Chapter 2

Switching on the AR410

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Introduction

This chapter gives an overview of Layer 1 (the physical layer) and Layer 2 (the data link layer) switching, and describes the support for switching and how to configure and operate the switch ports on the router.

The router operates at the data link layer, transparent to higher layer protocols, transferring frames between the data link layers of the networks to which it is attached.

Switching uses Virtual LAN (VLAN) configuration to connect multiple Local Area Network (LAN) segments together to form an extended LAN. Stations connected to different ports in the same VLAN communicate with one another as if they were on the same LAN. It also divides one physical LAN into multiple Virtual LANs (VLANs). Stations connected to each other on the same extended LAN are grouped in separate VLANs, so that a station in one VLAN can communicate directly with other stations in the same VLAN, but must go through higher layer routing protocols to communicate with stations in another VLAN. The default configuration for the router includes all switch ports in the same VLAN.

Because frames may be received faster than they can be forwarded, there are *Quality of Service* queues in which frames await transmission according to their priority.

VLANs can be used to:

- Segment a network to isolate the traffic of one group of users from that of other groups, thereby reducing the potential for congestion.
- Separate traffic to a De-Militarized Zone (DMZ) from the rest of a LAN, for instance to increase security by applying a firewall between a public web server and the more private LAN.
- Increase the physical extent and/or the maximum number of stations on a LAN.

  LANs are limited in their physical extent by the signal distortion and propagation delay characteristics of the media. The router overcomes this limitation by receiving a frame on one LAN and then retransmitting the frame on another LAN, using the normal access methods for each LAN. The physical characteristics of the LAN media also place a practical limit on the number of stations that can be connected to a single LAN segment. The router overcomes this limitation by joining LAN segments together to form an extended LAN capable of supporting more stations than either of the individual LANs.

Switch Ports

A switch port is one of the physical Ethernet interfaces on the base router unit. Each switch port is uniquely identified by a port number. The router supports a number of features at the physical level that allow it to be connected in a variety of physical networks. This physical layer (layer 1) versatility includes:

- Enabling and disabling of Ethernet ports.
- Autonegotiation of port speed and duplex mode for all 10/100 Ethernet ports.
- Manual setting of port speed and duplex mode for all 10/100 Ethernet ports.
- Options for handling excessive traffic.

Enabling and disabling switch ports

A switch port that is enabled is available for packet reception and transmission. Its administrative status in the Interfaces MIB is UP. Conversely, an Ethernet port that is disabled is not available for packet reception and transmission; it does not send or receive frames. Its administrative status in the Interfaces MIB is “down”. Every switch port on the router is enabled by default.

To enable or disable a switch port, use the commands:

```
enable switch port={port-list|ALL}
```

```
disable switch port={port-list|ALL}
```

To display information about switch ports, use the command:

```
show switch port[={port-list|ALL}]
```

Autonegotiation of port speed and duplex mode

Each of the switch ports can operate at either 10 Mbps or 100 Mbps, in either full duplex or half duplex mode. In full duplex mode a port can transmit and receive data simultaneously, while in half duplex mode the port can either transmit or receive, but not at the same time. This versatility makes it possible to connect devices with different speeds and duplex modes to different ports on the router. Such versatility also requires that each port on the router know which speed and mode to use.

Autonegotiation allows the ports to adjust their speed and duplex mode to accommodate the devices connected to them. Each switch port can be either configured with a fixed speed and duplex mode, or configured to autonegotiate speed and duplex mode with a device connected to it to determine a speed and mode that allows successful transmission. An autonegotiating port adopts the speed and duplex mode required by devices connected to it. If another autonegotiating device is connected to the router, they negotiate the highest possible common speed and duplex mode (Table 2-1 on page 2-5). Setting the port to a fixed speed and duplex mode allows it to support equipment that cannot autonegotiate.

When a port at one end of the link is set to a fixed speed (non-autonegotiating) the port at the other end of the link should be set to the operate at the same speed. This is because when autonegotiation is disabled, the link partner is not able to determine the duplex mode of the link and must be forced to use the

correct mode. Switch ports autonegotiate by default when they are connected to a new device. To change this setting, use the command:

```
set switch port={port-list|ALL} SPEED={AUTONEGOTIATE|10MHALF|
    10MFULL|100MHALF|100MFULL}
```

Table 2-1: Autonegotiation preferences for switch ports

Preference	10/100 Ethernet switch ports
Highest	100 Mbps, Full duplex
	100 Mbps, Half duplex
	10Mbps, Full duplex
Lowest	10Mbps, Half duplex

The **show switch port** command displays the configured port speed and duplex mode settings.

Limiting Switch Traffic

Some choices can be made about how the switch port responds when there is more traffic than the network or the switch ports can easily handle. These choices are made globally for all the switch ports on the base router unit.

If system resources such as packet buffers, and transmit and receive queues in the switch chip are not available to forward an incoming packet, by default it uses back pressure for flow control on half duplex ports, and pause frames for flow control on full duplex ports. Back pressure can be turned off or on for half duplex ports by using the command:

```
SET SWItch BACKPRessure={ON|OFF}
```

and flow control by using pause frames can be turned off or on for full duplex ports by using the command:

```
SET SWItch FLOwcontrol={ON|OFF}
```

Once the system resource becomes available the switch transmission by the link partner of the port can resume.

