Storm Status” on page 1827.

Table 253. QoS Display Commands

To Do This Task	Use This Command
Displays the status of the QoS feature.	`show mls qos`
Displays the contents of a class map when a class map name is specified. Without a class map name, it displays all class maps configured on the switch.	`show class-map` *`class-map-name`*
Displays the settings of the given policy map. Without a policy-map name, displays a list of all the QoS policy maps configured on the switch.	`show policy-map` *`policy-map-name`*
Displays all configured aggregate policers on the switch.	`show mls qos aggregate-policer` *`name`*
Displays the scheduling methods of the specified port and, for weighted round robin scheduling, the assignments of weights to egress queues.	`show mls qos interface` *`port`*

Table 253. QoS Display Commands (Continued)

To Do This Task	Use This Command
Displays the mappings of CoS priority values to egress queues of a specified port.	`show mls qos maps cos-queue`
Displays the mappings of DSCP values to egress queues of a specified port.	`show mls qos maps dscp-queue`
Displays the mapping between the existing DSCP value and the new DSCP value.	`show mls qos maps policed-dscp` *<0-63>*

Displaying QoS Status

To display the status of the QoS feature, use the SHOW MLS QOS command at the Global Configuration mode. The command syntax is:

```
show mls qos
```

See Figure 262 for an example of this command when QoS is disabled. For more information about this command, see "SHOW MLS QOS" on page 1799.

```
Qos is disabled
```

Figure 262. SHOW MLS QOS Command

Displaying a Class Map

To display the contents of a class map, use the SHOW CLASS-MAP command in the Privileged Exec mode. Here is the command syntax followed by an example display:

```
awplus# show class-map cmap2
```

See Figure 263 for an example of this command.

```
CLASS-MAP-NAME: cmap2
   Set IP DSCP: 56
   Match IP DSCP: 7
```

Figure 263. SHOW CLASS-MAP Command

Displaying a Policy Map

To display the contents of a policy map, use the SHOW POLICY-MAP command in the Privileged Exec mode. Here is the command syntax followed by an example display.

This example displays the settings of a policy map called “pmap4:'

```
awplus# show policy-map pmap4
```

```
POLICY-MAP-NAME: pmap4
   Description: video traffic
   State: attached
   Default class-map action: permit
   CLASS-MAP-NAME: cmap1
   CLASS-MAP-NAME: default
```

Figure 264. SHOW POLICY-MAP command

Displaying Aggregate Policers

To display the settings of configured aggregate policers configured on the switch, use the SHOW MLS QOS AGGREGATE-POLICER command in the Privileged Exec mode. For a full command description, see “SHOW MLS QOS AGGREGRATE-POLICER” on page 1800.

This example displays the contents of the aggregate policer, called ap2:

```
awplus# show mls qos aggregate-policer ap2
```

```
AGGREGATE-POLICER-NAME: ap2
   Policer single-rate action drop-red:
      average rate (125 kbps) minimum burst (12000 B) maximum burst (17000 B)
```

Figure 265. SHOW MLS QOS AGGREGATE-POLICER Command

Displaying QoS Scheduling Information

To display the scheduling methods of a port, use the SHOW MLS QOS INTERFACE command. In addition, the assignments of weights to egress queues for weighted round robin scheduling are displayed. The command syntax is:

```
show mls qos interface port
```

Figure 266 on page 1723 provides an example of a port set to strict priority.

```
Default CoS:   0
Default Queue: 2
Number of egress queues: 8
Egress Queue:       0
   Scheduler:       Strict Priority
   Weight:          N/A
Egress Queue:       1
   Scheduler:       Strict Priority
   Weight:          N/A
Egress Queue:       2
   Scheduler:       Strict Priority
   Weight:          N/A
Egress Queue:       3
   Scheduler:       Strict Priority
   Weight:          N/A
Egress Queue:       4
   Scheduler:       Strict Priority
   Weight:          N/A
Egress Queue:       5
   Scheduler:       Strict Priority
   Weight:          N/A
Egress Queue:       6
   Scheduler:       Strict Priority
   Weight:          N/A
Egress Queue:       7
   Scheduler:       Strict Priority
   Weight:          N/A
```

Figure 266. SHOW MLS QOS INTERFACE Command— Strict Priority

Displaying CoS to Queue Mappings

To display the mappings of CoS values to egress queues, use the SHOW MLS QOS MAPS COS-QUEUE command. The syntax of the command is:

```
show mls qos maps cos-queue
```

See Figure 267 for an example of this command.

```
COS-TO-QUEUE-MAP:
   COS:     0 1 2 3 4 5 6 7
----------------------------
   QUEUE:   2 0 1 3 4 5 6 7
```

Figure 267. SHOW MLS QOS MAPS COS-QUEUE Command

The CoS values in the first line are matched with the egress queue assignments in the second line. For example, in Figure 267 on page 1723, port 1 packets with a CoS value of 0 are placed in egress queue 2, packets with a CoS value of 1 are placed in egress queue 0, and so on.

For more information about this command, see “SHOW MLS QOS MAPS COS-QUEUE” on page 1805.

Displaying DSCP to Queue Mappings

Use this command to display the mappings of DSCP values to egress queues. The syntax of this command is:

```
show mls qos maps dscp-queue
```

See Figure 268 on page 1725 for an example of this information. For more information about this command, see “SHOW MLS QOS MAPS DSCP-QUEUE” on page 1806.

```
DSCP-TO-QUEUE-MAP:

---------------------
Queue: 0
DSCP: 0-7
---------------------

---------------------
Queue: 1
DSCP: 8-15
---------------------

---------------------
Queue: 2
DSCP: 16-23
---------------------

---------------------
Queue: 3
DSCP: 24-31
---------------------

---------------------
Queue: 4
DSCP: 32-39
---------------------

---------------------
Queue: 5
DSCP: 40-47
---------------------

---------------------
Queue: 6
DSCP: 48-55
---------------------

---------------------
Queue: 7
DSCP: 56-63
---------------------
```

Figure 268. SHOW MLS QOS MAPS DSCP-QUEUE Command

Displaying DSCP to Policed-DSCP Values

To display the mapping between the existing DSCP value and the new DSCP value, use the SHOW MLS QOS MAPS POLICED-DSCP command. You can configure this mapping with the MLS QOS MAPS POLICED-DSCP command. (For more information about this command, see "MLS QOS MAP POLICED-DSCP" on page 1772.)

The syntax of the SHOW MLS QOS MAPS POLICED-DSCP command is:

```
show mls qos maps policed-dscp <0-63>
```

See Figure 269 for an example display of the SHOW MLS QOS MAPS POLICED-DSCP command. For more information about this command, see “SHOW MLS QOS MAPS POLICED-DSCP” on page 1809.

```
POLICED-DSCP-MAP:
   DSCP 5
-----------------
   New DSCP 7
```

Figure 269. SHOW MLS QOS MAPS POLICED-DSCP Command

Chapter 103
QoS Commands

The Quality of Service (QoS) commands are summarized in Table 254 and described in detail in this chapter.

Table 254. Quality of Service Commands

Command	Mode	Description
“AUTO-QOS” on page 1731	Interface Configuration	Enables Auto-QoS support for a voice VLAN and specifies CoS or DSCP trusted traffic.
“AUTO-QOS-MED” on page 1733	Global Configuration	Enables Auto-QoS-MED support for a voice VLAN and specifies CoS or DSCP trusted traffic.
“CLASS” on page 1735	Policy Map Configuration	Associates an existing class map to a policy map and enters the Policy Map Class Configuration mode.
“CLASS-MAP” on page 1737	Global Configuration	Creates a class map and enters the Configuration Class Map mode.
“DEFAULT-ACTION” on page 1738	Policy Map	Sets the action for the default class map belonging to a particular policy map.
“DESCRIPTION (Policy Map)” on page 1740	Policy Map	Adds a description of the policy map.
“MATCH ACCESS-GROUP” on page 1742	Class Map	Defines a group name as a match criterion for a class map.
“MATCH COS” on page 1745	Class Map	Sets the Class of Service (CoS) for a class map to match with.
“MATCH DSCP” on page 1747	Class Map	Defines DSCP to match incoming packets.
“MATCH IP-PRECEDENCE” on page 1748	Class Map	Identifies IP precedence values as match criteria.
“MATCH MAC-TYPE” on page 1749	Class Map	Sets the MAC type for a class map.
“MATCH PROTOCOL” on page 1751	Class Map	Sets the Ethernet format and protocol for a class map.

Table 254. Quality of Service Commands (Continued)

Command	Mode	Description
“MATCH TCP-FLAGS” on page 1756	Class Map	Sets one or more TCP flags for a class map.
“MATCH VLAN” on page 1758	Class Map	Sets a VLAN ID for a class map.
“MLS QOS AGGREGATE-POLICE SINGLE-RATE” on page 1759	Policy Map Class mode	Configures a single-rate policer for a class map and creates a police aggregator.
“MLS QOS AGGREGATE-POLICE TWIN-RATE” on page 1762	Policy Map Class mode	Configures a twin-rate policer for a class map and creates a police aggregator.
“MLS QOS COS” on page 1765	Interface Configuration	Assigns a Class of Service (CoS) user-priority value to untagged frames that enter the specified interface.
“MLS QOS ENABLE” on page 1767	Global Configuration	Activates QoS on the switch. This feature is disabled by default.
“MLS QOS MAP COS-QUEUE” on page 1768	Global Configuration	Maps CoS priorities to egress queues.
“MLS QOS MAP DSCP-QUEUE” on page 1770	Global Configuration	Maps DSCP priorities to egress queues.
“MLS QOS MAP POLICED-DSCP” on page 1772	Global Configuration	Maps an existing DSCP to a new DSCP value.
“NO AUTO-QOS VOICE | TRUST DSCP” on page 1774	Interface Configuration	Disables Auto-QoS support for a voice VLAN and specifies CoS or DSCP trusted traffic.
“NO MATCH ACCESS-GROUP” on page 1776	Class Map Mode	Removes an ACL name or number from a class map.
“NO MATCH PROTOCOL” on page 1778	Class Map Mode	Removes an Ethernet format and a protocol from a class map.
“NO MLS QOS AGGREGATE-POLICE” on page 1780	Global Configuration	Removes an association between a police aggregator and a class map.
“NO MLS QOS ENABLE” on page 1781	Global Configuration	Disables QoS on the switch.
“NO POLICE AGGREGATE” on page 1782	Policy Map Class	Disables a policer configured on a class map.
“POLICE AGGREGATE” on page 1783	Policy Map Class	Associates an aggregate name with a class map.

Table 254. Quality of Service Commands (Continued)

Command	Mode	Description
"POLICE SINGLE-RATE ACTION" on page 1785	Policy Map Class	Configures a single-rate policer for a class map.
"POLICE TWIN-RATE ACTION" on page 1787	Policy Map Class	Create a twin-rate policer for a class map.
"POLICY-MAP" on page 1789	Global Configuration	Creates a policy map and enters the Policy Map Configuration mode.
"SET COS" on page 1790	Policy Map Class	Sets the CoS value of classified traffic.
"SET DSCP" on page 1792	Policy Map Class	Sets the DSCP value of classified traffic.
"SET QUEUE" on page 1793	Policy Map Class	Sets the egress queue of the classified traffic.
"SERVICE-POLICY INPUT" on page 1795	Interface Configuration	Associates a policy map with an interface.
"SHOW CLASS-MAP" on page 1796	User Exec and Privileged Exec	Displays a QoS class map.
"SHOW POLICY-MAP" on page 1797	User Exec and Privileged Exec	Displays a Policy map.
"SHOW MLS QOS" on page 1799	Privileged Exec	Displays the status of QoS.
"SHOW MLS QOS AGGREGRATE-POLICER" on page 1800	Privileged Exec	Displays the aggregate policers assigned on the switch.
"SHOW MLS QOS INTERFACE" on page 1802	Privileged Exec	Displays the scheduling methods of the ports, and for Weighted Round-Robin (WRR) based scheduling, the assignments of weights to egress queues.
"SHOW MLS QOS MAPS COS-QUEUE" on page 1805	Privileged Exec	Displays the mappings of CoS priority values to egress queues.
"SHOW MLS QOS MAPS DSCP-QUEUE" on page 1806	Privileged Exec	Displays the mappings of DSCP priority values to port egress queues.
"SHOW MLS QOS MAPS POLICED-DSCP" on page 1809	Privileged Exec	Displays the mappings of an existing DSCP to a new DSCP value.
"TRUST DSCP" on page 1810	Policy Map Class	Enables the pre-mark DSCP map to replace the bandwidth class, DSCP, and queue of classified traffic.

Table 254. Quality of Service Commands (Continued)

Command	Mode	Description
“WRR-QUEUE EGRESS-RATE-LIMIT QUEUES” on page 1812	Interface Configuration	Sets a limit on the amount of traffic that can be transmitted from the specified queues.
“WRR-QUEUE WEIGHT” on page 1814	Interface Configuration	Configures WRR based scheduling on the specified ports.

AUTO-QOS

Syntax

```
auto-qos [voice <VLANID> |trust dscp]
```

Parameters

voice
: Specifies a VLAN ID for voice VLAN support. Enter a value between 1 and 4094.

trust dscp
: Specifies DSCP traffic is trusted.

Mode

Interface Configuration mode

Description

Use this command to enable Auto-QoS support for a voice VLAN ID and optionally specify to trust DSCP (instead of CoS) ingress traffic on a port. You can also use this command to support *either* a voice VLAN or specify to trust DSCP.

Use the no form of this command, NO AUTO-QOS VOICE | TRUST DSCP to disable Auto-QoS, remove a voice VLAN ID, and remove DSCP as trusted ingress traffic. See "NO AUTO-QOS VOICE | TRUST DSCP" on page 1774.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

In the following example, VLAN 100 becomes the voice VLAN on port 1.0.1, and CoS is trusted on traffic ingressing onto this port:

```
awplus> enable
awplus# configure terminal
awplus(config-if)# interface port1.0.1
awplus(config)# auto-qos voice 100
```

In the following example, VLAN 50 becomes the voice VLAN on port 1.0.22, and DSCP is trusted on traffic ingressing onto this port:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.22
awplus(config-if)# auto-qos voice 50 trust dscp
```

In the following example, VLAN 100 becomes the voice VLAN on port 1.0.15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.15
awplus(config-if)# auto-qos voice 100
```

In the following example, DSCP is trusted on traffic ingressing onto port 1.0.30:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.30
awplus(config-if)# auto-qos voice trust dscp
```

AUTO-QOS-MED

Syntax

```
auto-qos-med [voice <VLANID> |trust dscp]
```

Parameters

voice
: Specifies a VLAN ID for voice VLAN support. Enter a value between 1 and 4094.

trust dscp
: Specifies DSCP traffic is trusted.

Mode

Global Configuration mode

Description

Use this command to enable Auto-QoS-MED support for a voice VLAN ID and specify to optionally trust DSCP (instead of CoS) ingress traffic on a port. You can also use this command to support *either* a voice VLAN or specify to trust DSCP.

Use the no form of this command, NO AUTO-QOS VOICE | TRUST DSCP to disable Auto-QoS, remove a voice VLAN, and remove trusted DSCP traffic. See "NO AUTO-QOS VOICE | TRUST DSCP" on page 1774.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

In the following example, VLAN 100 becomes the voice VLAN on port 1.0.8, and CoS is trusted on traffic ingressing onto this port:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.8
awplus(config-if)# auto-qos-med voice 100
```

In the following example, VLAN 50 becomes the voice VLAN on port 1.0.14, and DSCP is trusted on traffic ingressing onto this port:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.14
awplus(config-if)# auto-qos-med voice 50 trust dscp
```

In the following example, VLAN 100 becomes the voice VLAN on port 1.0.13:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.13
awplus(config-if)# auto-qos-med voice 100
```

In the following example, DSCP is trusted on traffic ingressing on port 17:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17
awplus(config)# auto-qos-med voice trust dscp
```

CLASS

Syntax

```
class name|default
```

Parameters

name
Indicates the name of a class map.

default
Indicates the class-map default name.

Mode

Policy Map Configuration mode

Description

Use this command to associate an existing class map to a policy map and enter the Policy Map Class Configuration mode to configure the class map. To create a class map, see "CLASS-MAP" on page 1737.

Use the no form of this command, NO CLASS, to delete an association between a policy map and a class map.

Confirmation Commands

"SHOW POLICY-MAP" on page 1797

"SHOW RUNNING-CONFIG" on page 168

Examples

The following example creates a policy map called "pmap1," then associates a class map called "cmap5" to policy map "pmap1" and enters the Policy Map Class Configuration mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap5
awplus(config-pmap-c)#
```

To delete an association between a class map called “cmap5” and policy map called “pmap1,” do the following:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# no class cmap5
```

CLASS-MAP

Syntax

```
class-map name
```

Parameters

name
Specifies the name of a class map.

Mode

Global Configuration mode

Description

Use this command to create a class map and access the Configuration Class Map mode.

Use the no form of this command, NO CLASS-MAP, to delete a class map.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

To create a class map called "cmap1" and access the Configuration Class-map mode, do the following:

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)#
```

To delete a class map called "cmap1," do the following:

```
awplus> enable
awplus# configure terminal
awplus(config)# no class-map cmap1
```

DEFAULT-ACTION

Syntax

```
default-action permit|deny|copy-to-mirror
```

Parameters

permit
: Specifies packets are permitted. This is the default.

deny
: Specifies packets are denied.

copy-to-mirror
: Specifies packets are copied to the mirrored port.

Mode

Policy Map mode

Description

Use this command to specify the action of the default class map belonging to a particular policy map. The action for a non-default class map depends on the action configured in the policy map for that specific class map.

The default action is the action that is applied to any data that does not meet the criteria specified by the applied matching commands, such as the commands that start with MATCH, within the policy map.

Use the no form of the command, NO DEFAULT-ACTION, to reset the default action to permit.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

To set the action for the default class-map to deny, do the following:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)#default-action deny
```

To reset the action for the default class-map to permit, do the following:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# no default-action
```

DESCRIPTION (Policy Map)

Syntax

```
description line
```

Parameters

line
Specifies an 80-character description of the QoS policy map.

Mode

Policy Map mode

Description

Use this command to add a description to the specified policy map.

Use the no version of this command, NO DESCRIPTION, to remove a description from the specified policy map.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

To add a description of “VOIP traffic” to a policy map called “pmap20,” do the following:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap20
awplus(config-pmap)# description VOIP traffic
```

To add a description of “Video traffic” to a policy map called “pmap1,” do the following:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# description Video traffic
```

To remove a description from a policy map called "pmap1," do the following:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# no description
```

MATCH ACCESS-GROUP

Syntax

```
match access-group group-name|group-number
```

Parameters

group-name
Indicates a group name that was created with the IP-ACCESS LIST command.

group-number
Indicates an IPv4 group number that was created with one of the ACCESS-LIST commands. There are two ranges of group numbers:

3000 to 3699: Specifies the ID number of an access control list for a numbered IPv4 ACL.

4000 to 4699: Specifies the ID number of a numbered MAC address IPv4 ACL.

Mode

Class Map mode

Description

Use this command to add an access list as a matching criteria to a class map using an ACL group name or group number. Only IPv4 ACL access lists are supported by this command.

Note
IPv6 group names are not supported by the MATCH ACCESS-GROUP command.

Before you set the MATCH ACCESS-GROUP command, you must create an access group with either a group name or group number. You may want to consult the description in “Creating ACLs” on page 1557 for detailed information about how to assign group names and numbers. See below for the commands to create named and numbered IPv4 ACLs:

- To create a named IPv4 ACL, use “IP ACCESS-LIST” on page 1623.
- To create a numbered MAC access group, use “ACCESS-LIST (MAC Address)” on page 1600.

- To create a numbered IPv4 ACL, see the commands listed in Table 255.

Table 255. ACCESS-LIST Commands for Creating Numbered IPv4 ACLs

To Do This Task	Use This Command
Create Numbered IPv4 ACLs for ICMP packets.	"ACCESS-LIST ICMP" on page 1603
Create Numbered IPv4 ACLs for source and destination IP addresses.	"ACCESS-LIST IP" on page 1606
Create Numbered IPv4 ACLs for packets of specified protocols.	"ACCESS-LIST PROTO" on page 1610
Create Numbered IPv4 ACLs that filter ingress packets based on TCP port numbers.	"ACCESS-LIST TCP" on page 1615
Create Numbered IPv4 ACLs that filter ingress packets based on UDP port numbers.	"ACCESS-LIST UDP" on page 1619

Use the no form of this command, NO MATCH ACCESS-GROUP, to remove an access group created with either a group name or a group number from a class map. See "NO MATCH ACCESS-GROUP" on page 1776.

Confirmation Command

"SHOW CLASS-MAP" on page 1796

"SHOW RUNNING-CONFIG" on page 168

Examples

The following example creates a named IPv4 ACL access list called "icmppermit" and matches it to a class map called "cmap1:"

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list icmppermit
awplus(config-ip-acl)# permit icmp any any
awplus(config-ip-acl)# exit
awplus(config)# class-map cmap1
awplus(config-cmap)# match access-group icmppermit
```

The following example creates a numbered IPv4 MAC ACL access list, 4012 and matches it to a class map called “cmap2:”

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 4012 deny any a4:54:86:12:00:00
00:00:00:00:ff:ff
awplus(config-ip-acl)# exit
awplus(config)# class-map cmap2
awplus(config-cmap)# match access-group 4012
```

The following example configures a class map named “cmap1,” creates a Numbered IPv4 ACL access list, 3001, and matches “cmap1” to the ACL group number:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 3001 permit any any
awplus(config)# class-map cmap1
awplus(config-cmap)# match access-group 3001
```

The following example creates a numbered IPv4 MAC address ACL (with a group number of 4025), a class map called “cmap1” and matches the class map to the group number:

```
awplus> enable
awplus# configure terminal
awplus(config)# access-list 4025 permit any any
awplus(config)# class-map cmap1
awplus(config-cmap)# match access-group 4025
```

MATCH COS

Syntax

```
match cos <0-7>
```

Parameters

0-7

Specifies the CoS value where 0 is the lowest value, and 7 is the highest value.

Mode

Class Map mode

Description

Use this command to add a CoS value as a matching criteria to a class map. See Table 256 for a summary of guidelines from the IEEE Standard 802.1d on applying priorities to the traffic types.

Table 256. CoS Traffic Mapping Guidelines

User Priority	Traffic Types
1	Background
2	Spare
0	Best Effort
3	Excellent Effort
4	Controlled Load
5	Video < 100 latency and jitter
6	Voice < 10 latency and jitter
7	Network Control

Use the no form of this command, NO MATCH COS, to remove the CoS value from a class map.

Confirmation Commands

“SHOW CLASS-MAP” on page 1796

“SHOW RUNNING-CONFIG” on page 168

Examples

The following example creates a class map, called “cmap1,” and adds a CoS value of 4 as a matching criteria to the class map:

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match cos 4
```

The following example removes the CoS matching criteria from the “cmap1” class map:

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# no match cos
```

MATCH DSCP

Syntax

```
match dscp <0-63>
```

Parameters

0-63

Specifies the DSCP value with 0 as the lowest value and 63 as the highest value.

Mode

Class Map mode

Description

Use this command to add the specified DSCP value as a matching criteria to a class map for the purpose of matching incoming packets.

Use the no form of this command, NO MATCH DSCP, to remove the DSCP value from a class map.

Confirmation Command

"SHOW CLASS-MAP" on page 1796

"SHOW RUNNING-CONFIG" on page 168

Examples

The following example creates a class map, called "cmap1," that matches ingress traffic with a DSCP value of 56:

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match dscp 56
```

The following example removes the DSCP value from class map "cmap1:"

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# no match dscp
```

MATCH IP-PRECEDENCE

Syntax

```
match ip-precedence <0-7>
```

Parameters

0-7
Specifies the precedence number.