When a switch port tries to transmit a packet and encounters a collision, it stops transmission and waits for a short delay period (backoff) before attempting re-transmission. For ports operating at half duplex, this delay period can be changed from the default (NORMAL) to a shorter period (AGGRESSIVE), using the command:

```
SET SWItch BACKOff={AGGressive|NORMal}
```

By default, the port repeatedly tries to transmit the packet until it succeeds (RETRY). If back pressure has been turned off (**set switch backpressure**=OFF), the half duplex ports can be set to drop such a packet after it has attempted to transmit it and had to back off 16 times due to a collision (DROP):

```
SET SWItch EXCessivecollision={DROp|RETry}
```

There are a total of 1024 packet buffers available in the buffer pool to be shared by all the switch ports. By default, these are allocated automatically according to the amount of traffic at each port (ADAPTIVE). To limit the number of buffers available for any port, use the command:

```
SET SWItch BUFferpool={EQual|ADAptive}
```

Broadcast and multicast packets are limited to 20% of the line rate (received and forwarded) by default. Broadcasts and multicasts in excess of the configured percentage are discarded. This broadcast limit can be turned on or off using the command:

```
SET SWItch BROadcastlimit={ON|OFF}
```

Virtual Local Area Networks (VLANs)

The router's VLAN feature allows the network to be segmented into separate software defined broadcast domains. More than one VLAN can be connected to the same router. Workstations, servers, and other network equipment connected to the router can be grouped according to similar data and security requirements. Devices that are members of a VLAN only exchange data with each other through the switching capabilities of the router. To exchange data between devices in separate VLANs, the router's routing capabilities are used.

Every switch port sees any non-unicast packet transmitted by the CPU no matter for which VLAN it was intended.

VLANs can consist of simple logical groupings of untagged ports, in which the ports receive and transmit untagged packets. Alternatively, VLANs can include tagged ports, which add VLAN tags to packets they transmit. A port can transmit either untagged packets or VLAN tagged packets to a VLAN of which it is a member, but not both. A VLAN can contain a mixture of VLAN tagged and untagged ports.

The router is VLAN aware, in that it can accept VLAN tagged frames. A network can contain a mixture of VLAN aware devices, for instance 802.1Q compatible devices, and VLAN unaware devices, for instance, workstations and legacy switches that do not support VLAN tagging. The router can be configured to send VLAN tagged or untagged frames on each port, depending on whether the devices connected to the port are VLAN aware. A port can belong to only one VLAN.

Creating VLANs without VLAN tags

VLANs that do not send any VLAN-tagged frames are logical groupings of ports. Any devices connected to the member ports share a common broadcast domain. The router only forwards the traffic in a VLAN to the member ports.

By default the router has one VLAN, the *default* VLAN. All switch ports belong to the default VLAN, and all the ports send untagged packets. If the default configuration is acceptable, then no further VLAN configuration is required. The VLAN configuration can be modified as required.

More such VLANs can be created on the router at any time. Each new VLAN is created with a VLAN name that is unique in the router, and a VLAN Identifier (VID) that uniquely identifies the VLAN on the physical LAN. VLANs are created by using the command:

```
create vlan=vlanname VID=2..4094
```

The *default* VLAN always has a VID of 1. The *default* VLAN cannot be deleted, but other VLANs can be deleted if they have no member ports, using the command:

```
destroy vlan={vlanname|2..4094|ALL}
```

Any port that is in the *default* VLAN can be added to another VLAN, and is then automatically removed from the *default* VLAN. A port can only be in one VLAN. Untagged ports are added to a VLAN using the command:

```
ADD VLAN={vlanname|2..4094} PORT={port-list|ALL}
```

Ports are returned to the *default* VLAN using the command:

```
DELETE VLAN={vlanname|2..4094} PORT={port-list|ALL}
```

To display the VLANs configured on the router, use the command:

```
show vlan[={vlanname|1..4094|ALL}]
```

VLAN tagging

By default, none of the switch ports add VLAN tags to packets when they transmit them. If a switch port is connected to a VLAN aware device, it can be set to send VLAN tagged frames. This VLAN tag includes the VID of the VLAN to which the port belongs.

Support for VLAN tagging is implemented in the router according to IEEE Standard 802.1Q. Just as with untagged ports, tagged ports in a VLAN belong to the VLAN's broadcast domain. A VLAN Identifier (VID) is defined for each VLAN, and this VID is used to switch traffic through a VLAN aware network so that frames are only transmitted on ports belonging to the VLAN.

A VID is associated with every frame admitted on a switch port, either because it already had a VLAN tag when it arrived, or because the VID for the incoming port's VLAN was associated with the frame when it was admitted. The switching process only forwards the frame over those ports that belong to the VLAN specified by this VID. When the router forwards a frame over a tagged port to another VLAN-aware device (for instance, another router), it adds a VLAN tag (the same VID) to the frame. When the router forwards the frame over an untagged port to a VLAN-unaware device, it transmits the frame as a VLAN-untagged frame, not including the VID in the frame.

A VLAN may have VLAN-aware devices connected to some ports that require VLAN tagging, and legacy devices connected to other ports that cannot accept VLAN tags. Whether VLAN tagged or untagged frames are transmitted on a port for a particular VLAN is determined when the port is added to that VLAN, or can be modified later, using the commands:

```
ADD VLAN={vlanname|1..4094} PORT={port-list|ALL}
    [FRAME=TAGGED|UNTAGGED]

SET VLAN={vlanname|1..4094} PORT={port-list|ALL}
    [FRAME=TAGGED|UNTAGGED]
```