Mode

Class Map mode

Description

Use this command to add the specified IP precedence value as a matching criteria to a class map. This value is used to match incoming packets.

Use the no form of this command, NO MATCH IP-PRECEDENCE, to remove the IP precedence value from a class map.

Confirmation Commands

“SHOW CLASS-MAP” on page 1796

“SHOW RUNNING-CONFIG” on page 168

Examples

The following example configures a class map, called “cmap7,” to evaluate all ingress IPv4 packets for a precedence value of 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap7
awplus(config-cmap)# match ip-precedence 5
```

The following example removes the IP precedence values from class map “cmap7:”

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap7
awplus(config-cmap)# no match ip-precedence
```

MATCH MAC-TYPE

Syntax

```
match mac-type <l2bcast|l2mcast|l2ucast>
```

Parameters

l2bcast
Specifies the Layer 2 Broadcast frames as the MAC type.

l2mcast
Specifies the Layer 2 Multicast frames as the MAC type.

l2ucast
Specifies the Layer 2 Unicast frames as the MAC type.

Mode

Class Map mode

Description

Use this command to set the destination MAC type as a matching criteria for a class map.

Note
All three parameters, l2bcast, l2mcast, and l2uncast, start with the letter "l" and the number "2" to represent Layer 2.

Use the no form of this command, NO MATCH MAC-TYPE, to remove a MAC type from a class map.

Confirmation Command

"SHOW CLASS-MAP" on page 1796

"SHOW RUNNING-CONFIG" on page 168

Examples

The following example sets the class map's MAC type to Layer 2 broadcast frames:

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match mac-type l2bcast
```

The following example removes the MAC type from a class map:

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# no match mac-type
```

MATCH PROTOCOL

Syntax

```
match eth-format layer-two-format protocol layer-three-protocol
```

Parameters

eth-format
Indicates the following parameter is a Layer 2 Ethernet format.

layer-two-format
Specifies the Layer 2 Ethernet format. For a list of entries, see Table 257.

protocol
Indicates the following parameter is a Layer 3 protocol.

layer-three-protocol
Specifies the Layer 2 Ethernet protocol. For a list of entries, see Table 258 on page 1752.

Mode

Class Map mode

Description

Use this command to set one Ethernet format and one protocol as a matching criteria for a class map. You can also assign one Ethernet format or one protocol to a class map with this command.

See "NO MATCH PROTOCOL" on page 1778 for information about how to remove an Ethernet format and protocol from a class map.

Table 257. Layer Two Ethernet Formats

Parameter	Description
802dot2-tagged	Indicates 802.2 tagged packets.
802dot2-untagged	Indicates 802.2 untagged packets.
ethii-tagged	Indicates Ethii tagged packets.
ethii-untagged	Indicates Ethii untagged packets.
netwareraw-tagged	Indicates NetWare Raw tagged packets.
netwareraw-untagged	Indicates NetWare Raw untagged packets.

Table 257. Layer Two Ethernet Formats (Continued)

Parameter	Description
snap-tagged	Indicates Sub-network Access Protocol (SNAP) tagged packets.
snap-untagged	Indicates SNAP untagged packets.

Table 258. Layer Three Protocol

Parameter	Description
WORD	Indicates a valid protocol number in hexadecimal format.
any	Indicates any protocol.
appletalk	Indicates protocol number 809B. Enter the parameter name or its number.
appletalk-arp	Indicates protocol number 80F3. Enter the parameter name or its number.
arp	Indicates protocol number 0806. Enter the parameter name or its number.
banyan-systems	Indicates protocol number 0BAD. Enter the parameter name or its number.
bbn-simnet	Indicates protocol number 5208. Enter the parameter name or its number.
chaosnet	Indicates protocol number 0804. Enter the parameter name or its number.
dec-customer	Indicates protocol number 6006. Enter the parameter name or its number.
dec-decnet	Indicates protocol number 6003. Enter the parameter name or its number.
dec-diagnostic	Indicates protocol number 6005. Enter the parameter name or its number.
dec-encryption	Indicates protocol number 803D. Enter the parameter name or its number.
dec-lanbridge	Indicates protocol number 8038. Enter the parameter name or its number.
dec-lat	Indicates protocol number 6004. Enter the parameter name or its number.

Table 258. Layer Three Protocol (Continued)

Parameter	Description
dec-lavc	Indicates protocol number 6007. Enter the parameter name or its number.
dec-mod-dump-id	Indicates protocol number 6001. Enter the parameter name or its number.
dec-mop-rem-cdons	Indicates protocol number 6002. Enter the parameter name or its number.
ecma-internet	Indicates protocol number 0803. Enter the parameter name or its number.
eia-rs protocol	Indicates protocol number 4E. Enter the parameter name or its number.
ethertalk-2	Indicates protocol number 809B. Enter the parameter name or its number.
ethertalk-2-aarp	Indicates protocol number 80F3. Enter the parameter name or its number.
ibm-sna	Indicates protocol number 80D5. Enter the parameter name or its number.
ip	Indicates protocol number 0800. Enter the parameter name or its number.
ipv6	Indicates protocol number 86DD. Enter the parameter name or its number.
ipx	Indicates protocol number 8137. Enter the parameter name or its number.
ipx-802dot2	Indicates protocol number E0. Enter the parameter name or its number.
ipx-802dot3	Indicates protocol number FFFF. Enter the parameter name or its number.
ipx-snap	Indicates protocol number 8137. Enter the parameter name or its number.
iso-clns-is	Indicates protocol number FE. Enter the parameter name or its number.
nbs-internet	Indicates protocol number 0802. Enter the parameter name or its number.
netbeui	Indicates protocol number F0. Enter the parameter name or its number.

Table 258. Layer Three Protocol (Continued)

Parameter	Description
proway	Indicates protocol number 8E. Enter the parameter name or its number.
proway-lan	Indicates protocol number 0E. Enter the parameter name or its number.
rarp	Indicates protocol number 8035. Enter the parameter name or its number.
sna-path-control	Indicates protocol number 04. Enter the parameter name or its number.
snmp	Indicates protocol number 814C. Enter the parameter name or its number.
xdot25-level-3	Indicates protocol number 0805. Enter the parameter name or its number.
xdot75-internet	Indicates protocol number 0801. Enter the parameter name or its number.
xns-compat	Indicates protocol number 0807. Enter the parameter name or its number.

Confirmation Commands

“SHOW CLASS-MAP” on page 1796

“SHOW RUNNING-CONFIG” on page 168

Examples

The following example assigns an Ethernet format of SNAP tagged packets and IP to a class map called “cmap1:”

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match eth-format snap-tagged protocol
ip
```

The following example assigns an Ethernet format of 802.2 untagged packets to a class map called “cmap8:”

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap8
awplus(config-cmap)# match eth-format 802dot2-untagged
```

The following example creates a class map called "cmap12" and assigns ARP to it:

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap12
awplus(config-cmap)# match protocol ar
```

MATCH TCP-FLAGS

Syntax

```
match tcp-flags ack|fin|rst|syn|urg
```

Parameters

ack
: Indicates the Acknowledge TCP flag.

fin
: Indicates the Finish TCP flag.

rst
: Indicates the Reset TCP flag.

syn
: Indicates the Synchronize TCP flag.

urg
: Indicates the Urgent TCP flag.

Mode

Class Map mode

Description

Use this command to set a TCP flag as a matching criteria for a class map. A TCP flag is a control bit. If a packet contains a TCP header, it matches the criteria based on the FLAGS field within the header.

You can only add one TCP flag to a MATCH TCP-FLAGS command. However, you can add multiple MATCH TCP-FLAGS commands to the same class map, each containing a different TCP flag. Multiple commands that apply to the same class map are filtered with an AND operand. For example, the following command matches packets that contain the Synchronize TCP flag:

```
match tcp-flags syn
```

In comparison, the following command matches packets that contain the Acknowledge TCP flag:

```
match tcp-flags ack
```

If you assign both of these commands to the same class map, such as "cmap1," the output of the SHOW CLASS-MAP command is:

```
CLASS-MAP-NAME: cmap1
   Match TCP Flags: SYN ACK
```

Figure 270. SHOW CLASS-MAP Command with TCP Flags

Using the above commands, packets that contain both the Synchronize TCP and Acknowledge TCP flags are matched. However, packets that contain *only* the Synchronize TCP flags are ignored. These packets are not matched.

Use the no form of this command, NO MATCH TCP-FLAGS, to remove the specified TCP flag from a class map.

Confirmation Command

"SHOW CLASS-MAP" on page 1796

"SHOW RUNNING-CONFIG" on page 168

Examples

The following example sets the class map, "cmap1," to match packets that contain the Finish TCP flags:

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# match tcp-flags fin
```

The following example removes the Urgent TCP flag from class map "cmap1:"

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# no match tcp-flags urg
```

The following example sets a class map named "cmap5" to match packets that contain Reset TCP flags:

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap5
awplus(config-cmap)# match tcp-flags rst
```

MATCH VLAN

Syntax

```
match vlan <1-4094>
```

Parameters

1-4094
: Specifies the VLAN ID number.

Mode

Class Map Configuration mode

Description

Use this command to add the specified VLAN ID as a matching criteria within a class map. This value is used to match incoming packets.

Use the no form of the command, NO MATCH VLAN, to remove the VLAN ID from the class map.

Confirmation Command

“SHOW CLASS-MAP” on page 1796

“SHOW RUNNING-CONFIG” on page 168

Examples

The following example configures a class map called “cmap3” to include traffic from VLAN 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap3
awplus(config-cmap)# match vlan 5
```

The following example disables the configured VLAN ID as a match criteria for class map “cmap3:”

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap3
awplus(config-cmap)# no match vlan
```

MLS QOS AGGREGATE-POLICE SINGLE-RATE

Syntax

```
mls qos aggregate-police <name> single-rate <CIR> <CBS>
<EBS> action [drop-red|policed-dscp-transmit]
```

Parameters

name

Indicates the name of the police aggregator.

cir

Specifies the Committed Information Rate (CIR) of 1 to 16,000,000 Kbps.

cbs

Specifies the Committed Burst Size (CBS) of 0 to 16,777,216 bytes.

ebs

Specifies the Excess Burst Size (EBS) of 0 to 16,777,216 bytes.

action

Specifies the action taken if the rate is exceeded. Choose from the following options:

drop-red: Drops the red packets.

policed-dscp-transmit: Modifies the packets using the policed DSCP map and then sends the packets.

Mode

Global Configuration mode

Description

Use this command to create a single-rate aggregate policer for a class map and create a police aggregator. The police aggregator can be applied to multiple class maps with the POLICE AGGREGATE command. See "POLICE AGGREGATE" on page 1783.

This type of policer can meter the traffic classified by the class map, and as a result, is given a red bandwidth class for non-conforming traffic. A single-rate aggregate policer is based on the average rate, minimum burst, and maximum burst. Non-conforming traffic exceeds the average rate and the maximum burst.

The setting of the action parameter greatly affects the outcome of this command. Assigning drop-red as an action means that any packets classified as red are discarded. Although data is metered per byte, the color-marking process is applied per packet. As a result, if there are sufficient tokens available that match a part of a packet, then the entire packet is marked red. It is important to note that if you assign the action parameter to drop-red, then these packets are dropped.

Assigning policed-dscp-transmit as the action modifies the packets using the policed DSCP map and then sends the packets. The data for the policed-dscp-transmit option is set with the MLS QOS MAP POLICED-DSCP command. Before you can select the policed-dscp-transmit option, you must configure the MLS QOS MAP POLICED-DSCP command. See “MLS QOS MAP POLICED-DSCP” on page 1772.

The MLS QOS AGGREGATE-POLICE SINGLE-RATE command is very similar to the POLICE SINGLE-RATE ACTION command. However, the POLICE SINGLE-RATE ACTION command does not permit you to create a police aggregate. See “POLICE SINGLE-RATE ACTION” on page 1785.

Use the NO MLS QOS AGGREGATE-POLICE command to remove the aggregator policer configuration. See “NO MLS QOS AGGREGATE-POLICE” on page 1780.

Confirmation Command

“SHOW MLS QOS AGGREGRATE-POLICER” on page 1800

Examples

The following example associates two class maps, “cmap1” and “cmap2,” to policy map, “pmap1.” An aggregate policer name, “policeagg1,” is created with the MLS QOS AGGREGATE-POLICE SINGLE-RATE command. In addition, the CIR is set to 125 Kbps, the CBS is set to 20,000 bytes, and the EBS is set to 30,000 bytes. The action is set to policed-dscp-transmit which modifies packets using the policed DSCP map and then sends the packets:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# mls qos aggregate-police policeagg1 single-
rate 125 20000 30000 action policed-dscp-transmit
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
```

```
awplus(config-pmap)# police aggregate policeagg1
awplus(config-pmap-c)# exit
awplus(config-pmap)# class cmap2
awplus(config-pmap)# police aggregate policeagg1
awplus(config-pmap)# exit
awplus(config)# exit
```

The following example associates two class maps, "cmap1" and "cmap2," to policy map, "pmap1." An aggregate name, "policeagg5," is created with the MLS QOS AGGREGATE-POLICE SINGLE-RATE command. In addition, the CIR is set to 1000 Kbps, the CBS is set to 12,000 bytes, and the EBS is set to 16,000 bytes. The action is set to drop red packets:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# mls qos aggregate-police policeagg5 single-
rate 1000 12000 16000 action drop-red
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
awplus(config-pmap)# police aggregate policeagg5
awplus(config-pmap-c)# exit
awplus(config-pmap)# class cmap2
awplus(config-pmap)# police aggregate policeagg5
awplus(config-pmap-c)# exit
awplus(config-pmap)# exit
```

MLS QOS AGGREGATE-POLICE TWIN-RATE

Syntax

```
mls qos aggregate-police <name> twin-rate <cir> <cbs>
<pir> <pbs> action [drop-red|policed-dscp-transmit]
```

Parameters

<name>
Indicates the name of the police aggregator.

cir
Specifies the Committed Information Rate (CIR) of 1 to 16000000 Kbps.

cbs
Specifies the Committed Burst Size (CBS) of 0 to 16,777,216 bytes.

pir
Specifies the Peak Information Rate (PIR) of 0 to 160000000 Kbps.

pbs
Specifies the Peak Burst Size (PBS) of 0 to 16,777,216 bytes.

action
Specifies the action taken if the rate is exceeded (non-conforming traffic). Choose from the following options:

drop-red: Drops the red packets.

policed-dscp-transmit: Modifies the packets using the policed DSCP map and then sends the packets.

Mode

Global Configuration mode

Description

Use this command to configure a twin-rate aggregate policer. A policer meters the traffic classified by the class map and, as a result, is given a red bandwidth class for non-conforming traffic. If the sum of the number of existing, or buffered, bytes plus those arriving at the port per unit time, resulting in a value that exceeds the PBS value, this indicates non-conforming traffic.

A twin-rate policier is based on four values:

- minimum rate
- minimum burst size
- maximum rate
- maximum burst size

The value of the action parameter greatly effects the outcome of this command.

The data for the policed-dscp-transmit option is supplied by the MLS QOS MAP POLICED-DSCP command. For more information, see "MLS QOS MAP DSCP-QUEUE" on page 1770.

Assigning drop-red as an action means that any packets classed as red are discarded. Although data is metered per byte, the color-marking process is applied per packet. As a result, if there are sufficient tokens available that match a part of a packet, then the entire packet is marked red. It is important to note that if you assign the action parameter to drop-red, then these packets are dropped.

The twin rate metering command can be used to create an aggregator which can be later applied to any number of classes with the POLICE AGGREGATE command. See "POLICE AGGREGATE" on page 1783.

Use the NO MLS QOS AGGREGATE-POLICE command to remove the association between an police aggregator and a policy map. See "NO MLS QOS AGGREGATE-POLICE" on page 1780.

Confirmation Command

"SHOW MLS QOS AGGREGRATE-POLICER" on page 1800

Examples

The following example associates two class maps, "cmaptwin1" and "cmaptwin2," to policy map, "pmaptwin1." An aggregate name, "policeaggtwin," is created with the MLS QOS AGGREGATE-POLICE TWIN-RATE command. In addition, the CIR is set to 20,000 Kbps, the CBS is set to 30,000 bytes, the PIR is 20000 Kbps and the PBS is set to 50,000 bytes. The action is set to drop red packets:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# mls qos aggregate-police policeaggtwin twin-
rate 20000 30000 20000 50000 action drop-red
awplus(config)# policy-map pmaptwin1
awplus(config-pmap)# class cmaptwin1
awplus(config-pmap)# police aggregate policeaggtwin
```

```
awplus(config-pmap-c)# exit
awplus(config-pmap)# class cmaptwin2
awplus(config-pmap)# police aggregate policeaggtwin
awplus(config-pmap-c)# exit
awplus(config-pmap)# exit
```

The following example associates two class maps, “cmaptwin7” and “cmaptwin9,” to policy map, “pmaptwin2.” An aggregate name, “paggtwin,” is created with the MLS QOS AGGREGATE-POLICE TWIN-RATE command. In addition, the CIR is set to 1000 Kbps, the CBS is set to 12,000 bytes, the PIR is 50,000 Kbps, and the PBS is set to 17,000 bytes. The action is set to drop red packets:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# mls qos aggregate-police paggtwin twin-rate
1000 12000 50000 17000 action drop-red
awplus(config)# policy-map pmaptwin2
awplus(config-pmap)# class cmaptwin7
awplus(config-pmap)# police aggregate paggtwin
awplus(config-pmap-c)# exit
awplus(config-pmap)# class cmaptwin9
awplus(config-pmap)# police aggregate paggtwin
awplus(config-pmap-c)# exit
awplus(config-pmap)# exit
```

MLS QOS COS

Syntax

```
mls qos cos <0-7>
```

Parameters

0-7

Specifies the Class of Service user-priority value. The highest value is 7 which indicates the highest priority of CoS. The default is 0.

Mode

Interface Configuration mode

Description

Use this command to assign a CoS user-priority value to untagged frames that are entering the interface specified. By default, all untagged frames are assigned a CoS value of 0.

Use the no form of the command, NO MLS QOS COS, to return the interface to the default CoS setting for untagged frames entering the interface.

The 802.1p priority value on ingress tagged packets are ignored unless QoS is enabled and CoS is trusted. This means, by default, a priority tagged packet will egress with the same tag value it was received with, but the switch will ignore the value.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

The following example sets the CoS priority value to 5 on port 17:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17
awplus(config-if)# mls qos cos 5
```

The following example sets the CoS priority value to 4 on port 22:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.22
awplus(config-if)# mls qos cos 4
```

MLS QOS ENABLE

Syntax

```
mls qos enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to activate the QoS feature on the switch. By default, the QoS feature is disabled.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

This example enables the QoS feature on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
```

MLS QOS MAP COS-QUEUE

Syntax

```
mls qos map cos-queue cos_priority to egress_queue
```

Parameters

cos_priority
: Specifies a Class of Service (CoS) priority level of 0, the lowest priority, through 7, the highest priority mapped to it. An egress queue can have more than one priority level, but you can specify only one priority level at a time with this command.

egress_queue
: Specifies an egress queue number of 0 through 7. The lowest priority queue is 0, and the highest queue is 7. You can specify only one queue.

Mode

Global Configuration mode

Description

Use this command to map CoS values to port egress queues. An egress queue can have more than one priority mapped to it, but you can assign only one priority at a time with this command. For a list of the default mappings between the CoS Priority and Queue, see Figure 271.

```
COS-TO-QUEUE-MAP:
   COS:     0 1 2 3 4 5 6 7
---------------------------
   QUEUE:   2 0 1 3 4 5 6 7
```

Figure 271. CoS Priority to CoS Queue Mapping

Use the NO form of this command, NO MLS QOS MAP COS-QUEUE, to return the CoS priority on mappings to their default values.

Confirmation Command

"SHOW MLS QOS MAPS COS-QUEUE" on page 1805

Examples

The following example sets an egress CoS queue on port 13, mapping priority 6 to queue 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# class-map trustcos
awplus(config-cmap)# exit
awplus(config)# policy-map pmap1
awplus(config-pmap)# class trustcos
awplus(config-pmap)# exit
awplus(config)# interface port1.0.13
awplus(config-if)# service-policy input pmap1
awplus(config-if)# exit
awplus(config)# mls qos map cos-queue 6 to 7
```

This example restores the default mappings of the CoS priorities to the egress queues on port 4:

```
awplus> enable
awplus# configure terminal
awplus(config-if)# no mls qos map cos-queue
```

MLS QOS MAP DSCP-QUEUE

Syntax

```
mls qos map dscp-queue dscp_value to egress_queue
```

Parameters

dscp_value
Specifies a DSCP value. The lowest value is 0, and the highest value is 63. You can map more than one value level to an egress queue, but you can specify only one value level at a time with this command.

egress_queue
Specifies an egress queue number of 0 through 7. The lowest priority queue is 0, and the highest queue is 7. You can specify only one queue.

Mode

Global Configuration mode

Description

Use this command to map DSCP values to port egress queues. An egress queue can have more than one priority value mapped to it, but you can assign only one priority at a time with this command.

Note
QoS must be enabled on the switch and a port must be set to DSCP trust before you can use this command. Refer to commands “CLASS-MAP” on page 1737 and “NO AUTO-QOS VOICE | TRUST DSCP” on page 1774.

Use the NO form of this command, NO MLS QOS MAP DSCP-QUEUE, to return the DSCP value mappings to their default values.

Confirmation Command

“SHOW MLS QOS MAPS DSCP-QUEUE” on page 1806

Examples

The following example maps a DSCP value of 46 to egress queue 7 on ingress port 1.0.24. The DSCP value is mapped to queue 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# class-map trustdscp
awplus(config-cmap)# exit
awplus(config)# policy-map pmap1
awplus(config-pmap)# class trustdscp
awplus(config-pmap-c)# trust dscp
awplus(config-pmap-c)# exit
awplus(config-pmap)# exit
awplus(config)# interface port1.0.24
awplus(config-if)# service-policy input pmap1
awplus(config-if)# exit
awplus(config)# mls qos map dscp-queue 46 to 7
```

This example restores the default mappings of the DSCP priorities to the egress queues on port 3:

```
awplus> enable
awplus# configure terminal
awplus(config-if)# no mls qos map dscp-queue
```

MLS QOS MAP POLICED-DSCP

Syntax

```
mls qos map policed-dscp <existing-dscp> to <new-dscp> <0 - 63>
```

Parameters

existing-dscp
Specifies the existing DSCP value.

new-dscp
Specifies the new DSCP value. The range is 0 to 63.

Mode

Global Configuration mode

Description

Use this command to configure the policed DSCP map. It maps the existing value set for DSCP with the MLS QOS MAP DSCP-QUEUE command to a new DSCP value. The map created with this command is used when a policer action is set to policed-dscp-transmit with the POLICE SINGLE-RATE ACTION or POLICE TWIN-RATE ACTION commands.

To remove the new DSCP value, use the NO MLS QOS MAP POLICED-DSCP command.

Note
This map will be used when a policer action is set to policed-dscp-transmit.

Confirmation Command

“SHOW MLS QOS MAPS POLICED-DSCP” on page 1809

Examples

This example changes the DSCP value from 5 to 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos map policed-dscp 5 to 7
```

This example changes the DSCP value from 20 to 44:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos map policed-dscp 20 to 44
```

NO AUTO-QOS VOICE | TRUST DSCP

Syntax

```
no auto-qos [voice <VLANID> |trust dscp]
```

Parameters

voice
: Specifies a VLAN ID for voice VLAN support. Enter a value between 1 and 4094.

trust dscp
: Specifies DSCP traffic is trusted.