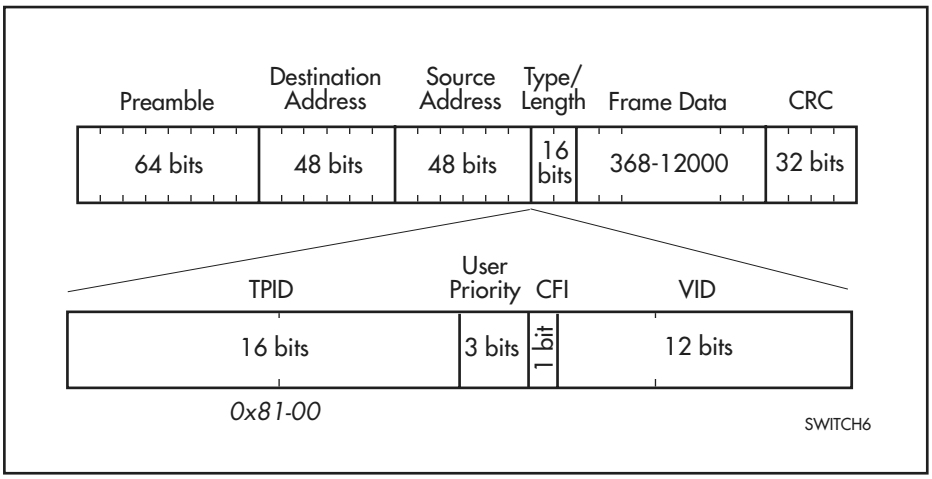
A switch port can only be in one VLAN.

Eth interfaces on the router can also apply a VLAN tag to frames that they transmit. For more information, see "VLAN Tagging on Eth Interfaces" on page 14-30 of Chapter 14, Internet Protocol (IP).

VLAN tags in the Ethernet Frame

IEEE Standard 802.3ac includes four octets in the Ethernet encapsulation of frame data for use in switching based on user priority and VLAN membership. This standard also increases the maximum allowable length for an Ethernet frame to 1522 octets (the minimum size is unchanged at 64 octets).

Figure 2-1: Format of user priority and VLAN data in an Ethernet frame



IEEE Standard 802.1Q specifies how this encapsulation data is used to switch frames.

Table 2-2: Fields in the Ethernet frame for QOS and VLAN switching

Field	Length	Meaning and use
Length/Type	2 octets	The TPID or Ethertype field is defined by IEEE Standard 802.1Q as 0x81-00.
User Priority	3 bits	The User Priority field is the priority tag for the frame, used by the router to determine the Quality of Service to apply to the frame. The 3-bit binary number represents 8 priority levels from 0 to 7.
CFI	1 bit	The Canonical Format Indicator (CFI flag) is used to indicate whether all MAC address information that may be present in the MAC data carried by the frame is in canonical format.
VID	12 bits	The VLAN Identifier (VID) field uniquely identifies the VLAN to which the frame belongs, and is used by the router to determine which VLAN to forward the frame to.

Table 2-3 on page 2-9 lists the VLAN Identifier values that have specific meaning.

Table 2-3: Reserved VID values.

VID value (hexadecimal)	Meaning and use of reserved VID values
0	The null VLAN ID. Indicates that the tag header contains only user priority information; no VLAN Identifier is present in the frame. This VID value must not be configured in any Forwarding Database entry, or used in any management operation. Frames that contain the null VLAN ID are also known as priority-tagged frames.
1	The default VID value used for classifying frames on ingress through an untagged switch port.
FFF	Reserved for implementation use. This VID value must not be configured in any Forwarding Database entry, used in any management operation, or transmitted in a tag header.

The Layer 2 Switching Process

The Layer 2 switching process comprises related but separate processes. The *Learning Process* learns the MAC addresses and VLAN membership of frames admitted on each port. The *Forwarding Process* determines which ports the frames are forwarded to, and the *Quality of Service* priority with which they are transmitted. Finally, the *Egress Rules* determine for each frame whether VLAN tags are included in the Ethernet frames that are transmitted. These processes assume that each station on the extended LAN has a unique data link layer address, and that all data link layer frames have a header which includes the source (sender's) MAC address and destination (recipient's) MAC address.

The Learning Process

The Learning Process uses an *adaptive learning* algorithm, sometimes called *backward learning*, to discover the location of each station on the extended LAN.

All frames admitted by the Ingress Rules on any port are passed on to the Forwarding Process if they are for destinations within the same VLAN. Frames destined for other VLANs are passed to the layer three protocol, for instance IP. For every frame admitted, the frame's source MAC address is compared with entries in the Forwarding Database (also known as a MAC address table, or a forwarding table) maintained by the router. The Forwarding Database contains one entry for every unique station MAC address the router knows.

If the frame's source address is not already in the Forwarding Database, the address is added and an ageing timer for that entry is started. If the frame's source address is already in the Forwarding Database, the ageing timer for that entry is restarted.

If the ageing timer for an entry in the Forwarding Database expires before another frame with the same source address is received, the entry is removed from the Forwarding Database. This prevents the Forwarding Database from being filled up with information about stations that are inactive or have been disconnected from the network, while ensuring that entries for active stations

are kept alive in the Forwarding Database. By default, the ageing timer is enabled, and it can be disabled or enabled using the commands:

```
ENAble SWItch AGEingtimer

DISable SWItch AGEingtimer
```

The Forwarding Database relates a station's (source) address to a port on the router, and is used by the router to determine from which port (if any) to transmit frames with a destination MAC address matching the entry in the station map.

To display general switch settings, including settings for the switch ageing timer, use the command:

```
show switch
```

The Forwarding Process

The Forwarding Process forwards received frames that are to be relayed to other ports in the same VLAN.

The destination address is then looked up in the Forwarding Database for the VLAN. If the destination address is not found, the router floods the frame on all ports in the VLAN except the port on which the frame was received. If the destination address is found, the router discards the frame if the destination address is on the same port as the source address. Otherwise, the frame is forwarded on the indicated port.

The Forwarding Process provides storage for queued frames to be transmitted over a particular port or ports. More than one transmission queue may be provided for a given port. Which transmission queue a frame is sent to is determined by the user priority tag in the Ethernet frame, and the Quality of Service mapping (see "Quality of Service" on page 2-10).

Quality of Service

The switch hardware has a number of Quality of Service (QOS) *egress queues* that can be used to give priority to the transmission of some frames over other frames on the basis of their user priority tagging. The user priority field in an incoming frame (with value 0 to 7) determines which of the eight priority levels the frame is allocated. When a frame is forwarded, it is sent to a QOS egress queue on the port determined by the mapping of priority levels to QOS egress queues. All frames in the first QOS queue are sent before any frames in the second QOS egress queue, and so on, until frames in the last QOS egress queue, which are only sent when there are no frames waiting to be sent in any of the higher QOS egress queues.

The mapping between user priority and a QOS egress queue can be configured using the command:

```
SET SWItch QOS=P1,P2,P3,P4,P5,P6,P7,P8
```

The router has two QOS egress queues. It has a default mapping of priority levels to QOS egress queues as defined in IEEE Standard 802.1Q (Table 2-4 on page 2-11).

Table 2-4: Default priority level to queue mapping for four QOS egress queues

Priority level	QOS Egress Queue
0	0
1	0
2	0
3	1
4	1
5	1
6	1
7	1

To display the mapping of user priority to QOS egress queues, use the command:

```
SHow SWItch QOS
```

The Egress Rules

Once the Forwarding Process has determined which ports and transmission queues to forward a frame from, the Egress Rules for each port determine whether the outgoing frame is VLAN-tagged with its numerical VLAN Identifier (VID). In the default configuration, no ports transmit VLAN tagged packets.

Configuration Example

This section shows an example of configuring VLANs. The example assumes that the router configuration begins from factory default settings.

Separate LAN and DMZ VLANs

The example in Figure 2-2 on page 2-12 configures two separate VLANs on the router's switch ports, so that traffic between ports in the *lan* VLAN is switched, while traffic between the *dmz* and *lan* VLANs must be routed using a routing protocol, such as IP (*Internet Protocol (IP)* chapter), Novell IPX, or AppleTalk. In this figure, the Ethernet port *eth0* is used to connect to the WAN. To configure a firewall between the *dmz* and *lan* VLANs and between the VLANs and the WAN connection, see the *Firewall* chapter.

Figure 2-2: VLAN configuration example.

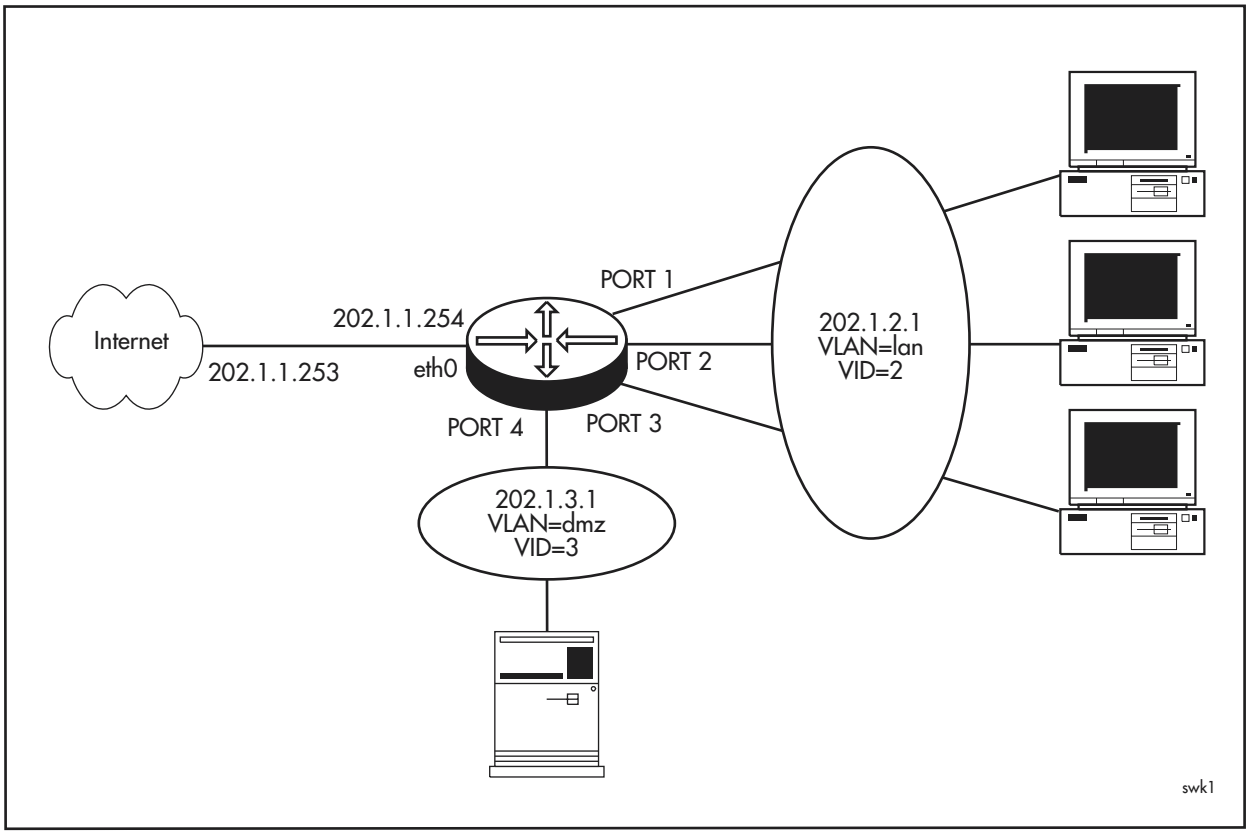
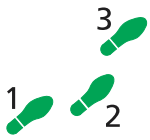