Mode

Interface Configuration mode

Description

Use this command to do one of the following:

- Remove a voice VLAN ID.
- Remove DSCP as trusted ingress traffic.
- Remove a voice VLAN ID and remove DSCP as trusted ingress traffic.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

In the following example, VLAN 100 is removed as a voice VLAN, and trust CoS is removed from port 1.0.1:

```
awplus> enable
awplus# configure terminal
awplus(config-if)# interface port1.0.1
awplus(config)# no auto-qos voice 100
```

In the following example, VLAN 50 is removed as a voice VLAN from port 1.0.1:

```
awplus> enable
awplus# configure terminal
awplus(config-if)# interface port1.0.1
awplus(config-if)# no auto-qos voice 50
```

In the following example, DSCP is removed as the type of trust:

```
awplus> enable
awplus# configure terminal
awplus(config-if)# interface port1.0.1
awplus(config-if)# no auto-qos trust dscp
```

NO MATCH ACCESS-GROUP

Syntax

```
match access-group group-name|group-number
```

Parameters

group-name
: Indicates an ACL group name that was created with the IP-ACCESS LIST command.

group-number
: Indicates an ACL group number that was created with one of the ACCESS-LIST commands. There are two ranges of group numbers:

  3000 to 3699: Specifies the ID number of an access control list for a numbered IPv4 ACL.

  4000 to 4699: Specifies the ID number of a numbered MAC address IPv4 ACL.

Mode

Class Map mode

Description

Use this command to remove an ACL group name or group number from a class map.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

The following example removes an IPv4 ACL access list called “icmppermit” from a class map called “cmap8:”

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap8
awplus(config-cmap)# no match access-group icmppermit
```

The following example removes group number 4000 from a class map, called "cmap41":

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap41
awplus(config-cmap)# no match access-group 4000
```

NO MATCH PROTOCOL

Syntax

```
no match eth-format layer-two-format protocol layer-three-
protocol
```

Parameters

eth-format
Indicates the following parameter is a Layer 2 Ethernet format.

layer-two-format
Specifies the Layer 2 Ethernet format. For a list of entries, see Table 257 on page 1751.

protocol
Indicates the following parameter is a Layer 3 protocol.

layer-three-protocol
Specifies the Layer 3 Ethernet protocol. For a list of entries, see Table 258 on page 1752.

Mode

Class Map mode

Description

Use this command to remove an Ethernet format and a protocol as a matching criteria for a class map. You can also remove one Ethernet format or one protocol from a class map with this command.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

The following example removes an Ethernet format of snap untagged packets and the AppleTalk protocol from a class map called “cmap1:”

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap1
awplus(config-cmap)# no match eth-format snap-untagged
protocol appletalk
```

The following example removes 802.2 tagged packets from a class map called "cmap8":

```
awplus> enable
awplus# configure terminal
awplus(config)# class-map cmap8
awplus(config-cmap)# no match eth-format 802dot2-tagged
```

NO MLS QOS AGGREGATE-POLICE

Syntax

```
no mls qos aggregate-police name
```

Parameters

name
Indicates the name of the police aggregator.

Mode

Global Configuration mode

Description

Use this command to remove the association between a class map and a police aggregator. You can use this command to remove the association between a class map and a single-rate or twin-rate police aggregator.

Example

This example remove the association between the class map and the twin-rate police aggregator named “policyaggtwin:”

```
awplus> enable
awplus# configure terminal
awplus(config)# no mls qos aggregate-police policyaggtwin
```

NO MLS QOS ENABLE

Syntax

```
no mls qos enable
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to disable the QoS feature on the switch. When QoS is disabled, all traffic is treated equally.

Example

This example disables the QoS feature on the switch

```
awplus> enable
awplus# configure terminal
awplus(config)# no mls qos enable
```

NO POLICE AGGREGATE

Syntax

```
no police aggregate name
```

Parameters

name
Indicates the name of a police aggregate.

Mode

Policy Map Class mode

Description

Use this command remove the association between a either a single-rate aggregate policer or a twin-rate aggregate policer and a class map.

Example

This example removes the association between a class map called “classname1” and an aggregate policer called “singlerate:”

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap2
awplus(config-pmap)# class classname1
awplus(config-pmap-c)# no police singlerate
```

POLICE AGGREGATE

Syntax

```
police aggregate name
```

Parameters

name
Indicates the name of the police aggregator.

Mode

Policy Map Class mode

Description

Use this command to assign an aggregate policer to a class map that is associated with a policy map. You can assign the same aggregate policer multiple times to different class maps within the same policy map and to class maps assigned to different policy maps.

To create an aggregate name, use one of the following commands:

- "MLS QOS AGGREGATE-POLICE SINGLE-RATE" on page 1759
- "MLS QOS AGGREGATE-POLICE TWIN-RATE" on page 1762.

Use the no form of this command, NO POLICE AGGREGATE, to remove the association between an aggregate name and a class map. See "NO POLICE AGGREGATE" on page 1782.

Examples

The following example creates an aggregate name, "policyagg1," with the MLS QOS AGGREGATE-POLICE SINGLE-RATE command. Then the aggregate name is assigned to class maps "cmap1" and "cmap2" within policy map, "pmap1:"

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# mls qos aggregate-police policyagg1 single-
rate 125 125 1024 1024 action policed-dscp-transmit
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# police aggregate policyagg1
awplus(config-pmap-c)# exit
awplus(config-pmap)# class cmap2
awplus(config-pmap-c)# police aggregate policyagg1
```

The following example removes the association between the aggregate name, “policyagg5,” and class maps “cmap7” and “cmap13:”

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap7
awplus(config-pmap-c)# no police aggregate policyagg5
awplus(config-pmap-c)# exit
awplus(config-pmap)# class cmap13
awplus(config-pmap-c)# no police aggregate policyagg5
```

POLICE SINGLE-RATE ACTION

Syntax

```
police single-rate <cir> <cbs> <ebs> action [drop-
red|policed-dscp-transmit]
```

Parameters

cir

Specifies the Committed Information Rate (CIR) of 1 to 16,000,000 Kbps.

cbs

Specifies the Committed Burst Size (CBS) of 0 to 16,777,216 bytes.

ebs

Specifies the Excess Burst Size (EBS) of 0 to 16,777,216 bytes.

action

Specifies the action taken if the rate is exceeded. Choose from the following options:

drop-red: Drops the red packets.

policed-dscp-transmit: Modifies the packets using the policed DSCP map and then sends the packets.

Mode

Policy Map Class mode

Description

Use this command to configure a single-rate policer for a class map. A policer can meter the traffic classified by the class map, and as a result, is given the bandwidth class. A single-rate policer is based on the average rate, minimum burst, and maximum burst. If the traffic exceeds the average rate and the maximum burst, the result is given the bandwidth class, red (non-conforming).

The setting of the action parameter greatly affects the outcome of this command. Assigning drop-red as an action means that any packets classed as red are discarded. Assigning policed-dscp-transmit as the action modifies the packets using the policed DSCP map and then sends the packets. The data for the policed-dscp-transmit option is from the MLS QOS MAP POLICED-DSCP command. Before you can select the policed-dscp-transmit option, you must configure the MLS QOS MAP

POLICED-DSCP command. See “MLS QOS MAP POLICED-DSCP” on page 1772.

Although data are metered per byte, if there are sufficient tokens available that match a part of a packet, then the entire packet is marked red. It is important to note that if you assign the action parameter to drop-red, then these packets are dropped.

To remove the association between a single-rate policer and a class map, use the NO POLICE command. See “NO POLICE AGGREGATE” on page 1782.

Examples

This example configures a single-rate policer requiring traffic to conform to a CIR of 10,000 Kbps with a CBS of 15,000 bytes that drops traffic bursting over 25,000 bytes:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap2
awplus(config-pmap)# class classname
awplus(config-pmap-c)# police single-rate 10000 15000 25000
action drop-red
```

This example configures a single-rate policer requiring traffic to conform to a CIR of 9000 Kbps, a CBS of 11,500 bytes and an EBS of 35,000 bytes, and then sends the packets. Non-conforming traffic is re-marked according to the action specified by the policed DSCP map:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# police single-rate 9000 11500 35000
action policed-dscp-transmit
```

POLICE TWIN-RATE ACTION

Syntax

```
police twin-rate <cir> <cbs> <pir> <pbs> action [drop-red|policed-dscp-transmit]
```

Parameters

cir

Specifies the Committed Information Rate (CIR) of 1 to 16,000,000 Kbps.

cbs

Specifies the Committed Burst Size (CBS) of 0 to 16,777,216 bytes. The suggested minimum is 10,000 bytes.

pir

Specifies the Peak Information Rate (PIR) of 0 to 160,000,000 Kbps.

pbs

Specifies the Peak Burst Size (PBS) of 0 to 16,777,216 bytes. The suggested minimum is 15,000 bytes.

action

Specifies the action taken if the rate is exceeded. Choose from the following options:

drop-red: Drops the red packets.

policed-dscp-transmit: Modifies the packets using the policed DSCP map and then sends the packets.

Mode

Policy Map Class mode

Description

Use this command to configure a twin-rate policer for a class map. A policer meters the traffic classified by the class map and, as a result, is given the bandwidth class. If the traffic exceeds the average rate and the maximum burst, the result is given the bandwidth class, red (non-conforming).

A twin-rate policer is based on four values:

- minimum rate

- minimum burst size
- maximum rate
- maximum burst size

The value of the action parameter greatly effects the outcome of this command. The data for the policed-dscp-transmit option is supplied by the MLS QOS MAP POLICED-DSCP command. See “MLS QOS MAP POLICED-DSCP” on page 1772.

Assigning drop-red as an action means that any packets classed as red are discarded. Although data is metered per byte, if there are sufficient tokens available that match a part of a packet, then the entire packet is marked red. It is important to note that if you assign the action parameter to drop-red, then these packets are dropped.

To remove the associate between a twin-rate policer and a class map, use “NO POLICE AGGREGATE” on page 1782.

Example

This example configures a twin-rate policer that requires traffic to conform to a CIR of 11,000 Kbps, a CBS of 13,000 bytes, a PIR of 20,000 Kbps, and a PBS of 20,000 bytes. This policer re-marks traffic if it does not conform to the set condition:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class classname7
awplus(config-pmap-c)# police twin-rate 11000 13000 20000
20000 action policed-dscp-transmit
```

POLICY-MAP

Syntax

```
policy-map name
```

Parameters

name
Specifies the name of a policy map.

Mode

Global Configuration mode

Description

Use this command to create a policy map and enter the Policy Map Configuration mode. A policy map allows you to group class maps together. You can assign up to five class maps to one policy map. In addition, a policy map allows you to set actions on traffic that meet all of the match criterion contained in the class maps. You can also assign a policy map to a port.

Use the no form of this command, NO POLICY-MAP, to delete an existing policy map.

Confirmation Command

"SHOW MLS QOS INTERFACE" on page 1802

Examples

This example creates a policy map called "pmap1" and enters the Policy Map Configuration mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)#
```

This example deletes a policy map called "pmap5:"

```
awplus> enable
awplus# configure terminal
awplus(config)# no policy-map pmap5
```

SET COS

Syntax

```
set cos <0-7>
```

Parameters

0-7
Specifies the CoS value of the classified traffic.

Mode

Policy Map Class mode

Description

Use this command to set the CoS value of the classified traffic specified.

Use the no form of the command, NO SET COS, to remove the CoS value of the classified traffic specified.

Note
You cannot use the SET QUEUE command and the SET COS command as policy map actions for the same class map.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

The following example creates a policy map called “pmap1,” then associates class map, “cmap5,” to “pmap1” and sets the action to a CoS value of 7:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap5
awplus(config-pmap-c)# set cos 7
```

The following example removes the policy-map action for class map "cmap25" by using the NO SET COS command:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap7
awplus(config-pmap)# class cmap25
awplus(config-pmap-c)# no set cos
```

SET DSCP

Syntax

```
set dscp <0-63>
```

Parameters

<0-63>
Specifies the DSCP value of the classified traffic.

Mode

Policy Map Class mode

Description

Use this command to set the DSCP value of the classified traffic specified.

Use the no form of the command, NO SET DSCP, to remove the DSCP value of the classified traffic specified.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

The following example creates a policy map called “pmap1,” then associates class map, “cmap5,” to “pmap1” and sets the action to 46:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap5
awplus(config-pmap-c)# set dscp 46
```

The following example removes the policy map action for class map, “cmap3”:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap7
awplus(config-pmap)# class cmap3
awplus(config-pmap-c)# no set dscp
```

SET QUEUE

Syntax

```
set queue <0-7>
```

Parameters

<0-7>
Specifies the queue.

Mode

Policy Map Class mode

Description

Use this command to set the egress queue of the classified traffic.

Use the no form of this command to remove the egress queue from a policy map.

Note
You cannot use the SET QUEUE command and the SET COS command as policy map actions for the same class map.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

The following example sets the egress queue to 6 for traffic classified by class map "cmap4:"

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# class-map cmap4
awplus(config-cmap)# exit
awplus(config)# policy-map pmap3
awplus(config-pmap)# class cmap4
awplus(config-pmap-c)# set queue 6
```

The following example removes the previously configured egress queue from class map “cmap2:”

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap2
awplus(config-pmap-c)# no set queue
```

SERVICE-POLICY INPUT

Syntax

```
service-policy input <policy-map>
```

Parameters

policy-map
Indicates the name of the policy map.

Mode

Interface Configuration mode

Description

Use this command to apply a policy map to an interface.

Note
You must create a policy map before you assign it to an interface with the SERVICE-POLICY INPUT command.

Use the no form of this command, NO SERVICE-POLICY INPUT, to remove the association between the specified policy map and an interface.

Examples

The following example applies policy map "pmap1" to port 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.5
awplus(config-if)# service-policy input pmap1
```

The following example applies the policy map "pmap2" to port 12:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.12
awplus(config-if)# service-policy input pmap2
```

The following example removes the application between policy map "pmap3" and port 17:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.17
awplus(config-if)# no service-policy input pmap3
```

SHOW CLASS-MAP

Syntax

```
show class-map class-map-name
```

Parameters

class-map-name
Specifies the name of the class map.

Modes

User Exec and Privileged Exec

Description

Use this command to display a QoS class map. See Figure 272 for an example of this command.

```
CLASS-MAP-NAME: cmap1

   Match IP DSCP: 46
```

Figure 272. SHOW CLASS-MAP Command

Example

This example displays the class map called “cmap1:”

```
awplus# show class-map cmap1
```

SHOW POLICY-MAP

Syntax

```
show policy-map policy-map-name
```

Parameters

policy-map-name
Specifies the name of the policy map.

Modes

User Exec and Privileged Exec

Description

Use this command to display a list of the QoS policy maps configured on the switch. See Figure 273 for an example of this command.

```
POLICY-MAP-NAME: pmap1
   Description: video traffic
   State: attached
   Default class-map action: permit
   CLASS-MAP-NAME: cmap1
      Set Queue: 6
   CLASS-MAP-NAME: default

POLICY-MAP-NAME: pmaptwin1
   Description: ip phones
   State: detached
   Default class-map action: permit
   CLASS-MAP-NAME: classmaptwin1
      Trust CoS
   CLASS-MAP-NAME: default
```

Figure 273. SHOW POLICY-MAP Command

See Table 259 for an explanation of the fields.

Table 259. SHOW POLICY-MAP Command Description

Field	Description
POLICY-MAP-NAME	Indicates the name of the policy map. This value is set with the POLICY-MAP command. See "POLICY-MAP" on page 1789.

Table 259. SHOW POLICY-MAP Command Description (Continued)

Field	Description
Description	This is an optional field that is used to describe the policy map. Set the description with the DESCRIPTION command. See “DESCRIPTION (Policy Map)” on page 1740.
State	Indicates if the policy map is assigned to a port (attached) or not (detached). Use the SERVICE-POLICY INPUT command to attach or detach a policy to a port. See “SERVICE-POLICY INPUT” on page 1795.
Default class-map action	Indicates the action for traffic not matched by any of the class maps associated with a given policy map. Set this value with the DEFAULT-ACTION command. There are three options: permit, deny, and copy-to-mirror. See “DEFAULT-ACTION” on page 1738.
CLASS-MAP-NAME	Indicates the class maps that are associated with the policy map. To associate a class map with a policy map, use the CLASS command. See “CLASS” on page 1735.

Example

This example displays the settings of a policy map called “pmap4:'

```
awplus# show policy-map pmap4
```

SHOW MLS QOS

Syntax

```
show mls qos
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the status of the QoS feature. By default, the QoS feature is disabled.

See Figure 274 for an example of this command when QoS is enabled.

```
Qos is enabled
```

Figure 274. SHOW MLS QOS Command

Example

This example displays the status of the QoS feature:

```
awplus# show mls qos
```

SHOW MLS QOS AGGREGATE-POLICER

Syntax

```
show mls qos aggregate-policer name
```

Parameters

name
Specifies the name of the aggregate policer.

Mode

Privileged Exec mode

Description

Use this command to display the settings of all aggregate policers configured on the switch. To set a single-rate police aggregate, see “MLS QOS AGGREGATE-POLICE SINGLE-RATE” on page 1759. To set the twin-rate police aggregate, see “MLS QOS AGGREGATE-POLICE TWIN-RATE” on page 1762.

Figure 275 displays an example of the output of the SHOW MLS QOS AGGREGATE-POLICER command.

```
AGGREGATE-POLICER-NAME: ap1
   Policer single-rate action drop-red:
         average rate (125 kbps) minimum burst (125 B) maximum burst (1024B)
AGGREGATE-POLICICER-NAME: COP
   Policer single-rate action policed-dscp-tx:
         average rate (1 kbps) minimum burst (3B) maximum burst (4B)
maximum rate (2 kpbs)
AGGREGATE-POLICICER-NAME: policytwin
   Policer twin-rate action drop-red:
         minimum rate (500 kbps) maximum rate (1200 kpbs) minimum burst (3 B)
         maximum burst (4B)
```

Figure 275. SHOW MLS QOS AGGREGATE-POLICER

See Table 260 on page 1801 for a description of the field listed in Figure 275.

Note
The definitions for the single-rate and twin-rate policers are different.

Table 260. SHOW MLS QOS AGGREGATE-POLICER Command Description

Field	Description
AGGREGATE-POLICER-NAME	Indicates the name of the aggregate policer.
Policer single-rate	Indicates the police aggregator is single-rate and was created with the MLS QOS AGGREGATE-POLICE SINGLE-RATE command. It contains the following definitions: ❒ average rate: Specifies the Committed Information Rate (CIR) of 1 to 16,000,000 Kbps. ❒ minimum burst: Specifies the Committed Burst Size (CBS) of 0 to 16,777,216 bytes. ❒ maximum burst: Specifies the Excess Burst Size (EBS) of 0 to 16,777,216 bytes.
Policer twin-rate	Indicates the police aggregator is twin-rate and was created with the MLS QOS AGGREGATE-POLICE TWIN-RATE command. It contains the following definitions: ❒ minimum rate: Specifies the Committed Information Rate (CIR) of 1 to 16,000,000 Kbps. ❒ maximum rate: Specifies the Peak Information Rate (PIR) of 0 to 160,000,000 Kbps. ❒ minimum burst: Specifies the Committed Burst Size (CBS) of 0 to 16,777,216 bytes. ❒ maximum burst: Specifies the Peak Burst Size (PBS) of 0 to 16,777,216 bytes. The suggested minimum is 15,000 bytes.
action	Specifies the action taken if the rate is exceeded. There are two options: ❒ drop-red indicates that red packets are dropped. ❒ policed-dscp-transmit indicates the packets are modified using the policed DSCP map and then sends the packets.

Example

This example displays the contents of the aggregate policer, called "ap1:"

```
awplus# show mls qos aggregate-policer ap1
```

SHOW MLS QOS INTERFACE

Syntax

```
show mls qos interface port
```

Parameters

port
Specifies the port to display. You can view only one port at a time.

Mode

Privileged Exec mode

Description

Use this command to display the scheduling methods of the ports, and for weighted round robin scheduling, the assignments of weights to egress queues. Together, Figure 276 and Figure 277 on page 1803 provide an example of a port set to strict priority.

```
CoS:   0
Queue: 2
Number of egress queues: 8
Egress Queue:       0
   Scheduler:       Strict Priority
   Weight:          N/A
Egress Queue:       1
   Scheduler:       Strict Priority
   Weight:          N/A
Egress Queue:       2
   Scheduler:       Strict Priority
   Weight:          N/A
Egress Queue:       3
   Scheduler:       Strict Priority
   Weight:          N/A
Egress Queue:       4
   Scheduler:       Strict Priority
   Weight:          N/A
Egress Queue:       5
   Scheduler:       Strict Priority
   Weight:          N/A
```

Figure 276. SHOW MLS QOS INTERFACE Command - Strict Priority

```
Egress Queue:       6
   Scheduler:       Strict Priority
   Weight:          N/A
Egress Queue:       7
   Scheduler:       Strict Priority
   Weight:          N/A
```

Figure 277. SHOW MLS QOS INTERFACE Command - Strict Priority (continued)

Figure 278 is an example of a port set to Weighted Round-Robin scheduling.

```
CoS:   0
Queue: 2
Number of egress queues: 8
Egress Queue:      0
   Scheduler:      Weighted Round Robin
   Weight:         1
Egress Queue:      1
   Scheduler:      Weighted Round Robin
   Weight:         1
Egress Queue:      2
   Scheduler:      Weighted Round Robin
   Weight:         5
Egress Queue:      3
   Scheduler:      Weighted Round Robin
   Weight:         5
Egress Queue:      4
   Scheduler:      Weighted Round Robin
   Weight:         10
Egress Queue:      5
   Scheduler:      Weighted Round Robin
   Weight:         10
Egress Queue:      6
   Scheduler:      Weighted Round Robin
   Weight:         15
Egress Queue:      7
   Scheduler:      Weighted Round Robin
   Weight:         15
```

Figure 278. SHOW MLS QOS INTERFACE Command - WRR

The fields in the display are described in Table 261.

Table 261. SHOW MLS QOS INTERFACE Command

Field	Description
CoS	Specifies the default CoS value for packets that do not have a value, that is, for untagged frames.
Queue	Specifies the default egress queue for packets that do not have a CoS value, that is, for untagged frames.
Number of egress queues	Specifies the number of egress queues on the port. Each port on the switch has eight queues.
Egress Queue	Specifies the egress queue number.
Scheduler	Specifies the packet scheduling method. The possible settings are Strict Priority and Weighted Round Robin.
Weight	Specifies the weight of the queue, in number of packets. This applies only to Weighted Round Robin. This is “N/A” for strict priority.

Example

This example displays the mappings of egress queues to CoS values for port 3:

```
awplus# show mls qos cos-queue port1.0.3
```

SHOW MLS QOS MAPS COS-QUEUE

Syntax

```
show mls qos maps cos-queue
```

Parameters

port

Specifies the port to display. You can view only one port at a time.

Mode

Privileged Exec mode

Description

Use this command to display the mappings of CoS priority values to egress queues. See Figure 279 for an example of the default mapping.

```
COS-TO-QUEUE-MAP:
   COS:      0 1 2 3 4 5 6 7
---------------------------
   QUEUE:    2 0 1 3 4 5 6 7
```

Figure 279. SHOW MLS QOS MAPS COS-QUEUE Command

The CoS values in the first line are matched with the egress queue assignments in the second line. For example, in Figure 279, port 1 packets with CoS 0 are placed in egress queue 2, packets with CoS 1 are placed in egress queue 0, and so on.

The mappings of CoS priorities and egress queues are set with "MLS QOS MAP COS-QUEUE" on page 1768.

Example

This example displays the mappings of CoS priority values:

```
awplus# show mls qos maps cos-queue
```

SHOW MLS QOS MAPS DSCP-QUEUE

Syntax

```
show mls qos maps dscp-queue
```

Parameters

port
Specifies the port. You can display only one port at a time.

Mode

Privileged Exec mode

Description

Use this command to display the mappings of DSCP values to port egress queues. See Figure 280 on page 1807 for an example of this information.

```
DSCP-TO-QUEUE-MAP:

---------------------
Queue: 0
DSCP: 0-7
---------------------

---------------------
Queue: 1
DSCP: 8-15
---------------------

---------------------
Queue: 2
DSCP: 16-23
---------------------

---------------------
Queue: 3
DSCP: 24-31
---------------------

---------------------
Queue: 4
DSCP: 32-39
---------------------

---------------------
Queue: 5
DSCP: 40-47
---------------------

---------------------
Queue: 6
DSCP: 48-55
---------------------

---------------------
Queue: 7
DSCP: 56-63
---------------------
```

Figure 280. SHOW MLS QOS MAPS DSCP-QUEUE Command

The mappings of DSCP value and egress queues are set with "MLS QOS MAP DSCP-QUEUE" on page 1770.

Example

The following example displays the DSCP mappings:

```
awplus# show mls qos maps dscp-queue
```

SHOW MLS QOS MAPS POLICED-DSCP

Syntax

```
show mls qos maps policed-dscp <0-63>
```

Parameters

<0-63>
Specifies the DSCP value.

Mode

Privileged Exec mode

Description

Use this command to display the mapping between the existing DSCP value and the new DSCP value. This mapping is set with the MLS QOS MAPS POLICED-DSCP command. For more information about this command, see "MLS QOS MAP POLICED-DSCP" on page 1772. See Figure 281 for an example display of the SHOW MLS QOS MAPS POLICED-DSCP command.

```
POLICED-DSCP-MAP:
   DSCP 5
-----------------
   New DSCP 7
```

Figure 281. SHOW MLS QOS MAPS POLICED-DSCP Command

Example

The following example displays the mappings between the existing DSCP with a value of 5 and the new DSCP value.

```
awplus> enable
awplus# show mls qos maps policed-dscp 5
```

TRUST DSCP

Syntax

```
trust dscp
```

Parameters

None

Mode

Policy Map Class mode

Description

Use this command to trust the DSCP field in an IP packet header to prioritize and preserve their prioritization values in Layer 3 packets. You set this command within a policy map, thereby enabling the policy map to trust DSCP frames. By default, the DSCP field in Layer 3 packets is ignored by the software. This command consults the DSCP-queue map, configured with the MLS QOS MAP DSCP-QUEUE command, to prioritize ingress traffic. See “MLS QOS MAP DSCP-QUEUE” on page 1770.

When you set a port to trust DSCP frames, the CoS value in the VLAN tag field is re-marked. For example, using the default DSCP settings in Table 231 on page 1691, a trust DSCP value of 46 on the ingress port causes it to egress on queue 5. As a result, the CoS frame will be re-marked to 5. This switch behavior exists so a packet carries both Layer 2 CoS packets and Layer 3 DSCP frames as it is passes downstream through the network.

> **Note**
> If the frame is not set to egress as a tagged frame, the CoS value is not an issue, because in this case, the entire VLAN tag is stripped off the frame.

Use the NO TRUST DSCP command to remove the DSCP trust setting from the specified policy map.

Examples

This example enables the DSCP-queue map lookup for the prioritization of all traffic classified by a class map named “cmap1:”

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap1
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# trust dscp
```

This example removes the DSCP-queue map lookup for the prioritization of all traffic classified by a class map named “cmap1:

```
awplus> enable
awplus# configure terminal
awplus(config)# policy-map pmap6
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# no trust dscp
```

WRR-QUEUE EGRESS-RATE-LIMIT QUEUES

Syntax

```
wrr-queue egress-rate-limit bandwidth queues
[0|1|2|3|4|5|6|7]
```

Parameters

bandwidth
: Indicates the bandwidth. Specify a value between 64 and 10,000,000 Kbits/second.

[0|1|2|3|4|5|6|7]
: Indicates the queue. You may enter multiple queues separated by commas without spaces.

Mode

Interface Configuration mode

Description

Use this command to set a limit on the bandwidth on a per egress-queue basis that is sent from the specified port queue or queues. Each port has a total of eight queues.

Use the no form of this command, NO WRR-QUEUE EGRESS-RATE-LIMIT QUEUE, to reset the queue to the default speed of the specified port.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Examples

This example sets egress rate limiting on queues 1, 2, and 3 on port 7 to 500 Kbits/second:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config-if)# interface port1.0.7
awplus(config-if)# wrr-queue egress-rate-limit 500 queues
1,2,3
```

This example removes egress rate limiting from port 14:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config-if)# interface port1.0.14
awplus(config-if)# no wrr-queue egress-rate-limit
```

WRR-QUEUE WEIGHT

Syntax

```
wrr-queue weight weight
```

Parameters

weight

Specifies the weight (the number of packets a port transmits from a queue) of a port's egress priority queue for the WRR scheduling method. The default value is 0.

Mode

Interface Configuration mode

Description

Use this command to set the egress scheduling method to WRR on the specified port. In addition, this command specifies the maximum number of packets a port transmits from a queue before moving to the next queue. Each port has a total of eight queues. You may enter multiple queues separated by commas without spaces. By default, WRR is disabled on a port.

Figure 282 displays the default WRR queue mapping for a port. To display the WRR queue mapping of a specific port, use the SHOW MLS QOS INTERFACE command.

```
Queue:  0  1  2  3  4  5  6  7
--------------------------------
Weight: 0  0  0  0  0  0  0  0
```

Figure 282. Default Mapping of WRR Queues

If you add multiple weights to this command, the queues are defined beginning with queue 0. For example, the following command creates a mapping of WRR queues for the specified port, as shown in Figure 283 on page 1815:

```
wrr-queue weight 9,8,7
```

```
Queue:  0  1  2  3  4  5  6  7
--------------------------------
Weight: 9  8  7  0  0  0  0  0
```

Figure 283. Mapping of WRR Queues

Use the no form of this command, NO WRR-QUEUE WEIGHT, to remove the WRR settings from the specified port. In addition, the no form of this command turns off WRR and turns on strict priority forwarding.

Confirmation Command

"SHOW MLS QOS INTERFACE" on page 1802

Examples

This example assigns queue 0 of port 3 to WRR with a weight of 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# interface port1.0.3
awplus(config-if)# wrr-queue weight 15
```

This example assigns weights in ascending order to queues 0 through 7 of port 12 to WRR with weights of 15, 14, 13, 12,11,10, 9, and 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# interface port1.0.12
awplus(config-if)# wrr-queue weight 15,14,13,12,11,10,9,8
```

This example removes the QoS weight from port 3, turns off WRR, and turns on Strict Priority forwarding:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface port1.0.3
awplus(config-if)# no wrr-queue weight
```

Chapter 104

QoS Storm Control Protection

This chapter describes the following topics:

Overview

The QoS Storm Control Protection (QSP) feature uses QoS mechanisms to classify traffic that is likely to cause a packet storm, which can consist of broadcast, multicast, or unicast traffic, and decide which action to take when a packet storm occurs. Without QSP, the per-port storm protection mechanism discards traffic that exceeds the configured limit. However, with QSP, the following actions are possible when a storm is detected:

- Removes a port from a VLAN
- Shuts down a port on the switch
- Disables the port in software

In addition to determining the action taken when a packet storm occurs, the storm control commands allow you to determine:

- The length of time the port remains disabled after a packet storm
- The data rate that triggers the storm control action
- The frequency at which traffic is measured

This is a policy-based feature. As a result, you must configure a class map (or multiple class maps) that identifies the broadcast, multicast, or unicast traffic and assign it to a policy map *before* setting the storm control commands. For instructions, see “Creating a Policy Map” on page 1688 and “Creating a Class Map” on page 1681.

One example of how the QSP commands work in conjunction with the QoS policies is the method of assigning a policy map to a port. This association is accomplished with the SERVICE-POLICY INPUT command. (See “Assigning a Policy Map to a Port” on page 1689.) The same port is affected by the setting for the storm control action if a packet storm occurs.

In addition, the setting of the MATCH commands within the class maps helps to determine what type of traffic triggers the storm control action. For instance, the MATCH DSCP command contained within a class map determines that the storm control settings affect specified DSCP traffic during a packet storm. This setting is used in combination with the data rate setting when the DSCP traffic reaches the configured data rate. Consequently, the storm control action only applies when DSCP traffic reaches the data rate. If other types of traffic exceed the data rate, the storm control action is not triggered. (For a list of the MATCH commands, see “Filtering Incoming Traffic” on page 1681.)

The QSP feature is configured and displayed with six storm control commands. All of the commands that begin with "STORM," such as STORM ACTION and STORM WINDOW, pertain to QSP.

See Table 262 for an explanation of the basic concepts involved with storm protection.

Table 262. Policy Based QoS Storm Protection Concepts

Concept	Description
Protection	Enables the QSP feature.
Window	Sets the frequency at which traffic is measured to determine whether storm protection should be activated.
Rate	Indicates the amount of traffic per second that must be exceeded before the switch takes the configured action.
Action	Determines which action the switch takes when it detects a storm on a port.
Downtime	Indicates the length of time the port remains disabled after a port has been disabled due to a packet storm.

This feature consists of the six commands listed in Table 263. You configure the QSP commands in the Policy Map Class mode. However, you display the QSP settings in the Privileged Exec mode.

Table 263. Policy-Based QSP Commands

To do this Task	Use this Command
Enables the policy-based QSP feature. This is an important command because without it, none of the following commands take effect.	`storm-protection`
Sets the action the interface takes when triggered by QSP.	`storm-action` *portdisable|vlandisable|linkdown*
Sets the time, in seconds, the port is re-enabled after being disabled by the QSP feature.	`storm-downtime` *<1 - 86400>*
Sets the data rate criteria for triggering the storm action in kbps.	`storm-rate` *<1 - 10000000>*

Table 263. Policy-Based QSP Commands (Continued)

To do this Task	Use this Command
Sets the frequency (in milliseconds) that traffic is measured to determine if storm protection is activated.	`storm-window <100 - 6000>`
Displays the QSP status for the specified port.	`show mls qos interface port storm-status`

When the software detects a storm on a port, a message is automatically recorded in the Event log or Syslog. In addition, you can configure a Linkdown trap to signal that a port has been disabled with the SNMP TRAP LINK-STATUS command. See “SNMP TRAP LINK-STATUS” on page 1204.

Enabling Policy-Based QSP

To enable QSP, use the STORM PROTECTION command. You enable storm protection on a policy map. Storm protection is activated as soon as a port is enabled which occurs *before* the port forwards frames. For more information about this command, see "STORM-PROTECTION" on page 1835.

The following example enables the QSP feature on a policy map called "pmap2."

Table 264. Enabling the Storm Protection Feature

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus(config)# policy-map pmap2`	Creates a policy map called "pmap2" and enters the Policy Map mode.
`awplus(config-pmap)# class cmap2`	Associates an existing class map, called "cmap2," to policy map "pmap2" and enters the Policy Map Class mode.
`awplus(config-pmap-c)# storm-protection`	Enables the QSP feature.

Setting the Storm Control Action

To determine which action the switch takes when the configured limits are reached, use the STORM-ACTION command. There are three possible actions:

- Removes a port from a VLAN
- Disables a port in software
- Shuts down a port on the switch

All three options disable a port in some way. This down state is temporary, and the length of time it lasts is determined by the value of the STORM-DOWNTIME command. See “Setting Storm Control Down Time” on page 1825.

When a port is removed from a VLAN, the port stops receiving traffic from that VLAN. However, a port may be assigned to two VLANs. In this case, the port could still receive traffic from the second VLAN.

The following storm control action examples are provided:

- “Disabling a VLAN” on page 1822
- “Disabling a Port” on page 1823
- “Shutting Down a Port” on page 1824

For more information about this command, see “STORM-ACTION” on page 1832.

Disabling a VLAN

The following example sets the storm control action to remove port 7 from a VLAN with a VID of 2 when a packet storm occurs. A policy map named “pmap3” is assigned to port 7. Also, pmap3 contains a class map named “cmap2” which is configured to match traffic with a VLAN ID of 2.

Table 265. Setting Storm Control Action: Disabling a VLAN

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus(config)# class-map cmap2`	Creates a class map called “cmap2.”

Table 265. Setting Storm Control Action: Disabling a VLAN (Continued)

Command	Description
awplus(config-cmap)# match vlan 2	Configures the class map to include traffic from VLAN 2.
awplus(config-cmap)# exit	Exits the Class Map mode and returns to the Global Configuration mode.
awplus(config)# policy-map pmap3	Creates a policy map called "pmap3" and enters the Policy Map mode.
awplus(config-pmap)# class cmap2	Associates class map "cmap2" to policy map "pmap3" and enters the Policy Map Class mode.
awplus(config-pmap-c)# storm-protection	Enables the QSP feature.
awplus(config-pmap-c)# storm-action vlandisable	Sets the storm action to remove a port from VLAN 2.
awplus(config-pmap-c)# exit	Exits the Policy Map Class mode and enters the Policy Map mode.
awplus(config-pmap)# exit	Exits the Policy Map mode and enters the Global Configuration mode.
awplus(config)# interface port1.0.7	Enters the Port Interface mode for port 7.
awplus(config-if)# service-policy input pmap3	Assigns a policy map "pmap3" to port 7.

Disabling a Port

The following example sets the storm protection action to disable the port assigned to the policy map named "pmap2." The STORM-ACTION command set to "portdisable" disables the port in software without physically disabling the port. See Table 266.

Table 266. Setting Storm Control Action: Disabling a Port

Command	Description
awplus> enable	Enters the Privileged Executive mode from the User Executive mode.
awplus# configure terminal	Enters the Global Configuration mode.
awplus(config)# mls qos enable	Activates the QoS feature on the switch.
awplus(config)# policy-map pmap2	Creates a policy map called "pmap2" and enters the Policy Map mode.

Table 266. Setting Storm Control Action: Disabling a Port (Continued)

Command	Description
`awplus(config-pmap)# class cmap1`	Associates an existing class map, called “cmap1,” to policy map “pmap2” and enters the Policy Map Class mode.
`awplus(config-pmap-c)# storm-protection`	Enables the QSP feature.
`awplus(config-pmap-c)# storm-action portdisable`	Sets the storm action to disable a port.

Shutting Down a Port

The following example sets the storm protection action to shut down the port assigned to the policy map named “pmap1.” See Table 267.

Table 267. Setting Storm Control Action: Shutting Down a Port

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus(config)# policy-map pmap1`	Creates a policy map called “pmap1” and enters the Policy Map mode.
`awplus(config-pmap)# class cmap1`	Associates an existing class map, called “cmap1,” to policy map “pmap1” and enters the Policy Map Class mode.
`awplus(config-pmap-c)# storm-protection`	Enables the QSP feature.
`awplus(config-pmap-c)# storm-action linkdown`	Sets the storm action to shut down a port.

Setting Storm Control Down Time

After the storm control action has been triggered, the port assigned to the policy map is disabled. You need to set the time, in seconds, the port remains disabled. After this time expires, the port is re-enabled. You set this time with the STORM-DOWNTIME command. For more information about this command, see "STORM-DOWNTIME" on page 1834.

The following example sets the port down time to 30 seconds on a policy-map called "pmap7."

Table 268. Setting the Storm Down Time

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus(config)# policy-map pmap7`	Creates a policy map called "pmap7" and enters the Policy Map mode.
`awplus(config-pmap)# class cmap4`	Associates an existing class map, called "cmap4," to policy map "pmap7" and enters the Policy Map Class mode.
`awplus(config-pmap-c)# storm-action vlandisable`	Sets the storm action to remove a port from VLAN 2.
`awplus(config-pmap-c)# storm-protection`	Enables the QSP feature.
`awplus(config-pmap-c)# storm-downtime 30`	Sets the storm downtime to 30 seconds.

Setting the Storm Control Speed and Sampling Frequency

You want to set the data rate for triggering policy-based QSP in conjunction with determining the frequency that traffic is sampled. The STORM-RATE command sets the data rate in kbps. The STORM-WINDOW command sets the frequency in milliseconds. For more information about these commands, see “STORM-RATE” on page 1836 and “STORM-WINDOW” on page 1838.

The following example sets the storm rate to 3000 kbps and the storm window size to 200 ms on a policy-map called “pmap7.”

Table 269. Setting the Storm Data Rate and Window Size

Command	Description
`awplus> enable`	Enters the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enters the Global Configuration mode.
`awplus(config)# mls qos enable`	Activates the QoS feature on the switch.
`awplus(config)# policy-map pmap7`	Creates a policy map called “pmap7” and enters the Policy Map mode.
`awplus(config-pmap)# class cmap4`	Associates an existing class map, called “cmap4,” to policy map “pmap7” and enters the Policy Map Class mode.
`awplus(config-pmap-c)# storm-protection`	Enables the QSP feature.
`awplus(config-pmap-c)# storm-rate 3000`	Sets the storm rate to 3000 kbps.
`awplus(config-pmap-c)# storm-action portdisable`	Sets the storm action to disable a port.
`awplus(config-pmap-c)# storm-window 200`	Sets the storm window size to 200 ms.

Displaying Port Storm Status

To display the storm status for the specified port, use the SHOW MLS QOS INTERFACE STORM-STATUS command. This is the command syntax:

```
show mls qos interface port storm-status
```

See Figure 284 for an example of the information displayed by this command. For more information about this command, see "SHOW MLS QOS INTERFACE STORM-STATUS" on page 1830.

```
Interface:            port1.0.12
Storm-Protection:     Enabled
Port-status:          Enabled
Storm Action:         vlandisable
Storm Window:         5000 ms
Storm Downtime:       15 s
Timeout Remaining:    0 s
Last read data-rate:  0 kbps
Storm Rate:           1000 kbps
```

Figure 284. SHOW MLS QOS INTERFACE STORM-STATUS Command

Chapter 105
QSP Commands

The QoS Storm Control Protection commands are summarized in Table 270 and described in detail in this chapter.

Table 270. Quality of Service Commands

Command	Mode	Description
“SHOW MLS QOS INTERFACE STORM-STATUS” on page 1830	Privileged Exec	Displays the storm status for the specified port.
“STORM-ACTION” on page 1832	Policy Map Class	Sets the action to take when triggered by QoS Storm Protection (QSP).
“STORM-DOWNTIME” on page 1834	Policy Map Class	Sets the number of seconds before the port is re-enabled.
“STORM-PROTECTION” on page 1835	Policy Map Class	Enables the policy-based QoS Storm Protection feature.
“STORM-RATE” on page 1836	Policy Map Class	Sets the data rate criteria for triggering the storm action.
“STORM-WINDOW” on page 1838	Policy Map Class	Sets the frequency that data is sampled.

SHOW MLS QOS INTERFACE STORM-STATUS

Syntax

```
show mls qos interface port storm-status
```

Parameters

port
Specifies the port to display. You can view only one port at a time.

Mode

Privileged Exec mode

Description

Use this command to display the storm status for the specified port. See Figure 285 for an example of this information.

```
Interface:            port1.0.5
Storm-Protection:     Enabled
Port-status:          Enabled
Storm Action:         vlandisable
Storm Window:         5000 ms
Storm Downtime:       15 s
Timeout Remaining:    0 s
Last read data-rate:  0 kbps
Storm Rate:           1000 kbps
```

Figure 285. SHOW MLS QOS INTERFACE STORM-STATUS Command

For an explanation of the fields in Figure 285, see Table 271.

Table 271. SHOW MLS QOS INTERFACE STORM-STATUS Command Description

Field	Description
Interface	Lists the name of the port.
Storm-Protection	Indicates if the QSP feature is enabled or disabled.
Port-status	Indicates if the port is enabled or disabled.

Table 271. SHOW MLS QOS INTERFACE STORM-STATUS Command Description (Continued)

Field	Description
Storm Action	Indicates the action the interface takes when triggered by the QSP feature. The choices are portdisable (disable the port), vlandisable (disable the VLAN), and linkdown (shuts down the port).
Storm Window	Indicates the frequency that traffic is measured to determine if storm protection is activated. The range is from 100 to 6,000 ms.
Storm Downtime	Indicates the time, in seconds, the port is reenabled after being disabled by the QoS storm protection feature.The range is from 1 to 86,400 seconds.
Timeout Remaining	Indicates time in seconds.
Last read data-rate	Indicates the most recent data rate in kbps.
Storm Rate	Indicates the data rate criteria for triggering the storm action. The range is 1 to 10,000,000 kbps.

Confirmation Command

None

Example

This example displays the storm status for port 5:

```
awplus# show mls qos interface port1.0.5 storm-status
```

STORM-ACTION

Syntax

```
storm-action portdisable|vlandisable|linkdown
```

Parameters

portdisable
: Disables the port in software.

vlandisable
: Removes the port from the VLAN. This parameter requires that the MATCH VLAN command is present in a class-map. See “MATCH VLAN” on page 1758.

linkdown
: Shuts down the port. In other words, turns off the port on the switch.

Mode

Policy Map Class

Description

Use this command to set the action triggered by QoS Storm Protection (QSP). All three options disable a port in some way. To determine the amount of time that the port is disabled, use the STORM-DOWNTIME command. See “STORM-DOWNTIME” on page 1834.

Use the no form of the command, NO STORM-ACTION, to disable the action set by the STORM-ACTION command.

Confirmation Command

“SHOW MLS QOS INTERFACE STORM-STATUS” on page 1830

Examples

The following example sets the storm protection action to block incoming packets on port 17 from VLAN 5 when a packet storm occurs:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# class-map cmap1
awplus(config-cmap)# match vlan 5
awplus(config-cmap)# exit
```

```
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# storm-protection
awplus(config-pmap-c)# storm-action vlandisable
awplus(config-pmap-c)# exit
awplus(config-pmap)# exit
awplus(config)# interface port1.0.17
awplus(config-if)# service-policy input pmap2
```

The following example negates the storm protection action set on the policy map named "pmap5" and the class-map named "cmap3:"

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# policy-map pmap5
awplus(config-pmap)# class cmap3
awplus(config-pmap-c)# storm-protection
awplus(config-pmap-c)# no storm-action
```

The following example sets the storm protection action to shut down the port assigned to the policy map named "pmap5" and the class-map named "cmap2:"

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# policy-map pmap5
awplus(config-pmap)# class cmap2
awplus(config-pmap-c)# storm-protection
awplus(config-pmap-c)# storm-action linkdown
```

STORM-DOWNTIME

Syntax

```
storm-downtime <1 - 86400>
```

Parameters

<1 - 86400>
Indicates the number of seconds.

Mode

Policy Map Class

Description

Use this command to set the time, in seconds, the port is reenabled after being disabled by the QSP feature. The default is 10 seconds.

Use the no form of the command, NO STORM-DOWNTIME, to return the number of seconds to the default value.

Confirmation Command

“SHOW MLS QOS INTERFACE STORM-STATUS” on page 1830

Examples

The following example sets the downtime to 2 minutes:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# storm-action vlandisable
awplus(config-pmap-c)# storm-protection
awplus(config-pmap-c)# storm-downtime 120
```

The following example returns the default downtime to 10 seconds:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# storm-action linkdown
awplus(config-pmap-c)# storm-protection
awplus(config-pmap-c)# no storm-downtime
```

STORM-PROTECTION

Syntax

```
storm-protection
```

Parameters

None

Mode

Policy Map Class

Description

Use this command to enable the Policy-Based Storm Protection feature. Storm protection is activated as soon as a port is enabled.

Use the no form of the command, NO STORM-PROTECTION, to disable the Storm Protection feature.