Table 2-5: Parameters for configuration example

Interface			**IP Address**	**IP Mask**
WAN				
Eth0			202.1.1.254	255.255.255.0
VLAN ID	**VLAN name**	**Ports (untagged)**	**IP Address**	**IP Mask**
VID=2	VLAN=lan	PORT 1-3	202.1.2.1	255.255.255.128
VID=3	VLAN=dmz	PORT 4	02.1.3.1	255.255.255.128



Configure VLANs

1. Create VLANs

Create the two VLANs on the router using the following commands:

```
CREATE VLAN=lan VID=2
CREATE VLAN=dmz VID=3
```

2. Add ports to VLANs

Add the ports to these VLANs using the following commands:

```
ADD VLAN=lan PORT=1-3
ADD VLAN=dmz PORT=4
```

Check the VLAN configuration by using the command:

```
SHOW VLAN
```

3. **Assign IP addresses to the interfaces.**

   This example uses IP routing between the interfaces. Other routing protocols, such as Novell IPX or AppleTalk can also be used over these interfaces.

   Assign IP addresses to each VLAN, and to the WAN connection.

```
ADD IP INTERFACE=VLAN2 IPADDRESS=202.1.2.1
   MASK=255.255.255.128

ADD IP INTERFACE=VLAN3 IPADDRESS=202.1.3.1
   MASK=255.255.255.128

ADD IP INTERFACE=ETH0 IPADDRESS=202.1.1.254
   MASK=255.255.255.0
```

   Check that traffic is switching across ports 1, 2 and 3. Traffic on the router can be monitored using the command:

```
SHOW SWITCH PORT=ALL COUNTER
```

   Check that traffic is routed between the interfaces, using PING.

Command Reference

This section describes the commands available to configure and manage the switching functions on the router.

See "Conventions" on page xcv of Preface in the front of this manual for details of the conventions used to describe command syntax. See Appendix A, Messages for a complete list of messages and their meanings.

add vlan port

Syntax

```
ADD VLAN={vlanname|1..4094} POrt={port-list|ALL}
   [FRAme={TAGged|UNTAGged}]
```

where:

- *vlanname* is a unique name for the VLAN 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlanname* cannot be a number or ALL or DEFAULT.
- *port-list* is a port number, range (specified as n-m), or comma-separated list of port numbers and/or ranges. Port numbers start at 1 and end at m, where m is the highest numbered switch port.

Description

This command adds ports to the specified VLAN. The port is automatically removed from the default VLAN.

The **vlan** parameter specifies the name or numerical VLAN identifier of the VLAN. The name is not case sensitive although the case is preserved for display purposes. The VLAN must already exist. By default, all ports belong to the default VLAN, with a numerical VLAN Identifier (VID) of 1.

The **port** parameter specifies the ports. A port may be a member of only one VLAN. It is not possible to add a port to a VLAN if the port is already present in any other VLAN except the default VLAN. If the port is a member of the default VLAN, adding it to another VLAN deletes it from the default VLAN. If the command would succeed on a subset of ports specified, but cause an error on the others, then the command as a whole fails and has no effect.

The **frame** parameter specifies whether a VLAN tag header is included in each frame transmitted on the specified ports. If **tagged** is specified, a VLAN tag is added to frames prior to transmission. The port is then called a tagged port for this VLAN. If **untagged** is specified, the frame is transmitted without a VLAN tag. The port is then called an untagged port for this VLAN. It is not possible to add a port to a VLAN if the port is already present in any other VLAN except the default VLAN. If the port is a member of the default VLAN, adding it to another VLAN deletes it from the default VLAN. The default setting is UNTAGGED.

Examples To add port 4 to the port-based Marketing VLAN, use the command:

```
add vlan=marketing port=4
```

To add port 2 to the Training VLAN as a tagged port, use the command:

```
add vlan=training port=2 frame=tagged
```

Related Commands **delete vlan port**
show vlan

create vlan

Syntax `CREate VLAN=`*`vlanname`* `VID=2..4094`

where *vlanname* is a unique name for the VLAN 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits), the underscore, and the hyphen. The *vlanname* cannot be a number or ALL or DEFAULT.

Description This command creates a VLAN with a unique name and VLAN Identifier (VID). To change the VID of an existing VLAN, that VLAN must be destroyed and created again with the modified VID. A maximum of 16 VLANs can be created with any VID from 2 to 4094.

The **vlan** parameter specifies a unique name for the VLAN. This name can be more meaningful than the VID, to make administration easier. The VLAN name is only used internally; it is not transmitted to other VLAN-aware devices, or used in the Forwarding Process or stored in the Forwarding Database. If the VLAN name begins with “vlan” and ends in a number, for instance “vlan1” or “vlan234”, then the number must be the same as the VID specified. This avoids confusion when identifying which VLAN subsequent commands refer to.

The **vid** parameter specifies a unique VLAN Identifier for the VLAN. If VLAN-tagged ports are added to this VLAN, the specified VID is used in the VID field of the tag in outgoing frames. If VLAN-untagged ports are added to this VLAN, the specified VID only acts as an identifier for the VLAN in the Forwarding Database. The default VLAN has a VID of 1.

Examples To create a VLAN named marketing with a VLAN Identifier of 2, use the command:

```
create vlan=marketing vid=2
```

To create a VLAN named vlan42, which must have a VID of 42, use the command:

```
create vlan=vlan42 vid=42
```

Related Commands
destroy vlan
set vlan port
show vlan

delete vlan port

Syntax `DELete VLAN={`*`vlanname`*`|1..4094} POrt={`*`port-list`*`|ALL}`

where:

- *vlanname* is a unique name for the VLAN 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0-9), the underscore character (“_”), and the hyphen (-). The *vlanname* cannot be a number or ALL or DEFAULT.
- port-list is a port number, range (specified as *n-m*), or comma-separated list of port numbers and/or ranges. Port numbers start at 1 and end at *m*, where *m* is the highest numbered switch Ethernet port.