Confirmation Command

"SHOW MLS QOS INTERFACE STORM-STATUS" on page 1830

Examples

The following example enables the Storm Protection feature on class map "cmap1:"

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# storm-action linkdown
awplus(config-pmap-c)# storm-protection
```

The following example disables the Storm Protection feature on class map "cmap3:"

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap3
awplus(config-pmap-c)# storm-action vlandisable
awplus(config-pmap-c)# no storm-protection
```

STORM-RATE

Syntax

```
storm-rate <1 - 10000000>
```

Parameters

<1 - 10000000>
Sets the data rate in kbps.

Mode

Policy Map Class

Description

Use this command to set the data rate criteria for triggering the storm control action. There is no default setting.

The STORM-RATE command sets the amount of traffic per second before the configured action is taken. The STORM-WINDOW command sets the frequency that traffic is sampled. As a result, you need to set the STORM-WINDOW command in conjunction with the STORM-RATE command. See “STORM-WINDOW” on page 1838.

Use the no form of this command, NO STORM-RATE, to remove the data rate criteria.

Confirmation Command

“SHOW MLS QOS INTERFACE STORM-STATUS” on page 1830

Examples

The following example sets the data rate to 2000 kbps:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# storm-action vlandisable
awplus(config-pmap-c)# storm-protection
awplus(config-pmap-c)# storm-rate 2000
```

The following example disables the storm-rate setting:

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap1
awplus(config-pmap-c)# storm-action portdisable
awplus(config-pmap-c)# storm-protection
awplus(config-pmap-c)# no storm-rate
```

STORM-WINDOW

Syntax

```
storm-window <100 - 6000>
```

Parameters

<100 - 6000>
: Indicates the window size, measured in ms. Enter this value in multiples of 100.

Mode

Policy Map Class

Description

Use this command to set the frequency at which traffic is measured to determine if storm protection is activated. The command sets the time to poll the data rate every given milliseconds. The minimum window size is 100 ms and the maximum window size is 60 seconds.

The STORM-WINDOW command sets the frequency that traffic is sampled. The STORM-RATE command sets the amount of traffic per second before the configured action is taken. As a result, you need to set the STORM-WINDOW command in conjunction with the STORM-RATE command. See “STORM-RATE” on page 1836.

Use the no form of this command, NO STORM-WINDOW command, to disable the setting of the STORM-WINDOW command.

Confirmation Command

“SHOW MLS QOS INTERFACE STORM-STATUS” on page 1830

Examples

The following example sets the QSP window size to 5000 ms on class map “cmap1:”

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap1
awplus(config-pmap)# storm-action vlandisable
awplus(config-pmap-c)# storm-protection
awplus(config-pmap-c)# storm-window 5000
```

The following example disables the storm-window setting on class map "cmap5:'

```
awplus> enable
awplus# configure terminal
awplus(config)# mls qos enable
awplus(config)# policy-map pmap2
awplus(config-pmap)# class cmap5
awplus(config-pmap)# storm-action portdisable
awplus(config-pmap-c)# storm-protection
awplus(config-pmap-c)# no storm-window
```

Section XIV

Routing

This section contains the following chapters:

Chapter 106

Internet Protocol Version 4 Packet Routing

This chapter describes the following topics:

Overview

This section contains an overview of the IPv4 routing feature on the switch and begins with an explanation of the following available routing methods:

- Routing interfaces - Routing interfaces are used to route IPv4 packets between the networks that are local to the switch. Local networks are networks that are connected directly to the switch. Routing interfaces are completely independent of static routes and RIP. You may be able to meet all of your routing requirements with routing interfaces if all of the networks are local to the switch. This feature is explained in “Routing Interfaces” on page 1845.
- Static routes - Static routes are used to route IPv4 packets to networks that are not directly connected to the switch. These are referred to as remote networks. Static routes are entered manually into the routing table in the switch and consist of the IP addresses of the remote destinations and the next hops to the destinations. Static routes always remain in the routing table even when the routes are not being used. This feature is described in “Static Routes” on page 1846.
- RIP version 1 and 2 - This routing protocol allows the switch to dynamically learn routes to remote destinations. The protocol makes it possible for the RIP routers of a network to dynamically share their routes by advertising their routing tables to each other. The switch supports versions 1 and 2 of this routing protocol. This feature is explained in “Routing Information Protocol (RIP)” on page 1847.

This overview also contains an explanation of the role played by routing interfaces with some of the management features of the switch, and how those features are dependent on there being at least one routing interface on the switch. A few examples of the management functions include uploading and downloading files to the switch using a TFTP server and the enhanced stacking feature. For information, refer to “Routing Interfaces and Management Features” on page 1854.

At the end of this overview is an example that illustrates the routing commands. You can refer there to see how the commands are used in practice. The section is “Example of the Routing Commands” on page 1855.

In the following discussions, unless stated otherwise the terms “local networks” refer to networks that are directly connected to the switch, and “remote networks” and “remote destinations” refer to networks that are not directly connected to the switch and are reached through other routing devices.

Routing Interfaces

Routing interfaces are used to route IPv4 packets between the networks that are local to the switch. Local networks are directly connected to the switch. Routing interfaces are applied to VLANs, and there can only be one routing interface per VLAN. Thus, each VLAN on the switch should have only one IPv4 network. Once you have applied routing interfaces to two or more VLANs, the switch automatically begins to route IPv4 packets across the VLAN boundaries.

Routing interfaces are an independent routing function and are not dependent on static routes or RIP to pass IPv4 traffic on the switch. The switch automatically begins to route IPv4 packets among its local networks in the different VLANs, as soon as you have defined two or more routing interfaces.

Routing interfaces have two components:

- VLAN ID (VID)
- IP address and subnet mask

VLAN ID (VID)

Routing interfaces are assigned to VLANs. The VLANs are identified by their VLAN identification (VID) numbers or names. You have to create the VLANs first before the routing interfaces.

IP Address and Subnet Mask

A routing interface must be assigned an IP address and subnet mask. The IP address must be a unique member of the local network in which the routing interface is to route IPv4 packets. The IP address and subnet mask of a routing interface can be assigned manually or supplied by a DHCP or BOOTP server on the network.

Static Routes

Static routes are used to route IPv4 packets to networks that are not directly connected to the switch. Such networks are referred to as remote networks. Static routes are manually added into the routing table in the switch and consist of the network addresses of the remote destinations and the next hops to the destinations.

Before a static route to a remote destination can be added to the switch, the switch must already have a routing interface on the VLAN where the next hop of the route is located. Furthermore, the IP addresses of the next hop of the route and the routing interface in the VLAN must be members of the same network.

For example, if you want to add a static route that has as its next hop the IP address 149.122.35.77 and mask 255.255.255.0, the VLAN where the next hop is located would need a routing interface with an IP address in the 149.122.35.0 network.

Static routes are available to all of the routing interfaces and VLANs on the switch. New static routes become functional immediately and are never deleted from the routing table by the switch, even when they are inactive. They cannot be disabled. If you do not want the switch to use a static route, you must delete it from the table.

Static routes also have a parameter for assigning an administrative distance. The switch uses the administrative distance to select a route when there is more than one route with the same destination address prefix. The lower the administrative distance, the higher the route preference.

Routing Information Protocol (RIP)

The switch supports Routing Information Protocol (RIP) versions 1 and 2. The protocol allows the switch to learn routes to remote destinations by sharing the contents of its routing table with its neighboring routers in the network.

RIP is a fairly simple distance-vector routing protocol that defines networks based on the number of hops that are from the switch. A network that is more than fifteen hops away (one hop is one link) is considered as unreachable and is not included in the routing table.

RIP version 2 permits the addition of subnet masks and next-hop information in RIP updates. This allows the use of different sized subnet masks on different networks within the same classful network.

RIP advertisements are automatically activated when the protocol is added to a routing interface on the switch. An interface sends RIP packets to the RIP multicast address 224.0.0.9 when sending version 2 packets or uses the broadcast address when sending out version 1 packets.

A route is propagated by RIP if its status at the physical level is active. An active route has at least one active port in the VLAN. RIP does not propagate an inactive route where there are no active ports in the VLAN.

RIP can be added to a maximum of 100 interfaces on the switch, and the route table can store up to 1024 dynamic routes.

Since the interfaces on the switch can route packets among the local networks without the presence of RIP or static routes, the routing protocol is only necessary if the switch needs to learn remote destinations by sharing the switch's routing table with the neighboring routers, and you choose not to specify the routes manually with static routes.

A route learned by RIP is immediately added to the routing table, where it becomes available to all the interfaces on the switch.

When you add RIP to an interface, you can specify the type of RIP packets the routing protocol is to send and receive. The switch can send either version 1 or 2 packets and accept either or both versions.

Version 2 supports the addition of a password of up to sixteen alphanumeric characters. The password is used by the routers to check for bogus routing update packets. The switch adds the password into the routing table when it broadcasts the contents of the table to its neighboring routing devices, which check the password prior to updating their tables.

The switch transmits its routing table every thirty seconds from those interfaces that have RIP. This interval is adjustable on the switch with “TIMERS BASIC” on page 1933. The entire table is sent with the following exceptions:

- Dynamic RIP routes that fall under the split horizon rule.
- Inactive interface routes where there are no active ports in the VLAN.

Note
The switch does not support the RIP holddown and flush timers.

The switch supports the following RIP functions:

- Split horizon
- Split horizon with poison reverse
- Autosummarization of routes

Default Route

A default route is a "match all" destination entry in the routing table. The switch uses it to route packets whose remote destinations are not in the routing table. Rather than discard the packets, the switch sends them to the next hop specified in the default route.

The default route has a destination IP address of 0.0.0.0 and a mask of 0.0.0.0. The default route can be enter manually in the form of a static route or learned through RIP. The switch can have only one default route.

The command to create the default route is the IP ROUTE command in the Global Configuration mode. This command is also used to create static routes to remote destinations. You may use either of the following commands to create the default route:

```
ip route 0.0.0.0/0 ipaddress
```

```
ip route 0.0.0.0 0.0.0.0 ipaddress
```

The IPADDRESS parameter is the IP address of the next hop of the default route. An example of the command is shown in "Adding Static and Default Routes" on page 1858.

Before you can create the default route, the switch must already have a routing interface whose network address includes the next hop of the default route. The switch rejects the command if the routing interface does not already exist.

Routing Table

The switch has a routing table of local and remote networks The local networks are the routing interfaces on the VLANs on the switch. The remote networks are static routes or routes learned through RIP. Each remote route is uniquely identified in the table with the following information:

- The network address of the remote destination
- The administrative distance
- The metric
- The IP address of the next hop
- The ID of the VLAN of the next hop

When the switch receives an IPv4 packet, it scans the routing table to find the most specific route to the destination and then forwards the packet to the next hop of the route. If the switch does not find a direct route to the remote destination, and no default route exists, the switch discards the packet and sends an ICMP message to that effect back to the source.

The switch advertises its routing table every thirty seconds from those VLANs that have RIP. The time interval is adjustable with “TIMERS BASIC” on page 1933. The switch also advertises its routing table and resets the timer to zero whenever there is a change to the table, thereby ensuring that the neighboring routers are immediately informed of updates to the table.

Dynamic RIP routes are removed from the table when they are not kept up to date (refreshed) by the neighboring routers. The metric of a route that is not refreshed is increased to 16 to indicate an unreachable network. Routes that are not updated after 180 seconds are deleted from the table.

The maximum storage capacity of the routing table in the switch is:

- Interface routes: 4094
- Interface and static routes: 4000
- Interface, static, and RIP routes: 4000

Address Resolution Protocol (ARP) Table

The switch has an ARP table. The switch uses the table to store the IP addresses and Ethernet MAC addresses of the network devices. It refers to the table to determine the destination MAC addresses of the nodes, as well as the VLANs and ports from where the nodes are reached.

The ARP table can store both static and dynamic entries. Static entries are entered manually. This type of entry is never removed by the switch from the ARP table, even when the corresponding nodes are inactive.

Dynamic entries are learned by the switch itself. Dynamic entries of inactive nodes are periodically removed from the table to prevent the table from filling with entries of inactive nodes.

The switch learns addresses by sending out ARP requests. It generates an ARP request when it receives a packet in which the source and destination IP addresses are located in different networks, and the destination MAC address is not in its ARP table. (The switch does not send an ARP request if the source and destinations IP addresses are in the same network.) The switch, after receiving the ARP response from the destination node, adds the IP address and MAC address of the node to its ARP table and begins to route packets to the device. It should be noted that the switch, until it receives a response to its ARP request, discards all routed packets intended for the destination node.

The switch can also learn addresses when it is the destination of an ARP request from another node, such as when it is pinged by a management station. The switch adds the source IP address and MAC address in the request from the node to the table when it responds to the ARP request.

Dynamic ARP entries are aged from the table according to the ARP cache timeout value to protect the table from filling with entries of inactive hosts. The default setting for the timeout value is 150 seconds. This value is adjustable with the SET IP ARP TIMEOUT command. Static ARP entries are not aged and are retained in the table even when the nodes are inactive.

The storage capacity of the ARP table in the switch is:

- 1024 static entries
- 1024 dynamic entries

Internet Control Message Protocol (ICMP)

ICMP allows routers to send error and control messages to other routers or hosts. It provides the communication between IP software on one system and IP software on another. The switch implements the ICMP functions listed in Table 272.

Table 272. ICMP Messages

ICMP Packet (Type)	Switch Response
Echo reply (0)	This is used to implement the “ping” command common to most UNIX and TCP implementations. The switch sends out an “Echo reply” packet in response to an “Echo request.”
Destination unreachable (3)	This message is sent when the switch drops a packet because it does not have a route to the destination.
Source Quench (4)	The switch sends a “Source Quench” if it drops a packet due to insufficient internal resources. This can happen if the source is sending data too fast to be forwarded.
Redirect (5)	The switch issues a “redirect” packet 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).
Echo request (8)	This is related to (1) and results in an “echo reply” packet being sent. The switch can also generate an “echo request” packet as a result of the PING command.

Table 272. ICMP Messages (Continued)

ICMP Packet (Type)	Switch Response
Time to Live Exceeded (11)	The switch sends a "Time to live exceeded" packet if the value in a packet's TTL field, the maximum number of permitted hops, is zero. This occurs when a route has too many hops for a packet.

Routing Interfaces and Management Features

Routing interfaces are primarily used to route IPv4 packets. But they are also used to assign the switch an IP address, which is a requirement for the management features in Table 27 on page 296. The switch uses the IP addresses of the routing interfaces as its source addresses when it communicates with other network devices on the network, such as TFTP and syslog servers.

If you want to use any of the management functions in Table 27 on page 296, but not the IPv4 routing feature, assign the switch only one routing interface. The switch does not route IPv4 packets if it has only one routing interface. You should assign the routing interface to the VLAN from which the switch is to access the management network devices. These devices may be members of the VLAN or accessed through routers or Layer 3 devices.

The switch is capable of accessing network devices from any VLAN that has a routing interface. So if you use the IPv4 routing feature and add routing interfaces to multiple VLANS, the switch will be able to use the different routing interfaces to access management devices on different VLANs.

Example of the Routing Commands

This section contains an example of the commands of the IPv4 routing feature. The example has the following sections:

The switch in the example has four local networks in separate VLANs. The table below lists the relevant information.

Table 273. IPv4 Routing Example

Company Group	VLAN Name	VID	Network IP Address	Subnet Mask	IP Routing Interface Address	Switch Ports[1]
Sales	Sales	4	149.35.67.0	255.255.255.0	149.35.67.11	U: 1-11 T: 50
Production	Production	5	149.35.68.0	255.255.255.0	149.35.68.24	U: 12-20 T: 50
Engineering	Engineering	11	149.35.69.0	255.255.255.0	149.35.69.23	U: 21 - 30 T: 50
Inventory	Inventory	15	149.35.70.0	255.255.255.0	149.35.70.45	U: 31 - 40 T: 50

1. U - untagged ports; T - tagged ports

Creating the VLANs

The first step is to create the VLANs for the local networks on the switch. The VLANs must be created before the routing interfaces. The following series of commands creates a VLAN for the Sales department with the VID 4 and the appropriate ports:

`awplus> enable`	Enter the Privileged Executive mode from the User Executive mode.
`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# vlan database`	Enter the VLAN Configuration mode.

`awplus(config-if)# vlan 4 name Sales`	Create the Sales VLAN with the ID 4.
`awplus(config-if)# exit`	Return to the Global Configuration mode.
`awplus(config)# interface port1.0.1-port1.0.11, port1.0.50`	Enter the Port Interface mode for ports 1 to 11.
`awplus(config-if)# switchport mode access`	Designate the ports as untagged ports.
`awplus(config-if)# switchport access vlan 4`	Add the ports to the Sales VLAN.
`awplus(config-if)# interface port1.0.50`	Enter the Port Interface mode for port 50.
`awplus(config-if)# switchport mode trunk`	Designate the port as a tagged port.
`awplus(config-if)# switchport trunk allowed vlan add 4`	Add the port to the Sales VLAN as a tagged port.
`awplus(config-if)# end`	Return to the Privileged Exec mode.
`awplus# show vlan all`	Confirm the new VLAN.
	Repeat the previous steps to create the other three VLANS.

Creating the Routing Interfaces

Now that the VLANs are created, you may use the IP ADDRESS command to add the routing interfaces for the individual networks to the VLANs. This command creates routing interfaces with static IP addresses. (To create routing interfaces with dynamic IP addresses assigned by a DHCP server, refer to “IP ADDRESS DHCP” on page 1867.) The command has this format:

`ip address` *`ipaddress/mask`*

The IPADDRESS parameter specifies the IPv4 address of the new routing interface. You may specify only one IP address. The address must be a unique member of the network in which the routing interface is to reside. The address is specified in this format:

nnn.nnn.nnn.nnn

Where each NNN is a decimal number from 0 to 255. The numbers must be separated by periods.

The MASK parameter specifies the subnet mask for the address. The mask is a decimal number that represents the number of bits, from left to right, that constitute the network portion of the address. For example, the

IPv4 decimal masks 16 and 24 are equivalent to masks 255.255.0.0 and 255.255.255.0, respectively.

There are four local networks in the example, and each network must have its own routing interface. Here are the commands for creating the routing interfaces:

`awplus# configure terminal`	Enter the Global Configuration mode.
`awplus(config)# interface vlan4`	Enter the VLAN Interface mode for the Sales VLAN with the ID 4.
`awplus(config-if)# ip address 149.35.67.11/24`	Create the IP routing interface 149.35.67.11 in the Sales VLAN.
`awplus(config-if)# interface vlan5`	Enter the VLAN Interface mode for the Production VLAN with the ID 5.
`awplus(config-if)# ip address 149.35.68.24/24`	Create the IP routing interface 149.35.68.24 in the Production VLAN.
`awplus(config-if)# interface vlan11`	Enter the VLAN Interface mode for the Engineering VLAN with the ID 11.
`awplus(config-if)# ip address 149.35.69.23/24`	Create the IP routing interface 149.35.69.23 in the Engineering VLAN.
`awplus(config-if)# interface vlan15`	Enter the VLAN Interface mode for the Inventory VLAN with the ID 15.
`awplus(config-if)# ip address 149.35.70.45/24`	Create the IP routing interface 149.35.70.45 in the Inventory VLAN.
`awplus(config-if)# end`	Return to the Privileged Exec mode.
`awplus# show ip interface`	Confirm the new routing interfaces.

At this point, the switch begins to route IPv4 packets among the four local networks.

Adding Static and Default Routes

Building on our example, assume you decide to manually enter a static route to a remote network. Here is the information you need to know to create static routes:

- The network address of the remote destination.
- The subnet mask of the remote destination.
- The IP address of the next hop.
- The administrative distance of the route. This is optional.

The command for creating static routes is the IP ROUTE command in the Global Configuration mode. Here is the format of the command:

`ip route` *ipaddress1 mask ipaddress2* [*admin*]

The IPADDRESS1 parameter specifies the IP address of a remote destination network, subnet, or node. The IP address for the default route is 0.0.0.0.

The MASK parameter specifies the mask of the IP address. The mask represents the number of bits, from left to right, that constitute the network portion of the address. The mask may be entered in IP notation (e.g., 255.255.255.0) or decimal notation (e.g., /24).

The IPADDRESS2 parameter specifies the IP address of the next hop to the remote destination network, subnet, or node. This address must be a member of the same network as one of the existing routing interfaces on the switch.

The ADMIN parameter specifies the administrative distance of the route. The range is 1 to 255. The default is 1.

For example, assume you decide to add a static route to the remote network 149.35.22.0, which has this mask: 255.255.255.0. Also assume that the IP address of the next hop is 149.35.70.26, making it part of the Inventory VLAN, ID 15, in the example in Table 273 on page 1855. Although the VLAN is mentioned here, you do not include it in the command because the switch automatically adds the static route to the appropriate VLAN for you. Here is the command:

```
awplus(config)# ip route 149.35.22.0/24 149.35.70.26
```

Static routes become available to all of the interfaces on the switch as soon as you create them with this command.

Now assume you want to create a default route for packets that have a destination address to an unknown network. The switch can have only one default route. All you need to know to create the default route is the IP address of the next hop for the packets. For this example, assume that the IP address of the next hop is 149.35.68.12, placing the next hop in the Production VLAN, ID 5. Here is the command for creating the default route:

```
awplus(config)# ip route 0.0.0.0/0 149.35.68.12
```

Activating RIP

Rather than adding static routes to remote destinations, or perhaps to augment them, you decide to activate RIP to allow the switch to learn new routes by advertising its routing table to its neighbors. The switch has a series of RIP commands, but this section mentions only two of them. The first command is the NETWORK command in the Router Configuration mode. You use this command to perform two functions. You use it to indicate which of the local networks are to be advertised to the RIP neighbors and which VLANs are to transmit the RIP update packets. Here is the format of the command:

```
network ipaddress/mask|vlanid
```

You can identify the VLAN by the network address and mask of its routing interface or the VID of the VLAN, preceded by “VLAN.”

The other command is the PASSIVE-INTERFACE command, also found in the Router Configuration mode. You use this command to block VLANs, on which RIP has been activated, from transmitting RIP update packets. This command is intended for VLANs that are not connected to RIP neighbors. Here is the format of the command:

```
passive-network vlanid
```

You identify the interface by its VID number.

Returning to the example in Table 273 on page 1855, assume that the Inventory VLAN has a RIP neighbor to which the switch is to transmit and receive RIP update packets. To activate RIP on the VLAN so that it transmits and receives RIP packets and to include the Inventory network in the advertisements, you use the NETWORK command in the Router Configuration mode.

Also assume you want the switch to advertise all four local networks in the RIP update packets, but not transmit RIP update packets on the Sales, Production, and Engineering VLANs because they are not connected to RIP neighbors. To accomplish that, you need to perform the NETWORK command on three VLANs so that RIP includes their networks in the RIP update packets, and the PASSIVE-INTERFACE command to keep the VLANs from advertising RIP update packets.

Here are the commands for activating RIP on the four VLANs. Note that the PASSIVE-INTERFACE command is used to block the Sales, Production, and Engineering VLANs (VIDs 4, 5, and 11, respectively) from advertising RIP update packets, because in our example, the VLANs are not connected to RIP neighbors. The command is not performed on the Inventory VLAN (VID 15), because it is connected to a RIP neighbor:

`awplus(config)# router rip`	Enter the Router Configuration mode.
`awplus(config-router)# network vlan4`	Activate RIP on VLAN 4 to include its network address in the RIP update packets.
`awplus(config-router)# passive-interface vlan4`	Configure RIP in VLAN 4 not to send update packets.
`awplus(config-router)# network vlan5`	Activate RIP on VLAN 5 to include its network address in the RIP update packets.
`awplus(config-router)# passive-interface vlan5`	Configure VLAN 5 not to send RIP update packets.
`awplus(config-router)# network vlan11`	Activate RIP on VLAN 11 to include its network address in the RIP update packets.
`awplus(config-router)# passive-interface vlan11`	Configure VLAN 11 not to send RIP update packets.
`awplus(config-router)# network vlan15`	Activate RIP on VLAN 15 to include its network address in the RIP update packets. (Do not perform the PASSIVE-INTERFACE command on this VLAN because it is to transmit RIP update packets to its RIP neighbor.)

You may specify the interfaces in the NETWORK command by their respective network addresses instead of their VLAN IDs. This is illustrated in this command, which activates RIP on VLAN 4:

```
awplus(config-router)# network 149.35.67.0/24
```

For further information on RIP, refer to Chapter 108, "Routing Information Protocol (RIP)" on page 1881 and Chapter 109, "Routing Information Protocol (RIP) Commands" on page 1895.

Chapter 107

IPv4 Routing Commands

The IPv4 routing commands are summarized in Table 274 and described in detail within the chapter.

Table 274. IPv4 Routing Commands

Command	Mode	Description
“IP ADDRESS” on page 1865	VLAN Interface	Creates IPv4 routing interfaces with static addresses.
“IP ADDRESS DHCP” on page 1867	VLAN Interface	Creates IPv4 routing interfaces with dynamic addresses from a DHCP server.
“IP ROUTE” on page 1868	Global Configuration	Creates static routes to remote destination networks and the default gateway address.
“NO IP ADDRESS” on page 1871	VLAN Interface	Deletes routing interfaces that have static addresses.
“NO IP ADDRESS DHCP” on page 1873	VLAN Interface	Deletes routing interfaces that have dynamic addresses.
“NO IP ROUTE” on page 1875	Global Configuration	Deletes static routes and the default gateway.
“SHOW IP INTERFACE” on page 1877	Privileged Exec	Displays the IPv4 routing interfaces on the switch.
“SHOW IP ROUTE” on page 1879	Privileged Exec	Displays the routes to local and remote destination networks and the default gateway.

Note
The commands in this chapter may be used to configure the switch as a router of IPv4 packets. These commands may also be used to assign the switch an IPv4 management address to add support for the management functions listed in Table 27 on page 296. If you do not want the switch to route IPv4 packets, but want to assign it an IP address, refer to Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295 and Chapter 14, “IPv4 and IPv6 Management Address Commands” on page 309.

Note
The switch does not support IPv6 packet routing, but it does support one IPv6 management address. For instructions on how to create an IPv6 management address, refer to Chapter 13, “IPv4 and IPv6 Management Addresses” on page 295 and Chapter 14, “IPv4 and IPv6 Management Address Commands” on page 309.

IP ADDRESS

Syntax

```
ip address ipaddress/mask
```

Parameters

ipaddress

Specifies an IPv4 address for a new routing interface. You may specify only one IP address. The address must be a unique member of the network in which the interface is to reside. The address is specified in this format:

nnn.nnn.nnn.nnn

Where each NNN is a decimal number from 0 to 255. The numbers must be separated by periods.

mask

Specifies the subnet mask for the address. The mask is a decimal number that represents the number of bits, from left to right, that constitute the network portion of the address. For example, the IPv4 decimal masks 16 and 24 are equivalent to masks 255.255.0.0 and 255.255.255.0, respectively.

Mode

VLAN Interface mode

Description

Use this command to create IPv4 routing interfaces with static IP addresses. You can create only one routing interface at a time with this command. A VLAN can have only one routing interface. To create routing interfaces that have dynamic addresses from a DHCP server, refer to "IP ADDRESS DHCP" on page 1867.

Confirmation Command

"SHOW IP INTERFACE" on page 1877

Examples

This example adds a new routing interface to the Default VLAN, which has the VID 1.The interface is assigned the IP address 142.35.78.21 and subnet mask 255.255.255.0:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip address 142.35.78.21/24
```

This example creates an IP routing interface with the IP address 116.152.173.45 and subnet mask 255.255.255.0, in a VLAN with the ID 14:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan14
awplus(config-if)# ip address 116.152.173.45/24
```

IP ADDRESS DHCP

Syntax

```
ip address dhcp
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to create IPv4 routing interfaces with dynamic addresses a DHCP server assigns. You may create only one routing interface at a time with this command. A VLAN can have only one routing interface. The switch immediately begins to query the network for a DHCP server as soon as you enter the command. To create routing interfaces that have static addresses, refer to "IP ADDRESS" on page 1865.

Confirmation Commands

"SHOW IP INTERFACE" on page 1877

Examples

This example creates an IP routing interface in the Default VLAN, which has the VID 1. The IP address of the interface is supplied by a DHCP server:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan1
awplus(config-if)# ip address dhcp
```

This example creates an IP routing interface in a VLAN with the VID 81. The IP address of the interface is assigned by a DHCP server:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan81
awplus(config-if)# ip address dhcp
```

IP ROUTE

Syntax

`ip route` *ipaddress1 mask ipaddress2* [*admin*]

Parameters

ipaddress1
: Specifies the IP address of a remote destination network, subnet, or node. The IP address for the default route is 0.0.0.0/0.

mask
: Specifies the mask of the IP address. The mask represents the number of bits, from left to right, that constitute the network portion of the address. The mask may be entered in IP notation (e.g., 255.255.255.0) or decimal notation (e.g., /24).

ipaddress2
: Specifies the IP address of the next hop to the remote destination network. This address must be a member of the same network as one of the existing routing interfaces on the switch.

admin
: Specifies the administrative distance of the route. The switch uses the administrative distance to select a route when there is more than one route with the same destination address prefix. The lower the administrative distance, the higher the route preference. The range is 1 to 255. The default for a static route is 1.

Mode

Global Configuration mode

Description

Use this command to create static routes and the default route. You may create only one route at a time with this command. Here are the guidelines for creating static routes:

- Before you can add a new static route, the switch must already have a routing interface with an IP address that is a member of the same network as the next hop of the new static route.
- The switch does not support multiple static routes with the same destination address prefix.

The switch uses the default route to route packets to remote destination networks that are not listed in its routing table. Here are the guidelines for creating the default route:

- The switch can have only one default route.
- The IP address and mask of the destination network for the default route in the command is 0.0.0.0/0.
- The switch must already have a routing interface with an IP address that is a member of the same network as the next hop of the default route.

Confirmation Command

"SHOW IP ROUTE" on page 1879

Examples

This example adds a route to the destination network 149.67.101.0 and mask 255.255.255.0 to the routing table. The next hop of the route is 149.67.87.3. The example specifies the mask in IP notation:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip route 149.67.101.0 255.255.255.0
149.67.87.3
```

This example adds the same route, but the mask is specified in decimal notation:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip route 149.67.101.0/24 149.67.87.3
```

This example adds a route to the destination network 115.203.0.0 and mask 255.255.0.0 to the routing table. The next hop is 149.101.201.45 and the administrative distance is 10:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip route 115.203.0.0 25.255.0.0
149.101.201.45 10
```

This example adds the same route, but the mask is specified in decimal notation:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip route 115.203.0.0/16 149.101.201.45 10
```

This example assigns the switch the IPv4 default gateway address 143.87.132.45. The mask is specified in IP notation:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip route 0.0.0.0 0.0.0.0 143.87.132.45
```

This example creates the same default gateway address, but the mask is specified in decimal notation:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip route 0.0.0.0/0 143.87.132.45
```

NO IP ADDRESS

Syntax

```
no ip address
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to delete IPv4 routing interfaces with static IP addresses from the switch. You may delete only one routing interface at a time with this command. To delete routing interfaces that have dynamic IP addresses from a DHCP server, refer to "NO IP ADDRESS DHCP" on page 1873. You must perform this command from the VLAN Interface modes of the VLANs in which the routing interfaces reside.

Please review the following guidelines before deleting routing interfaces:

- Deleting a routing interface from a VLAN that has static routes also deletes the static routes.
- Deleting a routing interface from a VLAN that has RIP also deletes RIP from the VLAN.
- If you are remotely managing the switch with Telnet or SSH and delete the routing interface through which you are managing the device, your management session is interrupted. You have to manage the switch locally through the Console port if you delete all of the routing interfaces.
- Deleting a routing interface may stop the switch from performing one or more of the management functions listed in Table 27 on page 296.

Confirmation Command

"SHOW IP INTERFACE" on page 1877

Example

This example deletes the IPv4 routing interface from the VLAN with the VID 15:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan15
awplus(config-if)# no ip address
```

NO IP ADDRESS DHCP

Syntax

```
no ip address dhcp
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to delete IPv4 routing interfaces that have dynamic IP addresses a DHCP server assigned. You may delete only one routing interface at a time with this command. To delete routing interfaces with static addresses, refer to "NO IP ADDRESS" on page 1871. You must perform this command from the VLAN Interface modes of the VLANs in which the routing interfaces reside.

Please review the following guidelines before deleting routing interfaces:

- Deleting a routing interface from a VLAN that has static routes also deletes the static routes.
- Deleting a routing interface from a VLAN that has RIP also deletes RIP from the VLAN.
- If you are remotely managing the switch with Telnet or SSH and delete the routing interface through which you are managing the device, your management session is interrupted. You will have to manage the switch locally through the Console port if you delete all of the routing interfaces.
- Deleting a routing interface may stop the switch from performing one or more of the management functions listed in Table 27 on page 296.

Confirmation Command

"SHOW IP INTERFACE" on page 1877

Example

This example deletes the IPv4 routing interface with a dynamic IP address from the VLAN with the VID 3:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# no ip address dhcp
```

NO IP ROUTE

Syntax

```
no ip route ipaddress1/mask ipaddress2 [admin]
```

Parameters

ipaddress1
: Specifies the IP address of the destination network, subnet, or node. The IP address for the default route is 0.0.0.0/0.

mask
: Specifies the mask of the IP address. The mask represents the number of bits, from left to right, that constitute the network portion of the address. The mask may be entered in IP notation (e.g., 255.255.255.0) or decimal notation (e.g., /24).

ipaddress2
: Specifies the IP address of the next hop of the route.

admin
: Specifies the administrative distance of the route. This parameter is optional.

Mode

Global Configuration mode

Description

Use this command to delete static routes and the default gateway from the routing table. The command to delete the default gateway must include the IP address of the next hop.

Confirmation Command

"SHOW IP ROUTE" on page 1879

Examples

This example deletes a static route that has the destination network 156.78.101.0, mask 255.255.255.0, and next hop 145.20.11.132:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip route 156.78.101.0 255.255.255.0
145.20.11.132
```

This example deletes the same static route, but the mask is entered in decimal notation:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip route 156.78.101.0/24 145.20.11.132
```

This example deletes the default route from the switch. The mask is entered in IP notation, and the next hop is 121.114.17.28:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip route 0.0.0.0 0.0.0.0 121.114.17.28
```

This example deletes the same default route, but the mask is entered in decimal notation:

```
awplus> enable
awplus# configure terminal
awplus(config)# no ip route 0.0.0.0/0 121.114.17.28
```

SHOW IP INTERFACE

Syntax

```
show ip interface
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the routing interfaces on the switch. Figure 286 is an example of the information.

```
Interface      IP Address         Status        Protocol
VLAN14         123.94.146.34/24   admin up      running
VLAN25         123.94.152.72/24   admin up      running
VLAN26         123.94.126.4/24    admin up      running
VLAN28         123.94.111.37/24   admin up      running
```

Figure 286. SHOW IP INTERFACE Command

The fields are described in Table 275.

Table 275. SHOW IP INTERFACE Command

Parameter	Description
Interface	The VID of the VLAN to which the routing interface is assigned.
IP Address	The IP address and mask (in decimal notation) of the routing interface.
Status	Status of the routing interface.

Table 275. SHOW IP INTERFACE Command (Continued)

Parameter	Description
Protocol	The status of the ports in the VLAN of the routing interface. The possible states are listed here: ❒ Down: The ports in the VLAN have not established links to network devices. ❒ Running: The VLAN has at least one port that has established a link to a network device.

Example

This example displays the routing interfaces on the switch:

```
awplus# show ip interface
```

SHOW IP ROUTE

Syntax

```
show ip route
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the routes on the switch. Figure 287 displays an example of the information.

```
Codes:   C - connected, S - static, R - RIP
         * - candidate default

Gateway of last resort is 149.101.23.28 to network 0.0.0.0.

S*       0.0.0.0/0 [1/0] via 149.101.23.28, vlan28
R        149.101.152.0/24 [120/2] via 149.101.23.28, vlan15, 00:05:27
R        149.101.201.0/24 [120/2] via 149.101.54.109, vlan23, 01:38:09
S        149.101.32.0/24 [1/0] via 149.101.23.28, vlan15
S        149.101.33.0/24 [1/0] via 149.101.23.28, vlan15
S        149.101.42.0/24 [1/0] via 149.101.54.109, vlan23
C        149.101.23.0/24 is directly connected, vlan15
C        149.101.54.0/24 is directly connected, vlan23
```

Figure 287. SHOW IP ROUTE Command

The field "Gateway of last resort is" states the default gateway, which, if defined on the switch, is also included as the first entry in the table.

The possible codes in the left column in the table are described in Table 276.

Table 276. Route Codes in the SHOW IP ROUTE Command

Code	Description
S*	Default gateway.
R	Route to a remote network learned by RIP.

Table 276. Route Codes in the SHOW IP ROUTE Command (Continued)

Code	Description
S	Static route to a remote network.
C	Local network of a routing interface.

Note
RIP routes have an additional option which indicates the time lapsed in hours: minutes: seconds since the RIP entry was added. See Figure 288.

The elements of the static and RIP routes are identified in Figure 288.

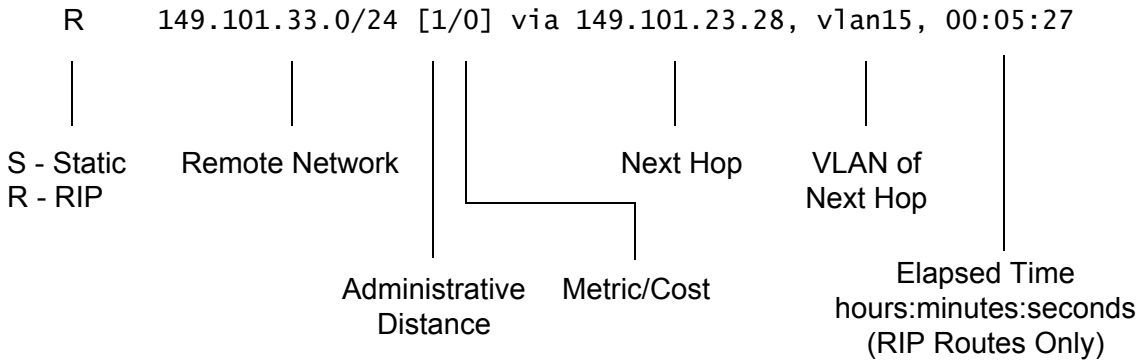

Figure 288. Static and RIP Route Elements in the SHOW IP ROUTE Command

Example

This example displays the routes on the switch:

```
awplus# show ip route
```

Chapter 108

Routing Information Protocol (RIP)

This chapter describes the following topics:

Overview

The AT-FS970M Series switches provide Layer 3 routing functionality as well as Layer 2 switching functionality. When Virtual LANs (VLANs) are applied, the end nodes who belong to different VLANs cannot communicate, even though they are physically connected through a switch or switches. With Layer 3 routing functionality, the Layer 3 switches can make end nodes on different VLANs communicate without a router. The AT-FS970M Series switches also support Routing Information Protocol (RIP) to communicate with other Layer 3 switches or routers so that the switches can communicate with remote networks.

A routing protocol specifies how routing devices, such as a router or Layer 3 switch, send routing information to other routers. With a routing protocol, routing devices can learn about remote networks and add the information to their routing tables dynamically. Based on the routing tables, routing devices forward packets to other networks. A routing protocol uses a metric to determine which path to send a packet to a given destination across the network.

Routing Information Protocol (RIP) is a distance-vector routing protocol, which uses hop counts as its metric. RIP determines a best route to a remote destination based on the hop count, the number of routers which the packet traverses. Each hop in a path from source to destination is assigned a hop count value. For instance, a device that is directly connected to the switch has a hop count of zero. The maximum number of hops allowed for RIP is 15. Due to the small range of the metric, RIP is suitable for smaller networks.

By default, RIP prevents routing loops with a feature called split horizon with poison reverse. With this feature, the hop count is assigned to 16 which is equal to infinity.

RIP sends routing update messages at regular, 30 second, intervals when the network topology changes. This process is called *advertising*. When receiving a routing update message (including a change), a routing device updates its routing table to reflect the change.

The AlliedWare Plus™ Management Software supports both RIP Version 1 and 2. With the implement of RIP Version 2, the Management Software supports authentication and allows you to enable and disable automatic route summarization. For more information about authentication and automatic summarization, see “Enabling Authentication” on page 1886” and “Enabling and Disabling Automatic Route Summarization” on page 1888.

Enabling RIP

To connect remote networks dynamically, you must enable the RIP routing process on the switches. Networks connected directly to the switch can communicate; however, a switch needs routing information for networks connected indirectly to the switch.

Figure 289 shows an example configuration of a routing protocol. Two switches are connected through a trunk, which allows the switches to exchange information for VLANs. PC1 on Switch S1 can communicate with PC2 on Switch S3 because both PC1 and PC3 belong to the same VLAN. However, PC1 cannot communicate with the file server on Switch S2 because two devices do not belong to the same VLAN. To connect different networks dynamically, you can enable RIP on the switches.

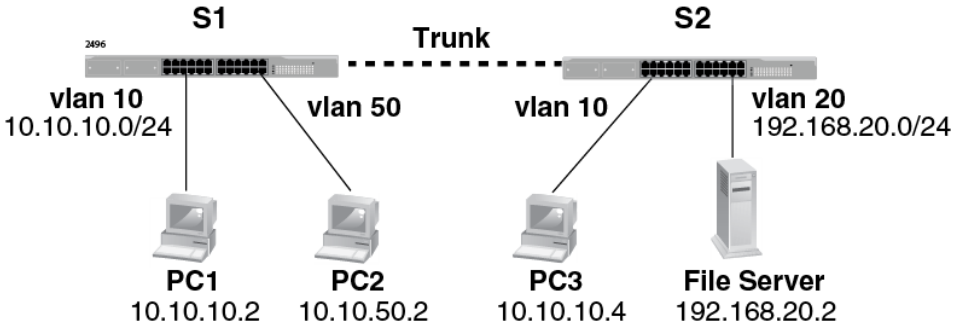

Figure 289. Enabling RIP Example

Table 277 lists the commands to enable RIP and associate a network with the RIP routing process so that a route to the network is advertised. In the example, when you enable RIP on Switch S1 and associate VLAN 50 interface to the RIP routing process, the route to PC2 on VLAN 50 is advertised to Switch S2. For Switch S2 to receive RIP packets from Switch S1, you must enable RIP on Switch S2 as well.

Table 277. RIP Commands

To Do This Task	Use This Command
Enter the Routing Configuration mode.	ROUTER RIP
Associate a network or VLAN interface with the RIP routing process so that the network is advertised through the RIP process.	NETWORK *network-address* or *vlan ID*

The following example enables RIP on Switch S1 so that VLAN interfaces 10 and 50 receive and send RIP packets, and the networks that VLANs 10 and 50 belong to are advertised through RIP:

```
S1> enable
S1# configure terminal
S1(config)# router rip
S1(config-router)# network vlan10
S1(config-router)# network vlan50
```

The following example enables RIP on Switch S2 so that VLAN interfaces 20 and 50 receive and send RIP packets, and the networks that VLANs 20 and 50 belong to are advertised through RIP:

```
S2> enable
S2# configure terminal
S2(config)# router rip
S2(config-router)# network vlan20
S2(config-router)# network vlan50
```

The following example displays routing information indicating which information was obtained by the RIP routing process:

```
S1> enable
S1# show ip rip
```

Specifying a RIP Version

The Management Software supports both RIP Version 1 and 2. The default RIP Version is 2.

The following example specifies RIP Version 1 on the switch:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# version 1
```

You can specify a RIP version for routing updates to send or to receive using the IP RIP REVCEIVE VERSION and IP RIP SEND VERSION commands. These commands override the RIP Version specified by the VERSION command.

The following example specifies RIP Version 2 for routing updates that VLAN 5 sends and RIP Version 2 for routing updates that VLAN 5 receives:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan5
awplus(config-if)# ip rip receive version 2
awplus(config-if)# ip rip send version 2
```

Enabling Authentication

Security is one of the primary requirements for corporate networks. RIP Version 2 supports authentication to ensure that the routing information entering into the routing table is valid and to prevent from unauthorized access to the network.

The AlliedWare Plus™ Management Software supports two authentication modes: plain-text and Message Digest 5 (MD5). The plain-text authentication mode is the default setting in RIP Version 2 packets when authentication is enabled. Because the plain-text authentication uses the unencrypted password in routing updates, use the MD5 authentication mode when security is an issue.

Assume that you have the networks shown in Figure 290. The routing interfaces in VLAN 50 are RIP enabled in both receiving and sending RIP Version 2, and VLANs 10 and 20 are associated with RIP using the NETWORK command.

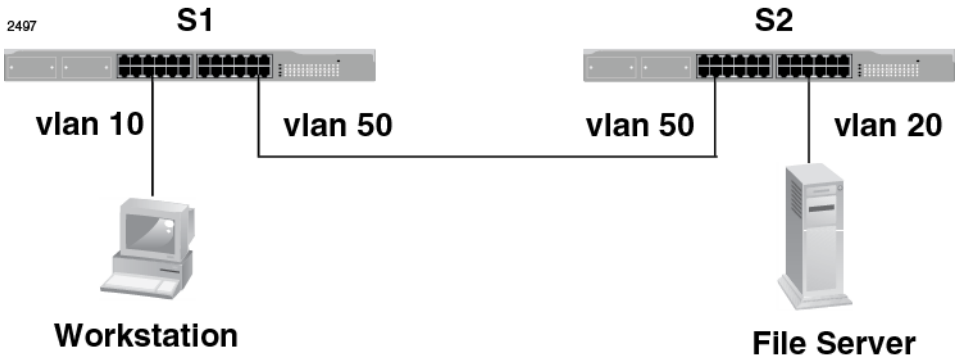

Figure 290. Enabling Authentication Example

To authenticate routing updates, set the same password on corresponding routing interfaces. When sending a routing update, RIP adds the password in the packet. When receiving a routing update, the switch compares its own password with the password in the received packet. The switch authenticates the packet only when the two passwords match. You must configure the same password on the routing interfaces on Switches S1 and S2 respectively.

To specify the authentication mode, use the IP RIP ANUTHENTICATION MODE command. You must configure the same mode on the interface on Switches S1 and S2.

To specify the authentication key, use the IP RIP AUTHENTICATION STRING command. You must configure the same mode on the interface on Switches S1 and S2.

The following example configures Switch S1 to specify MD5 as the authentication mode and "axc222" as the password:

```
S1> enable
S1# configure terminal
S1(config)# interface vlan50
S1(config-if)# ip rip authentication mode md5
S1(config-if)# ip rip authentication string axc222
```

The following example configures Switch S2 to specify MD5 as the authentication mode and "axc222" as the password:

```
S2> enable
S2# configure terminal
S2(config)# interface vlan50
S2(config-if)# ip rip authentication mode md5
S2(config-if)# ip rip authentication string axc222
```

Enabling and Disabling Automatic Route Summarization

As a corporation grows, the corporate network needs to expand as well. The number of entries in routing tables increases, and this growth costs CPU resources, memory, and bandwidth used to maintain routing tables. To reduce the size of routing tables and keep the network scalable, RIP automatically summarizes network boundaries by default.

Note
You are allowed to disable automatic route summarization in RIP Version 2. Automatic summarization is always enabled in RIP Version 1.

Assume that you have the networks shown in Figure 291. The routing interfaces in VLAN 50 are RIP enabled in both receiving and sending RIP Version 2, and the networks in VLANs 10, 20, and 30 are associated with RIP using the NETWORK command.

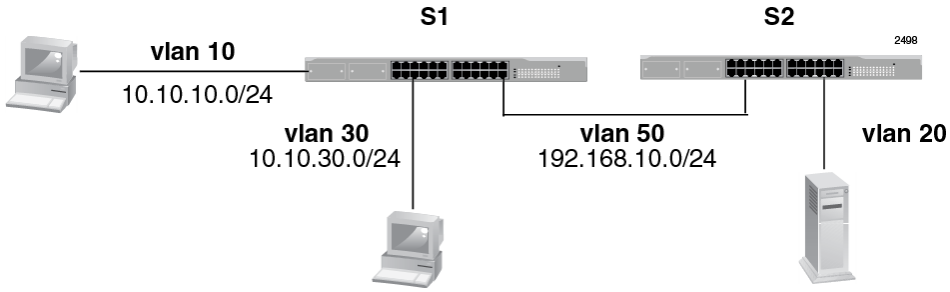

Figure 291. Automatic Summarization Example

RIP allows Switch S1 to summarize 10.10.10.0/24 and 10.10.30.0/24 into 10.10.0.0/16 route and advertises the summarized route to Switch S2. However, if other subnets of 10.10.0.0/16 exist downstream in the network, meaning that the network address is not contiguous, summarization may not be ideal. In that case, you want to disable automatic summarization.

The following example disables automatic summarization:

```
S1> enable
S1# configure terminal
S1(config)# router rip
S1(config-router)# no auto-summary
```

The following example enables automatic summarization:

```
S1> enable
S1# configure terminal
S1(config)# router rip
S1(config-if)# auto-summary
```

Enabling and Disabling Split Horizon

RIP implements the split-horizon mechanism to prevent propagating incorrect routing information and causing a loop. Split horizon blocks routing updates from being sent out to the same gateway where the update packet originated. This behavior optimizes communications among multiple routing devices, particularly when links are broken. Split horizon is enabled by default.

However, there are situations that this behavior may cause a problem and you want to disable split horizon.

The following example disables split horizon:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan10
awplus(config-if)# no ip rip split-horizon
```

The following example enables split horizon:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan10
awplus(config-if)# ip rip split-horizon
```

The IP RIP SPLIT-HORIZON command offers an option. This command with the POISONED keyword advertises a route with a metric of infinity or 16 if the route in a routing update is sent out to the same gateway where the route originated.

The following example advertises a route with a metric of 16 when the route in a routing update is sent out to the same gateway where the route originated:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan10
awplus(config-if)# ip rip split-horizon poisoned
```

Advertising the Default Route

RIP has a built-in feature which allows you to advertise a default route to direct neighbors and propagate the default route. Advertising a default route via RIP can save you time in managing the switches.