Description This command deletes the specified ports from the specified VLAN. It is not possible to delete a port that belongs only to the default VLAN as an untagged port. When a port is deleted from a VLAN it automatically becomes a member of the default VLAN.

The **vlan** parameter specifies the name or numerical VLAN identifier of the VLAN. The name is not case sensitive. The VLAN must already exist.

The **port** parameter specifies the ports to be deleted from the VLAN. If ALL is specified, then all ports belonging to the VLAN are deleted. Deleting a port from a VLAN that is not the default VLAN returns it to the default VLAN with the tagging configuration remaining unchanged. If the command would succeed on a subset of the ports specified, but cause an error on the others, then the command as a whole fails and has no effect.

Example To delete port 3 from the marketing VLAN, use the command:

```
delete vlan=marketing port=3
```

Related Commands
add vlan port
show vlan

destroy vlan

Syntax `DESTroy VLAN={`*`vlanname`*`|2..4094|ALL}`

where *vlanname* is a unique name for the VLAN 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0-9), the underscore character ("_"), and the hyphen (-). The *vlanname* cannot be a number or ALL or DEFAULT.

Description This command destroys the specified static VLAN or all static VLANs in the router. The default VLAN, with a VID of 1, cannot be destroyed. If ALL is specified then all VLANs except the default VLAN are destroyed. A VLAN cannot be destroyed if ports still belong to it, or if other modules are attached to it.

Examples To destroy the VLAN with the VLAN Identifier of 1234, use the command:

```
DESTROY VLAN=1234
```

To remove all user created VLANs from the router, none of which have any member ports, use the command:

```
destroy vlan=all
```

Related Commands **create vlan**
show vlan

disable switch ageing timer

Syntax `DISable SWItch AGEingtimer`

Description This command disables the ageing timer from ageing out dynamically learned entries in the Forwarding Database. The default setting for the ageing timer is enabled.

Example To disable the ageing out of learned MAC addresses, use the command:

```
disable switch ageingtimer
```

Related Commands **enable switch ageingtimer**
show switch

disable switch debug

Syntax `DISable SWItch DEBug`

Description This command disables the display of the data used in configuring the control registers of the switch device at the time of use. The data is displayed whenever the switch circuitry is configured.

Example To disable the debug output of the switch configuration information, use the command:

```
disable switch debug
```

Related Commands enable switch debug
show switch

disable switch port

Syntax `DISable SWItch POrt={`*`port-list`*`|ALL}`

where *port-list* is a port number, range (specified as *n-m*), or comma-separated list of numbers and/or ranges. Port numbers start at 1 and end at *m*, where *m* is the highest numbered switch port.

Description This command disables a switch port or group of switch ports. If the port is disabled, it does not send or receive packets. Ports should be disabled if there is faulty wiring or equipment attached to the ports, or as a security measure to stop access from intruders. Switch ports are enabled by default.

The **port** parameter specifies the port or ports to be disabled.

Example To disable ports1, 2 and 3, use the command:

```
disable switch port=1-3
```

Related Commands enable switch port

disable vlan debug

Syntax `DISable VLAN={`*`vlanname`*`|1..4094|ALL} DEBug={PKT|ALL}`

where *vlanname* is a unique name for the VLAN 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0-9), the underscore character ("_"), and the hyphen (-). The *vlanname* cannot be a number or ALL.

Description This command disables packet debugging or all debugging for the specified VLAN or all VLANs. The default is for all VLAN debugging to be disabled.

The **debug** parameter specifies the VLAN debugging mode to be disabled. If PKT is specified, the packet debug mode (displaying raw ASCII packets) is disabled. If ALL is specified, all debugging is disabled.

Example To disable packet debugging on the *default* VLAN, use the command:

```
disable vlan=default debug=pkt
```

Related Commands enable vlan debug
show vlan debug

enable switch ageingtimer

Syntax `ENAble SWItch AGEingtimer`

Description This command enables the ageing timer to age out dynamically learned entries in the Forwarding Database after 300 seconds. The default setting for the ageing timer is enabled.

Example To enable the ageing out of learned MAC addresses, use the command:

```
enable switch ageingtimer
```

Related Commands **disable switch ageing timer**
show switch

enable switch debug

Syntax `ENAble SWItch DEBug [OUTput=CONsole]`

Description This command enables output of switch debug information when the switching process is reset or reconfigured.

The **output** parameter set to CONSOLE specifies that the debugging information produced is sent to the console. The debugging data is by default sent to the port on which it received the **enable switch debug** command. Use this option if the command is used in a script, since a script is not received on a port.

Example To enable the debug output of the switch configuration information, use the command:

```
enable switch debug
```

Related Commands **disable switch debug**
show switch

enable switch port

Syntax `ENAble SWItch POrt={`*`port-list`*`|ALL}`

where *port-list* is a port number, range (specified as *n*-*m*), or comma-separated list of port numbers and/or ranges. Port numbers start at 1 and end at *m*, where *m* is the highest numbered switch port.

Description This command enables a port or group of ports on the router. If the port is enabled, the port sends and receives packets. Switch ports are enabled by default.

The **port** parameter specifies the port or ports to be enabled.