To propagate a default route, use the DEFAULT-INFORMATION ORIGINATE command in the Routing Configuration mode.

The following example assigns the switch the default gateway address 192.168.1.1 and adds the route into the routing update to advertise it:

```
awplus> enable
awplus# configure terminal
awplus(config)# ip route 0.0.0.0 0.0.0.0 192.168.1.1
awplus(config)# router rip
awplus(config-route)# default-information originate
```

Displaying Routing Information with RIP

To confirm that routes are dynamically added by RIP, use the SHOW IP RIP command.

```
S1# show ip rip
```

Figure 292 is an example of the information the command displays.

```
Codes: R - RIP, Rc - RIP connected, Rs - RIP static
       C - Connected, S - Static

     Network Next hop Metric  From If        Time
Rc   10.10.10.0/24 1 vlan10
Rc   10.10.50.0/24 1 vlan50
C    192.168.99.0/24 1 vlan1
R    192.168.20.0/24 10.10.10.32 10.10.10.3 vlan10    00:00:19
```

The R indicates that this network entry is added through RIP.

Figure 292. SHOW IP RIP Command

The columns in Figure 292 are defined in Table 280 on page 1928.

Adjusting Timers

RIP sends routing updates at regular intervals. By default, the Management Software transmits routing updates every 30 seconds. If the switch does not receive a routing update from another switch for 180 seconds, it declares the route invalid. If no routing update is received after an additional 120 seconds, the switch removes the route from the routing table. You can adjust the timers to minimize disruptions to end users of the network when a quick recovery is necessary.

To regulate performance, the Management Software offers three timers: the interval at which RIP routing updates are sent, the interval after which a route is declared invalid, and the interval after which the router is removed from the routing table. To control timers, the TIMERS BASIC command uses three parameters:

- update
- timeout
- garbage

Table 278 lists the parameters of the TIMERS BASIC command.

Table 278. TIMERS BASIC Command Parameters

To Do This Task	Parameter	Ranges
Specify the interval at which routing updates are sent in seconds. The default is 30 seconds.	*update*	5 to 2,147,483,647 seconds
Specify the routing information timeout timer in seconds. After this interval has elapsed, and no updates for a route are received, the route is declared invalid. The default is 180 seconds.	*timeout*	5 to 2,147,483,647 seconds
Specify the routing garbage-collection timer in seconds. After this interval has elapsed, and no updates for a route are received, the route is removed from the routing table. The default is 120 seconds.	*garbage*	5 to 2,147,483,647 seconds

The following example sets the switch to transmit routing updates every 20 seconds, declare a route invalid after 120 seconds have passed and no updates for the route are received, and remove the route from the routing table after an additional 60 seconds have passed:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# timers basic 20 120 60
```

Blocking Routing Updates on an Interface

The interfaces on the switch receive routing updates every 30 seconds, including the interfaces that are not connected to routing devices. To prevent the switch from sending out routing updates to an interface, which does not need routing updates, use the PASSIVE-INTERFACE command on the interface. This command still allows the network in the interface to be advertised to other routing devices.

The following example advertises the VLAN 20, but blocks the switch from sending routing updates to VLAN 20:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# network vlan20
awplus(config-router)# passive-interface vlan20
```

Chapter 109

Routing Information Protocol (RIP) Commands

The RIP commands are summarized in Table 279 and described in detail within the chapter.

Table 279. RIP Commands

Command	Mode	Description
“AUTO-SUMMARY” on page 1898	Routing Configuration	Activates automatic route summarization.
“DEFAULT-INFORMATION ORIGINATE” on page 1899	Routing Configuration	Configures the switch to send its default route from the RIP-enabled routing interfaces.
“IP RIP AUTHENTICATION STRING” on page 1900	VLAN Interface	Specifies an authentication key or password that a routing interface uses to authenticate the routing updates.
“IP RIP AUTHENTICATION MODE” on page 1901	VLAN Interface	Specifies the MD5 or plain-text authentication mode for an authentication key or password on a routing interface.
“IP RIP RECEIVE-PACKET” on page 1902	VLAN Interface	Enables the VLAN interface to receive routing updates.
“IP RIP RECEIVE VERSION” on page 1903	VLAN Interface	Specifies the version of routing updates accepted on the VLAN interface.
“IP RIP SEND-PACKET” on page 1905	VLAN Interface	Enables the VLAN to send routing updates.
“IP RIP SEND VERSION” on page 1906	VLAN Interface	Specifies the version of routing updates that the VLAN interface sends.
“IP RIP SPLIT-HORIZON” on page 1907	VLAN Interface	Activates split-horizon or split-horizon with poison reverse on the routing interfaces.
“NETWORK” on page 1909	Routing Configuration	Specifies a network or VLAN to allow the interface to send and accept routing updates.

Table 279. RIP Commands (Continued)

Command	Mode	Description
“NO AUTO-SUMMARY” on page 1911	Routing Configuration	Disables automatic route summarization.
“NO DEFAULT-INFORMATION ORIGINATE” on page 1912	Routing Configuration	Stops the switch from sending the default route.
“NO IP RIP AUTHENTICATION MODE” on page 1913	VLAN Interface	Restores the default value of plain-text authentication mode.
“NO IP RIP AUTHENTICATION STRING” on page 1914	VLAN Interface	Deletes the specified authentication key or password.
“NO IP RIP RECEIVE-PACKET” on page 1915	VLAN Interface	Disables the VLAN interface to receive routing updates.
“NO IP RIP RECEIVE VERSION” on page 1916	VLAN Interface	Deletes the version of the routing updates that the routing interface accepts.
“NO IP RIP SEND-PACKET” on page 1917	VLAN Interface	Disables the VLAN to send routing updates.
“NO IP RIP SEND VERSION” on page 1918	VLAN Interface	Deletes the version of the routing updates that the routing interface sends out.
“NO IP RIP SPLIT-HORIZON” on page 1919	VLAN Interface	Disables split horizon or split horizon with poison reverse.
“NO NETWORK” on page 1920	Routing Configuration	Stops the specified network or VLAN from sending and accepting routing updates.
“NO PASSIVE-INTERFACE” on page 1921	Routing Configuration	Allows the switch to send route updates from the specified VLAN interface.
“NO ROUTER RIP” on page 1922	Global Configuration	Stops the RIP process and erases all existing RIP configurations on the switch.
“NO TIMERS BASIC” on page 1923	Routing Configuration	Resets update, timeout, and garbage timers to the default values.
“NO VERSION” on page 1924	Routing Configuration	Resets the RIP version to the default value of Version 2.
“PASSIVE-INTERFACE” on page 1925	Routing Configuration	Prevents the transmission of routing updates through the routing interface in the specified VLAN.

Table 279. RIP Commands (Continued)

Command	Mode	Description
"ROUTER RIP" on page 1926	Global Configuration	Enters the Routing Configuration mode to configure RIP.
"SHOW IP RIP" on page 1927	User Exec and Privileged Exec	Displays information about RIP routes.
"SHOW IP RIP COUNTER" on page 1929	User Exec and Privileged Exec	Displays counters for RIP packets on the switch.
"SHOW IP RIP INTERFACE" on page 1931	User Exec and Privileged Exec	Displays RIP information about the specified VLAN routing interface.
"TIMERS BASIC" on page 1933	Routing Configuration	Specifies the update, timeout, and garbage timers.
"VERSION" on page 1935	Routing Configuration	Specifies a RIP Version 1, or 2, used by the switch.

AUTO-SUMMARY

Syntax

```
auto-summary
```

Parameters

None

Mode

Routing Configuration mode

Description

Use this command to activate automatic route summarization to consolidate the routes in RIP update packets. By default, automatic summarization is enabled. For RIP Version 1, automatic summarization is always used and cannot be disabled. For RIP Version 2, you can enable and disable automatic summarization.

Confirmation Command

“SHOW IP RIP INTERFACE” on page 1931

Example

The following example enables automatic route summarization in RIP Version 2:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# auto-summary
```

DEFAULT-INFORMATION ORIGINATE

Syntax

```
default-information originate
```

Parameter

None

Mode

Router Configuration mode

Description

Use this command to configure the switch to send its default route to its neighboring routing devices.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

The following example configures the switch to send its default route from its routing interfaces:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# default-information originate
```

IP RIP AUTHENTICATION STRING

Syntax

```
ip rip authentication string auth-string
```

Parameters

auth-string
: Specifies an authentication key or password. A password can be up to sixteen alphanumeric characters and/or special characters, such as !@#$%^&*?<>. It is case-sensitive and cannot include spaces.

Mode

VLAN Interface mode

Description

Use this command to specify an authentication key or password that the routing interfaces use to authenticate the routing updates. You may configure only one routing interface at a time. In addition, a routing interface must already exist before you can assign it a password.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

The following example assigns “add45wqy” as the password to a new routing interface in VLAN 17:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan17
awplus(config-if)# ip address 192.168.1.15/24
awplus(config-if)# ip rip authentication string add45wqy
```

IP RIP AUTHENTICATION MODE

Syntax

```
ip rip authentication mode md5|text
```

Parameters

md5
Specifies the MD5 authentication mode.

text
Specifies the plain-text authentication mode.

Mode

VLAN Interface mode

Description

Use this command to specify either MD5 or plain-text authentication mode for the routing interface. The interfaces use the authentication mode to authenticate the passwords in the routing updates that the interfaces send and receive. A routing interface and the neighboring routing device must use the same authentication mode and password to accept routing updates. You may configure only one routing interface at a time. The default is the plain-text authentication mode.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

The following example specifies MD5 authentication as the authentication mode for a routing interface in VLAN 2. Assume that the VLAN has already a routing interface:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip rip authentication mode md5
```

IP RIP RECEIVE-PACKET

Syntax

```
ip rip receive-packet
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to enable the routing interfaces to receive routing updates. By default, the receive-packet is enabled. You can configure only one routing interface at a time with this command.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

The following example configures the routing interface in VLAN 3 to accept routing updates:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# ip rip receive-packet
```

IP RIP RECEIVE VERSION

Syntax

```
ip rip receive version 1|2|1 2
```

Parameters

1
Specifies RIP Version 1.

2
Specifies RIP Version 2.

1 2
Specifies both RIP Versions 1 and 2. You must enter a space between 1 and 2.

Mode

VLAN Interface mode

Description

Use this command to specify the version number of the routing updates that the routing interface accepts. You may specify Version 1, 2, or both versions. Different routing interfaces on the switch may accept different versions of the routing updates. You may configure only one routing interface at a time with this command.

This command overrides the version setting configured with the VERSION command. For the description of the VERSION command, refer to "VERSION" on page 1935.

Confirmation Command

"SHOW IP RIP INTERFACE" on page 1931

Examples

The following example configures the routing interface in VLAN 2 to receive RIP Version 2 packets:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# ip rip receive version 2
```

The following example configures the routing interface in VLAN 3 to receive both RIP Version 1 and 2 packets:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# ip rip receive version 1 2
```

IP RIP SEND-PACKET

Syntax

```
ip rip send packet
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to enable the routing interfaces in VLANs to send routing updates. You can configure only one routing interface at a time with this command.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

The following example configures the routing interface in VLAN 3 to send routing updates:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# ip rip send-packet
```

IP RIP SEND VERSION

Syntax

```
ip rip send version 1|2
```

Parameters

1
Specifies RIP Version 1.

2
Specifies RIP Version 2.

Mode

VLAN Interface mode

Description

Use this command to specify the version number of the routing updates that the routing interfaces send to the neighboring routing devices. You can specify either version 1 or 2. You may configure different routing interfaces on the switch to send different versions of the routing updates. You can configure only one routing interface at a time with this command.

This command overrides the version setting configured with the VERSION command. For the description of the VERSION command, refer to “VERSION” on page 1935.

Confirmation Command

“SHOW IP RIP INTERFACE” on page 1931

Example

The following example configures the routing interface in VLAN 4 to send Version 2 packets:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# ip rip send version 2
```

IP RIP SPLIT-HORIZON

Syntax

```
ip rip split-horizon [poisoned]
```

Parameters

poisoned

Assigns a hop value of infinity (16) to routes in the routing updates when the packets are transmitted from the same interfaces on which the routes were learned.

Mode

VLAN Interface mode

Description

Use this command to activate split horizon or split horizon with poison reverse on a routing interface to prevent routing loops caused by slow convergence of RIP. By default, split horizon with poison reverse is activated. You can configure only one interface at a time with this command.

Routing updates that are transmitted from a routing interface on which split horizon is activated do not contain any of the routes that were learned on that interface, from its neighboring routing device.

Routing update packets that are transmitted from a routing interface on which split horizon with poison reverse is activated contain the routes that were learned on that interface, but the routes are given a hop count of infinity (16) to indicate that they are unusable.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

"SHOW IP RIP INTERFACE" on page 1931

Examples

The following example activates split horizon on the routing interface in VLAN 5. The routing updates do not include any routes that were learned by the interface, from the neighboring routing device:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan5
awplus(config-if)# ip rip split-horizon
```

The following example activates split horizon with poison reverse on the routing interface in VLAN 7. Routes learned on that interface are assigned a hop count of infinity (16) in the routing updates:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan7
awplus(config-if)# ip rip split-horizon poisoned
```

NETWORK

Syntax

```
network network-address|subnet-mask|vlanid
```

Parameters

network-address
: Specifies the network address.

subnet-mask
: Specifies the subnet mask of the network address. This parameter is optional. When no mask is entered, the switch applies a mask based on the class (A, B, or C) of the entered network address. For example, the switch gives an IP address of 10.0.0.0 to a prefix length of 8.

vlanid
: Specifies the ID number of a VLAN.

Mode

Router Configuration mode

Description

Use this command to specify a network or VLAN to allow its interface to send and accept routing updates. The connected routes corresponding to the specified network or VLAN are automatically advertised in routing updates. By default, the interface of a network or VLAN does not send or accept any routing updates.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Examples

The following example allows the interface of the network 192.168.1.0/24 on the switch to send and accept routing updates:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# network 192.168.1.0/24
```

The following example allows VLAN 2 to send and accept routing updates:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# network vlan2
```

NO AUTO-SUMMARY

Syntax

```
no auto-summary
```

Parameters

None

Mode

Routing Configuration mode

Description

Use this command to disable automatic summarization for RIP Version 2. When automatic summarization is disabled, subnets are included in the routing updates. Automatic summarization cannot be disabled for RIP Version 1.

Confirmation Command

"SHOW IP RIP INTERFACE" on page 1931

Example

The following example disables automatic summarization for RIP Version 2:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# version 2
awplus(config-router)# no auto-summary
```

NO DEFAULT-INFORMATION ORIGINATE

Syntax

```
no default-information originate
```

Parameter

None

Mode

Router Configuration mode

Description

Use this command to stop advertising a default route to RIP-enabled interfaces.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

The following example stops advertising a default route:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# no default-information originate
```

NO IP RIP AUTHENTICATION MODE

Syntax

```
no ip rip authentication mode
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to restore the default value of plain-text authentication mode.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

The following example restores the default value of plain-text authentication mode for the routing interface in VLAN 2:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip rip authentication mode
```

NO IP RIP AUTHENTICATION STRING

Syntax

```
no ip rip authentication string auth-string
```

Parameters

auth-string
Specifies an authentication key or password.

Mode

VLAN Interface mode

Description

Use this command to delete the specified authentication string from a routing interface.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

The following example deletes the string “Secret” as the password from the routing interface in VLAN 2:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan2
awplus(config-if)# no ip rip authentication string Secret
```

NO IP RIP RECEIVE-PACKET

Syntax

```
no ip rip receive-packet
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to stop routing interfaces from accepting routing updates. By default, a routing interface is enabled to receive routing updates.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

The following example stops the routing interface in VLAN 3 from accepting routing updates:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# no ip rip receive-packet
```

NO IP RIP RECEIVE VERSION

Syntax

```
no ip rip receive version
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to delete the version number of the routing updates that the routing interface accepts.

Confirmation Command

“SHOW IP RIP INTERFACE” on page 1931

Example

The following example deletes the version setting for the routing updates that the routing interface in VLAN 3 accepts:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan3
awplus(config-if)# no ip rip receive version
```

NO IP RIP SEND-PACKET

Syntax

```
no ip rip send packet
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to stop routing interfaces from sending routing updates.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

The following example stops the routing interface in VLAN 5 from sending routing updates:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan5
awplus(config-if)# no ip rip send-packet
```

NO IP RIP SEND VERSION

Syntax

```
no ip rip send version
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to delete the version number of the routing updates that the routing interface sends out.

Confirmation Command

“SHOW IP RIP INTERFACE” on page 1931

Example

The following example deletes the version setting for the routing updates that the routing interface in VLAN 4 sends out:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan4
awplus(config-if)# no ip rip send version
```

NO IP RIP SPLIT-HORIZON

Syntax

```
no ip rip split-horizon
```

Parameters

None

Mode

VLAN Interface mode

Description

Use this command to disable split horizon or split horizon with poison reverse.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

"SHOW IP RIP INTERFACE" on page 1931

Example

The following example disables split horizon on VLAN 5:

```
awplus> enable
awplus# configure terminal
awplus(config)# interface vlan5
awplus(config-if)# no ip rip split-horizon
```

NO NETWORK

Syntax

no network network-address|subnet-mask|vlanid

Parameters

network-address
Specifies the network address to remove.

subnet-mask
Specifies the subnet mask of the network address. This parameter is optional. When no mask is entered, the switch applies a mask based on the class (A, B, or C) of the entered network address. For example, the switch gives an IP address of 10.0.0.0 to a prefix length of 8.

vlanid
Specifies the ID number of a VLAN.

Mode

Router Configuration mode

Description

Use this command to remove the specified network or VLAN from the RIP routing process and stop the network or VLAN from sending and receiving routing updates:

Confirmation Command

“SHOW IP RIP” on page 1927

Example

The following example removes VLAN 2 from the RIP routing process and stops VLAN 2 from sending or receiving routing updates:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# no network vlan2
```

NO PASSIVE-INTERFACE

Syntax

```
no passive-interface vlanid
```

Parameters

vlanid
Specifies the ID number of a VLAN.

Mode

Routing Configuration

Description

Use this command to allow the transmission of routing updates to the routing interface in the specified VLAN.

Confirmation Command

"SHOW IP RIP" on page 1927

Example

The following example allows the transmission of routing updates through the routing interface in VLAN 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# no passive-interface vlan8
```

NO ROUTER RIP

Syntax

```
no router rip
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to stop the RIP process and erase all existing RIP configurations on the switch.

Confirmation Command

“SHOW IP RIP” on page 1927

Example

The following example exits the Router Configuration mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# no router rip
```

NO TIMERS BASIC

Syntax

```
no timers basic
```

Parameters

None

Mode

Routing Configuration mode

Description

Use this command to reset timers to the default values for all three parameters. The default values are:

- Update: 30 seconds
- Timeout: 180 seconds
- Garbage: 120 seconds

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

The following example resets the switch to transmit routing updates every 30 seconds, declare a route invalid after 180 seconds have passed and no updates from the route are received, and remove a route from the routing table after additional 120 seconds have passed:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# no timers basic
```

NO VERSION

Syntax

```
no version
```

Parameters

None

Mode

Router Configuration mode

Description

Use this command to reset the RIP version to the default value of Version 2.

Confirmation Command

“SHOW RUNNING-CONFIG” on page 168

Example

The following example restores the default value of RIP Version 2:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# no version
```

PASSIVE-INTERFACE

Syntax

```
passive-interface vlanid
```

Parameters

vlanid
Specifies the ID number of a VLAN.

Mode

Routing Configuration

Description

Use this command to prevent the transmission of routing updates through the routing interface in the specified VLAN. The routing interface in the VLAN does not receive routing updates, but the network that the specified VLAN belongs to is still advertised.

Confirmation Command

"SHOW IP RIP" on page 1927

Example

The following example blocks the transmission of routing updates through the routing interface in VLAN 8:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# passive-interface vlan8
```

ROUTER RIP

Syntax

```
router rip
```

Parameters

None

Mode

Global Configuration mode

Description

Use this command to enter the Router Configuration mode. You must be in the Router Configuration mode to configure RIP.

Example

The following example uses the ROUTER RIP command to enter the Router Configuration mode:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)#
```

SHOW IP RIP

Syntax

```
show ip rip
```

Parameters

None

Mode

User Exec and Privileged Exec modes

Description

Use this command to display the management IP address and the default gateway on the switch. Figure 293 provides an example of this information.

```
Codes: R - RIP, Rc - RIP connected, Rs - RIP static
       C - Connected, S - Static

     Network          Next hop    Metric  From         If        Time
Rc   10.10.10.0/24                1       vlan10
Rc   10.10.50.0/24                1       vlan50
C    192.168.99.0/24              1       vlan1
R    192.168.20.0/24 10.10.10.3   2       10.10.10.3   vlan10    00:00:19
```

Figure 293. SHOW IP RIP Command

The fields are described in Table 280.

Table 280. SHOW IP RIP Command

Parameter	Description
Codes	Indicates how the destination routing information is obtained: ❒ R: RIP ❒ Rc: RIP connected ❒ Rs: RIP static ❒ C: Connected ❒ S: Static
Network	Indicates the IP address and subnet mask of the destination.
Next Hop	Indicates the management IP address of the next-hop routing device.
Metric	Indicates the number of routing devices a packet must travel through to reach the destination.
From	Indicates the IP address of the source where the routing information is obtained.
If	Indicates the VLAN interface the network belongs to.

Example

The following example displays routing information, including RIP routes, on the switch:

```
awplus# show ip route
```

SHOW IP RIP COUNTER

Syntax

```
show ip rip counter
```

Parameters

None

Mode

User Exec and Privileged Exec modes

Description

Use this command to display counters for RIP packets on the switch. Figure 294 provides an example of information that the command displays.

```
IP RIP Counter Summary
Input:
 inResponses.....................5
 inRequests......................1
 inDiscards......................0
Output:
 outResponses....................6
 outRequests.....................2
 outTrigResponses................0
 outErrors.......................0
```

Figure 294. SHOW IP RIP COUNTER Command

The fields are described in Table 281.

Table 281. SHOW IP RIP COUNTER Command

Parameter	Description
Input:	Indicates that the counters are for incoming RIP packets.
inResponses	Displays the number of response packets received.
inRequests	Displays the number of request packets received.

Table 281. SHOW IP RIP COUNTER Command (Continued)

Parameter	Description
inDiscards	Displays the number of packets discarded. Packets may be discarded due to authentication failure, packet received when receive is disabled, or mismatched sequence number of a triggered acknowledgement.
Output:	Indicates that the counters are for outgoing RIP packets.
outResponses	Displays the number of response packets transmitted.
outReqests	Displays the number of request packets transmitted.
outTrigResposes	Displays the number of triggered response packets transmitted.
outErrors	Displays the number of packets with errors.

Example

The following example displays counters for RIP packets on the switch:

```
awplus# show ip route counter
```

SHOW IP RIP INTERFACE

Syntax

```
show ip rip interface interface
```

Parameters

interface
Specifies a VLAN interface. This parameter is optional.

Mode

User Exec and Privileged Exec modes

Description

Use this command to display RIP information about the specified VLAN interface. If no interface is specified, the command displays RIP information about all of the RIP-enabled VLAN interfaces on the switch. Figure 295 provides an example of information that the command displays when you do not specify a parameter.

```
-------------------------------------------------------------------------
Interface      Send  Recv     Auth   Password  PoisonReverse   AutoSummary
-------------------------------------------------------------------------
vlan2-0        RIP2  BOTH     PASS   ********  On                On
vlan5-0        RIP1  BOTH     NONE   NOT SET   Off               On
vlan8-0        RIP2  BOTH     PASS   ********  On                On
```

Figure 295. SHOW IP RIP INTERFACE Command

The fields are described in Table 282.

Table 282. SHOW IP RIP INTERFACE Command

Parameter	Description
Interface	Indicates a RIP-enabled VLAN routing interface.
Send	Indicates the version of RIP packets sent out the VLAN routing interface. The version value is one of the following: ❒ RIP1 ❒ RIP2

Table 282. SHOW IP RIP INTERFACE Command (Continued)

Parameter	Description
Recv	Indicates the version of RIP packets accepted on the VLAN routing interface. The version value is one of the following: ❒ RIP1 ❒ RIP2 ❒ Both
Auth	Indicates the authentication method. The method is one of the following: ❒ PASS: Plain-text password ❒ MD5: MD5 password ❒ NONE
Password	Indicates the status of the password. The indication is one of the following: ❒ ********: A plain-text or MD5 password is set. ❒ NOT SET
PoisonReverse	Indicates the status of poison reserve on the VLAN routing interface.
AutoSummary	Indicates the status of auto-summary on the VLAN interface.

Examples

The following example displays RIP information about VLAN 5:

```
awplus# show ip route interface vlan5
```

The following example displays RIP information about all of the RIP-enabled VLAN interfaces on the switch.:

```
awplus# show ip route interface
```

TIMERS BASIC

Syntax

`timers basic update` *`update`* `timeout` *`timeout`* `garbage` *`garbage`*

Parameters

update
: Specifies the interval, in seconds, that routing updates are transmitted. The range is 5 to 2,147,483,647 seconds. The default value is 30 seconds.

timeout
: Specifies the routing information timeout timer in seconds. The range is 5 to 2,147,483,647 seconds. After this interval has elapsed, and no updates from a route are received, the route is declared invalid. The default value is 180 seconds.

garbage
: Specifies the routing garbage-collection timer in seconds. After this interval has elapsed, and no updates from a route are received, the route is removed from the routing table. The range is 5 to 2,147,483,647 seconds. The default value is 120 seconds.

Mode

Routing Configuration mode

Description

Use this command to adjust the timers that RIP uses to minimize disruptions to end users of the network in the situation where quick recovery is necessary. You can change three timers with this command:

- Interval that a RIP packet is sent
- Interval that a route is declared invalid
- Interval that the invalid route is removed from the routing table

All the routing devices in the network must have the same timers to ensure the smooth operation of RIP throughout the network.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

Example

The following example sets the switch to transmit routing updates every 20 seconds, declare a route invalid after 120 seconds have passed and no updates from the route are received, and remove a route from the routing table after additional 60 seconds have passed:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# timers basic update 20 timeout 120
garbage 60
```

VERSION

Syntax

```
version 1|2
```

Parameters

1
Specifies RIP Version 1.

2
Specifies RIP Version 2.

Mode

Router Configuration mode

Description

Use this command to specify a RIP Version, 1 or 2, used by the switch. All the RIP-enabled interfaces receive and send RIP packets of the specified version. The default version is 2.

Both IP RIP RECEIVE VERSION and IP RIP SEND VERSION commands override the value set by the VERSION command. For more information about these commands, see "IP RIP RECEIVE VERSION" on page 1903 and "IP RIP SEND VERSION" on page 1906.

Confirmation Command

"SHOW RUNNING-CONFIG" on page 168

"SHOW IP RIP INTERFACE" on page 1931

Example

The following example configures the switch to use RIP Version 1 for routing updates that the switch sends and receives from the routing interfaces:

```
awplus> enable
awplus# configure terminal
awplus(config)# router rip
awplus(config-router)# version 1
```

Appendix A
System Monitoring Commands

The system monitoring commands are summarized in Table 283 and described in detail within the Appendix.

Table 283. System Monitoring Commands

Command	Mode	Description
“SHOW CPU” on page 1938	Privileged Exec	Displays a list of running processes and their CPU utilization.
“SHOW CPU HISTORY” on page 1939	Privileged Exec	Displays graphs of historical CPU utilization of the switch.
“SHOW CPU USER-THREADS” on page 1940	Privileged Exec	Displays a list of CPU utilization and status of the user threads.
“SHOW MEMORY” on page 1941	Privileged Exec	Displays memory consumptions of the processes.
“SHOW MEMORY ALLOCATION” on page 1942	Privileged Exec	Displays the memory allocations used by the processes.
“SHOW MEMORY HISTORY” on page 1943	Privileged Exec	Displays a graph showing historical memory usage.
“SHOW MEMORY POOLS” on page 1944	Privileged Exec	Displays a list of memory pools used by the processes.
“SHOW PROCESS” on page 1945	Privileged Exec	Displays a summary of the current running processes.
“SHOW SYSTEM SERIALNUMBER” on page 1946	User Exec and Privileged Exec	Displays the serial number of the switch.
“SHOW SYSTEM INTERRUPTS” on page 1947	Privileged Exec	Displays the number of interrupts for each Interrupt Request (IRQ) used to interrupt input lines on a Programmable Interrupt Controller (PIC) on the switch.
“SHOW TECH-SUPPORT” on page 1948	Privileged Exec	Stores system information in a file in the file system.

SHOW CPU

Syntax

```
show cpu [sort pri|runtime|sleep|thrds]
```

Parameters

pri
: Sorts the list by process priorities.

runtime
: Sorts the list by the runtimes of the processes.

sleep
: Sorts the list by the average sleeping times.

thrds
: Sorts the list by the number of threads.

Mode

Privileged Exec mode

Description

Use this command to display a list of running processes with their CPU utilizations.

Examples

This example lists the running processes by ID numbers:

```
awplus# show cpu
```

This example lists the running processes by runtimes:

```
awplus# show cpu sort runtime
```

SHOW CPU HISTORY

Syntax

```
show cpu history
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display graphs of historical CPU utilization on the switch.

Example

This example displays graphs of historical CPU utilization on the switch:

```
awplus# show cpu history
```

SHOW CPU USER-THREADS

Syntax

```
show cpu user-threads
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display a list of CPU utilization and the status of the user threads.

Example

This example displays a list of CPU utilization and the status of the user threads:

```
awplus# show cpu user-threads
```

SHOW MEMORY

Syntax

```
show memory [sort peak|size|stk]
```

Parameters

peak
: Sorts the list by the peak amounts of memory the processes have ever used.

size
: Sorts the list by the peak amounts of memory the processes are currently using.

stk
: Sorts the list by the stack sizes of the processes.

Mode

Privileged Exec mode

Description

Use this command to display the memory consumption of each process.

Examples

This example displays the memory consumptions of the processes by ID number:

```
awplus# show memory
```

This example displays the memory consumptions by size:

```
awplus# show memory sort size
```

SHOW MEMORY ALLOCATION

Syntax

```
show memory allocation process
```

Parameter

process
: Specifies a system process.

Mode

Privileged Exec mode

Description

Use this command to display the memory allocations used by the processes.

Examples

This example displays the memory allocations used by all the processes:

```
awplus# show memory allocation
```

This example displays the memory allocation of the INIT process:

```
awplus# show memory allocation init
```

SHOW MEMORY HISTORY

Syntax

```
show memory history
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display a graph showing historical memory usage.

Example

This example displays a graph showing historical memory usage:

```
awplus# show memory history
```

SHOW MEMORY POOLS

Syntax

```
show memory pools
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display a list of memory pools used by the processes.

Example

This example displays a list of memory pools used by the processes:

```
awplus# show memory pools
```

SHOW PROCESS

Syntax

```
show memory process [sort cpu|mem]
```

Parameters

cpu
: Sorts the list by percentage of CPU utilization.

mem
: Sorts the list by percentage of memory utilization.

Mode

Privileged Exec mode

Description

Use this command to display a summary of the current running processes.

Examples

This example lists the running processes by ID number:

```
awplus# show process
```

This example sorts the list by percentage of CPU utilization:

```
awplus# show process sort mem
```

This example lists the running processes by percentage of memory utilization:

```
awplus# show process sort mem
```

SHOW SYSTEM SERIALNUMBER

Syntax

```
show system serialnumber
```

Parameters

None

Modes

User Exec mode and Privileged Exec mode

Description

Use this command to display the serial number of the switch. The serial number is also displayed with “SHOW SYSTEM” on page 171.

Example

This example displays the serial number of the switch:

```
awplus# show system serialnumber
```

SHOW SYSTEM INTERRUPTS

Syntax

```
show system interrupts
```

Parameters

None

Mode

Privileged Exec mode

Description

Use this command to display the number of interrupts for each Interrupt Request (IRQ) used to interrupt input lines on a Programmable Interrupt Controller (PIC) on the switch.

Example

This example displays the number of interrupts for each IRQ:

```
awplus# show system interrupts
```

SHOW TECH-SUPPORT

Syntax

```
show tech-support [all]
```

Parameters

all

Performs the full set of technical support commands.

Mode

Privileged Exec mode

Description

Use this command to store the system information in a file. You may be asked to perform this command and to send the file to Allied Telesis technical support if you contact the company for assistance with a switch problem. The file is stored in the file system with the file name “tech-support” followed by a string of numbers and the extension “txt.” After performing the command, upload the file from the switch using TFTP or Zmodem, and email it to Allied Telesis technical support. For instructions on how to upload files from the switch, refer to “Uploading Files from the Switch with TFTP” on page 611 or “Uploading Files from the Switch with Zmodem” on page 614.

Without the ALL option, the command performs these commands and stores the results in a text file in the file system of the switch:

- DIR
- SHOW CLOCK
- SHOW CPU
- SHOW FILE SYSTEMS
- SHOW LOG
- SHOW MEMORY
- SHOW PROCESS
- SHOW RUNNING-CONFIG
- SHOW STARTUP-CONFIG
- SHOW SYSTEM
- SHOW VERSION

With the ALL option, the command performs the previous commands and these additional commands:

- SHOW ARP
- SHOW INTERFACE
- SHOW IP INTERFACE
- SHOW IPV6 INTERFACE
- SHOW MAC ADDRESS-TABLE

Examples

This example stores the system information in a file:

```
awplus# show tech-support
```

This example performs the full set of technical support commands and stores the system information in a file:

```
awplus# show tech-support all
```

Appendix B
Management Software Default Settings

This appendix lists the factory default settings of the switch. The features are listed in alphabetical order:

❒ “Web Server” on page 1982

Boot Configuration File

The following table lists the name of the default configuration file.

Table 284. Boot Configuration File

Boot Configuration File	Default
Switch	boot.cfg

Class of Service

The following table lists the default mappings of the IEEE 802.1p priority levels to the egress port priority queues.

Table 285. Class of Service

IEEE 802.1p Priority Level	Port Priority Queue
0	Q2
1	Q0 (lowest)
2	Q1
3	Q3
4	Q4
5	Q5
6	Q6
7	Q7 (highest)

Console Port

The following table lists the default settings for the Console port.

Table 286. Console Port

Console Port Setting	Default
Data Bits	8
Stop Bits	1
Parity	None
Flow Control	None
Baud Rate	9600 bps

Note
The baud rate is the only adjustable parameter on the port.

DHCP Relay

The following table lists the default settings for the DHCP relay feature.

Table 287. DHCP Relay

DHCP Relay Setting	Default
DHCP Relay Status	Disabled
Insertion of Option 82 Information	Disabled
DHCP Requests with Option 82 Information and Null IP address in the giaddr Fields	Forward
Policy for Option-82 Information in Client Packets	Replace
Maximum Length of Client Requests	576 bytes

802.1x Port-Based Network Access Control

The following table describes the 802.1x Port-based Network Access Control default settings.

Table 288. 802.1x Port-based Network Access Control

802.1x Port-based Network Access Control Settings	Default
Port Access Control	Disabled
Authentication Method	RADIUS EAP
Port Roles	None
Authentication Port	1812

The following table lists the default settings for an authenticator port.

Table 289. Authenticator Port

Authenticator Port Setting	Default
Authentication Mode	802.1x
Supplicant Mode	Single
Port Control	Auto
Quiet Period	60 seconds
TX Period	30 seconds
Reauth Enabled	Enabled
Reauth Period	3600 seconds
Supplicant Timeout	30 seconds
Server Timeout	30 seconds
Max Requests	2
VLAN Assignment	Disabled
Control Direction	Both
Guest VLAN	Disabled

The following table lists the default settings for RADIUS accounting.

Table 290. RADIUS Accounting

RADIUS Accounting Settings	Default
Status	Disabled
Port	1813

The following table lists the default settings for supplicant ports.

Table 291. Supplicant

Supplicant Port Settings	Default
Auth Period	30 seconds
Held Period	60 seconds
Max Start	3
User Name	(none)
User Password	(none)

Enhanced Stacking

The following table lists the enhanced stacking default setting.

Table 292. Enhanced Stacking

Enhanced Stacking Setting	Default
Switch State	Member

GVRP

This section provides the default settings for GVRP.

Table 293. GVRP

GVRP Setting	Default
Status	Disabled
GIP Status	Enabled
Join Timer	20 centiseconds
Leave Timer	60 centiseconds
Leave All Timer	1000 centiseconds

IGMP Snooping

The following table lists the IGMP Snooping default settings.

Table 294. IGMP Snooping

IGMP Snooping Setting	Default
IGMP Snooping Status	Disabled
Multicast Host Topology	Single Host/ Port (Edge)
Host/Router Timeout Interval	260 seconds
Maximum IGMP Multicast Groups	64
Multicast Router Ports Mode	Auto Detect

IGMP Snooping Querier

The following table lists the IGMP snooping querier default settings.

Table 295. Snooping Querier

IGMP Snooping Querier Setting	Default
IGMP Snooping Querier Status	Disabled
IGMP Query Interval	125 seconds

Link Layer Discovery Protocol (LLDP and LLDP-MED)

The following table lists the default settings for LLDP and LLDP-MED.

Table 296. LLDP and LLDP-MED

LLDP an LLDP-MED	Default
Status	Disabled
Notification Interval	5 seconds
Transmit Interval	30 seconds
Holdtime Multiplier	4
Reinitialization Delay	2 seconds
Transmission Delay Timer	2 seconds
Non-strict MED TLV Order Check	Disabled

MAC Address-based Port Security

The following table lists the MAC address-based port security default settings.

Table 297. MAC Address-based Port Security

MAC Address-based Port Security Setting	Default
Status	Disabled
Intrusion Action	Protect
Maximum MAC Addresses	No Limit

MAC Address Table

The following table lists the default setting for the MAC address table.

Table 298. MAC Address Table

MAC Address Table Setting	Default
MAC Address Aging Time	300 seconds

Management IP Address

The following table lists the default settings for the management IP address.

Table 299. Management IP Address

Management IP Address Setting	Default
Management IP Address	0.0.0.0
Subnet Mask	0.0.0.0
DHCP Client	Disabled

Manager Account

The following table lists the manager account default settings.

Table 300. Manager Account

Manager Account Setting	Default
Manager Login Name	manager
Manager Password	friend
Console Disconnect Timer Interval	10 minutes
Maximum Number of Manager Sessions	3

Note
Login names and passwords are case sensitive.

Port Settings

The following table lists the port configuration default settings.

Table 301. Port Configuration

Port Configuration Setting	Default
Status	Enabled
10/100/1000Base-T Speed	Auto-Negotiation
Duplex Mode	Auto-Negotiation
MDI/MDI-X	Auto-MDI/MDIX
Threshold Limits for Ingress Packets	Disabled
Broadcast, Multicast, or Unknown Unicast Packet Filtering (Storm-control)	33,554,431 packets per second
Override Priority	No override
Head of Line Blocking Threshold	682 cells
Backpressure	Disabled
Backpressure Threshold	7,935 cells
Flow Control - Send	Disabled
Flow Control - Receive	Disabled
Flow Control Threshold	7,935 cells
Maximum Packet Size	9198 bytes[1]

1. Not adjustable.

RADIUS Client

The following table lists the RADIUS configuration default settings.

Table 302. RADIUS Configuration

RADIUS Configuration Setting	Default
Global Encryption Key	ATI
Global Server Timeout Period	5 seconds
RADIUS Server 1 Configuration	0.0.0.0
RADIUS Server 2 Configuration	0.0.0.0
RADIUS Server 3 Configuration	0.0.0.0
Auth Port	1812
Encryption Key	Not Defined

Remote Manager Account Authentication

The following table describes the remote manager account authentication default settings.

Table 303. Remote Manager Account Authentication

Authentication Setting	Default
Server-based Authentication	Disabled
Active Authentication Method	TACACS+

RMON

The following table lists the default settings for RMON collection histories. There are no default settings for alarms or events.

Table 304. RMON Collection Histories

RMON Setting	Default
History Buckets	50
History Polling Interval	1800 seconds
Owner	Agent
Statistics Groups	None
Events	None
Alarms	None

Secure Shell Server

The following table lists the SSH default settings.

Table 305. SSH

SSH Setting	Default
Status	Disabled
Host Key ID	Not Defined
Server Key ID	Not Defined
Server Key Expiry Time	0 hours
Login Timeout	180 seconds
SSH Port Number	22

Note
The SSH port number is not adjustable.

sFlow Agent

The default settings for the sFlow agent are listed in this table.

Table 306. sFlow Agent

sFlow Agent Setting	Default
sFlow Agent Status	Disabled
sFlow Collector IP Address	0.0.0.0
UDP Port	6343
Port Sampling Rate	0
Port Polling Interval	0

Simple Network Management Protocol (SNMPv1, SNMPv2c and SNMPv3)

The following table describes the default settings for SNMPv1, SNMPv2c and SNMPv3.

Table 307. SNMPv1, SNMPv2c and SNMPv3

SNMP Communities Setting	Default
SNMP Status	Disabled
Authentication Failure Trap Status	Disabled

Simple Network Time Protocol

The following table lists the SNTP default settings.

Table 308. SNTP

SNTP Setting	Default
System Time	Sat, 01 Jan 2000 00:00:00
SNTP Status	Disabled
SNTP Server	0.0.0.0
UTC Offset	+0
Daylight Savings Time (DST)	Enabled

Spanning Tree Protocols (STP, RSTP and MSTP)

This section provides the default settings for STP and RSTP.

Spanning Tree Status

The following table describes the Spanning Tree Protocol default settings for the switch.

Table 309. Spanning Tree Status

Spanning Tree Setting	Default
Spanning Tree Status	Enabled
Active Protocol Version	RSTP

Spanning Tree Protocol

The following table describes the STP default settings.

Table 310. Spanning Tree Protocol

STP Setting	Default
Bridge Priority	32768
Bridge Hello Time	2
Bridge Forwarding	15
Bridge Max Age	20
Port Cost	Automatic Update
Port Priority	128

Rapid Spanning Tree Protocol

The following table describes the RSTP default settings.

Table 311. RSTP

RSTP Setting	Default
Force Version	RSTP
Bridge Priority	32768
Bridge Hello Time	2
Bridge Forwarding	15
Bridge Max Age	20
Edge Port	Yes

Table 311. RSTP

RSTP Setting	Default
Point-to-Point	Auto Detect
Port Cost	Automatic Update
Port Priority	128
Loop Guard	Disabled
BPDU Guard	Disabled
BPDU Guard Timeout Status	Disabled
BPDU Guard Timeout Interval	300 seconds

Multiple Spanning Tree Protocol

The following table describes the MSTP default settings.

Table 312. MSTP

MSTP Setting	Default
Force Version	MSTP
Bridge Priority	32768
Bridge Hello Time	2
Bridge Forwarding	15
Bridge Max Age	20
Edge Port	Yes
Point-to-Point	Auto Detect
Port Cost	Automatic Update
Port Priority	128
Loop Guard	Disabled
BPDU Guard	Disabled
BPDU Guard Timeout Status	Disabled
BPDU Guard Timeout Interval	300 seconds

System Name

The default setting for the system name is listed in this table.

Table 313. System Name

System Name Setting	Default
System Name	awplus

TACACS+ Client

The following table lists the TACACS+ client configuration default settings.

Table 314. TACACS+ Client

TACACS+ Client Configuration Setting	Default
TAC Server 1	0.0.0.0
TAC Server 2	0.0.0.0
TAC Server 3	0.0.0.0
TAC Global Secret	None
TAC Timeout	5 seconds

Telnet Server

The default settings for the Telnet server are listed in this table.

Table 315. Telnet Server

Telnet Server Setting	Default
Telnet Server	Enabled
Telnet Port Number	23

Note
The Telnet port number is not adjustable.

VLANs

This section provides the VLAN default settings.

Table 316. VLAN

VLAN Setting	Default
Default VLAN Name	Default_VLAN (all ports)
Management VLAN ID	1 (Default_VLAN)
VLAN Type	Port-based
Member Ports	All Ports
Ingress Filtering	Enabled

Web Server

The following table lists the web server default settings.

Table 317. Web Server

Web Server Configuration Setting	Default
Status	Disabled
Operating Mode	HTTP
HTTP Port Number	80
HTTPS Port Number	443

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