Example To enable ports 2 and 4, use the command:

```
enable switch port=2,4
```

Related Commands disable switch port

enable vlan debug

Syntax

```
ENAble VLAN={vlanname|1..4094|ALL} DEBug={PKT|ALL}
   [OUTput=CONsole] [TIMEOut={1..4000000000|NONE}]
```

where *vlanname* is a unique name for the VLAN 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0-9), the underscore character ("_"), and the hyphen (-). The *vlanname* cannot be a number or ALL.

Description This command enables debugging options for the specified VLAN or all VLANs. The default is for all VLAN debugging to be disabled. Be aware that enabling debug could flood the receiving Telnet session or asynchronous port with raw data.

The **debug** parameter specifies which debugging mode is enabled. If PKT is specified, packet debug mode (displaying raw ASCII packets) is enabled. If ALL is specified, all debugging is enabled.

The **output** parameter set to CONSOLE specifies that the debugging information produced is sent to the console. The debugging data is by default sent to the port on which it received the **enable vlan debug** command. Use this option if the command is used in a script, since a script is not received on a port.

The **timeout** parameter specifies the time in seconds for which debugging is enabled on a specific VLAN. This reduces the risk of the router and the display being overloaded with too much debugging information. This value overrides previous VLAN debugging timeout values for the VLAN, even if they were specified for other debugging modes. If **timeout** is not specified, the timeout is the most recent TIMEOUT value previously used in an **enable vlan debug** command, or NONE if it has not been previously set.

Example To enable all debugging on the *default* VLAN, use the command:

```
enable vlan=default debug=all
```

Related Commands disable vlan debug
show vlan debug

reset switch

Syntax `RESET SWItch`

Description This command resets the switch module. All dynamic switching information is cleared, and all ports are reset. Counters and timers are reset to zero.

Example To reset the switch module, use the command:

```
reset switch
```

Related Commands **show switch**

set switch backoff

Syntax `SET SWItch BACKOff={AGGressive|NORMal}`

Description This command sets the global retransmission time delay for all switch ports operating in half duplex mode. When the port attempts to transmit a packet and encounters a collision, the router stops transmission and starts a short delay before attempting re-transmission. If AGGRESSIVE is specified, the time delay is shorter. If NORMAL is specified, the time delay is standard. This command resets the switching process, and clears the forwarding database. The default is NORMAL.

Example To enable aggressive backoff for all half duplex switch ports, use the command:

```
set switch backoff=aggressive
```

Related Commands **show switch port**
set switch excessivecollision

set switch backpressure

Syntax `SET SWItch BACKPRessure={ON|OFF}`

Description This command sets backpressure on or off globally for the switch ports. If ON is specified, any switch port operating at half duplex uses back pressure for flow control when system resources, including packet buffers, transmit and receive queues, are not available to forward an incoming packet. If OFF is specified, backpressure is not used. This command resets the switching process, and clears the switch forwarding database. The default is ON.

When BACKPRESSURE is ON, the setting for EXCESSIVECOLLISION has no effect.

Example To enable backpressure for flow control on ports configured as half duplex, use the command:

```
set switch backpressure=on
```

Related Commands show switch port

set switch broadcastlimit

Syntax `SET SWItch BROadcastlimit={ON|OFF}`

Description This command sets a global broadcast limit on the switch ports, resets the switching process, and clears the switch forwarding database.

The **broadcastlimit** parameter specifies the maximum number of broadcast packets forwarded by a switch port as a percentage of the line rate. The default is ON.

Example To set the broadcast limit of ON, use the command:

```
set switch broadcastlimit=on
```

Related Commands show switch

set switch bufferpool

Syntax `SET SWItch BUFferpool={EQual|ADAptive}`

Description This command enables a global mechanism for the switch ports. BUFFERPOOL assigns limits to the number of buffers associated with any one switch port. There are a total of 1024 packet buffers available in the buffer pool. This resource is shared between all switch ports. The Adaptive Buffer Pool (ADAPTIVE) option automatically allocates buffers based on the amount of traffic at each port. This command resets the switching process, and clears the switch forwarding database. The default is ADAPTIVE.

Example To enable Adaptive Buffer Pool sizing, use the command:

```
set switch bufferpool=adaptive
```

Related Commands show switch port

set switch excessivecollision

Syntax `SET SWItch EXCessivecollision={DROp|RETry}`

Description This command configures a global mechanism on the router that affects ports configured as half-duplex. This command resets the switching process, and clears the switch forwarding database. Use this command when back pressure has been turned off with the **set switch backpressure** command on page 2-20.

The **excessivecollision** parameter specifies how switch ports behave when excessive collisions occur while they are trying to transmit the same packet. If DROP is specified, the port drops these packets after 16 collisions. If RETRY is specified, the switch port retransmits the packet until it succeeds. The default is RETRY.

Example To enable the router to drop a packet after 16 collisions, use the command;

```
set switch excessivecollision=drop
```

Related Commands **show switch port**

set switch flowcontrol

Syntax `SET SWItch FLOwcontrol={ON|OFF}`

Description This command enables a global mechanism for the switch ports that affects ports configured as full-duplex. If FLOWCONTROL is ON, the port uses pause frame flow control as defined in IEEE Standard 802.3x. Flow control is applied when system resources, including packet buffers, transmit and receive queues, are not available to forward an incoming packet. The switch ports emit a flow control frame (XOFF), containing the maximum pause time specified in IEEE Standard 802.3x. Once the system resource becomes available the router issues a flow control frame (XON), with zero pause time to turn off flow control and therefore allow transmission by the link partner of the port. The default is ON.

Example To enable flow control on ports set as full duplex, use the command:

```
set switch flowcontrol=on
```

Related Commands **show switch port**

set switch port

Syntax

```
SET SWITCH POrt={port-list|ALL} [DESCription=description]
   [SPeed={AUTOnegotiate|10MHALf|10MFUll|100MHALf|
   100MFUll}]
```

where:

- *port-list* is a port number, range (specified as *n-m*), or comma-separated list of port numbers and/or ranges. Port numbers start at 1 and end at *m*, where *m* is the highest numbered switch port.
- *description* is a string 1 to 47 characters long. Valid characters are any printable characters.

Description

This command modifies the value of parameters for switch ports, resets the switching process, and clears the switch forwarding database.

The **port** parameter specifies the ports for which parameters are modified. If the command would succeed on a subset of the ports specified, but cause an error on the others, then the command as a whole fails and has no effect.

While you may specify **set switch port** commands using groups of ports, the **create config** command on page 1-70 of Chapter 1, Operation generates a separate **set switch port** command for each port.

The **description** parameter can be used to describe the port. It is displayed by the **show switch port** command on page 2-30, but does not affect the operation of the router in any way. The default is no description.

The **speed** parameter specifies the configured line speed and duplex mode of the port(s). If AUTONEGOTIATE is specified, the port autonegotiates the line speed and duplex mode with the device attached to the port. If any other option is specified, the port is forced to the speed and duplex mode given. The default is AUTONEGOTIATE.

Examples

To set the speed of port 2 to 10Mbps, half duplex, use the command:

```
set switch port=2 speed=10mhalf
```

Related Commands

disable switch port
enable switch port
show switch port

set switch qos

Syntax

```
SET SWItch QOS=P1,P2,P3,P4,P5,P6,P7,P8
```

where *P1-P8* are each numbers from 0-n where n+1 is the number of Quality of Service egress queues supported

Description

This command maps user priority levels to Quality of Service egress queues.

The **qos** parameter specifies a comma-separated list of eight values, all of which must be present. The first value, P0, represents the QOS queue for priority level 0. The last value, P7, represents the QOS queue for priority level 7. Similarly, values P1 to P6 represent the QOS queue for the corresponding priority level.

The AR410 has two QOS egress queues. Its default QOS values are 0,0,0,1,1,1,1,1 as shown in Table 2-6 on page 2-24.

For the AR400 series, packets that originate on the router or are routed by the router's software have been assigned a Quality of Service priority of 7. To ensure that these packets are transmitted promptly, you should not assign priority 7 to a low-numbered egress queue.

Table 2-6: Default priority level to queue mapping for four QOS egress queues.

Priority level	Queue
0	0
1	0
2	0
3	1
4	1
5	1
6	1
7	1

Example To set the mapping shown in Table 2-7 on page 2-24, use the command:

```
SET SWITCH QOS=1,0,0,0,1,1,1,1
```

Table 2-7: Example priority level to QOS egress queue mapping.

Priority level	Queue
0	1
1	0
2	0
3	0
4	1
5	1
6	1
7	1

Related Commands **show switch qos**

set vlan port

Syntax

```
SET VLAN={vlanname|1..4094} POrt={port-list|ALL}
   FRAme={UNTAGged|TAGged}
```

where:

- *vlanname* is a unique name for the VLAN 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0-9), the underscore character ("_"), and the hyphen (-). The *vlanname* cannot be a number or ALL.
- *port-list* is a port number, range (specified as *n-m*), or comma-separated list of numbers and/or ranges. Port numbers start at 1 and end at *m*, where *m* is the highest numbered Ethernet switch port, including uplink ports.

Description

This command changes the status of ports in a VLAN from tagged to untagged or vice-versa.

The **vlan** parameter specifies the name or VID of the VLAN. The name is not case sensitive although the case is preserved for display purposes. The VLAN specified must exist.

The **port** parameter specifies the port or ports to be changed. The ports must belong to the VLAN specified. If the command would succeed on a subset of the ports specified, but cause an error on the others, then the command as a whole fails and has no effect. If ALL is specified, then all ports in the VLAN change.

The **frame** parameter specifies whether packets transmitted from a port for a specific VLAN include a VLAN tag header. If **frame** is set to UNTAGGED, the port becomes an untagged port for the specified VLAN, and sends no VLAN tags. **frame** may only be set to UNTAGGED if the port was previously a tagged port in the same VLAN. If **frame** is set to TAGGED then the port becomes a tagged port for the specified VLAN, and adds a VLAN tag to every frame it sends. **frame** may only be set to TAGGED if the ports were previously untagged ports in the same VLAN. The default is UNTAGGED.

Example

To change the status of port 1 of the default VLAN from untagged to tagged, use the command:

```
set vlan=default port=1 frame=tagged
```

Related Commands

add vlan port
delete vlan port
show vlan

show switch

Syntax

```
SHow SWItch
```

Description

This command displays configuration information for the switch functions (Figure 2-3 on page 2-26, Table 2-8 on page 2-26).

Figure 2-3: Example output from the **show switch** command

```
Switch Configuration
------------------------------------------------------------
Switch Address..................... 00-00-cd-00-7a-47
  Ageing Timer..................... Enabled (300 Seconds
Fixed)
  Backoff.......................... Aggressive
  Back Pressure.................... On
  Broadcast Frame Limit............ On
  Buffer Pool Settings............. Adaptive
  Excessive Collision Drop......... Drop
  Flow Control..................... On
  UpTime........................... 00:10:32
  Config Time...................... 00:01:02
------------------------------------------------------------
```

Table 2-8: Parameters in the output of the **show switch** command

Parameter	Meaning
Switch Address	MAC address of the switch from which the Bridge Identifier used in the Spanning Tree Algorithm is derived.
Switch Address	MAC address of the switch.
Ageing Timer	Whether the Aging Timer feature is enabled.The time that a MAC address entry remains in the address lookup table cannot be altered.
Backoff	Whether the Backoff mode is aggressive or normal for ports that are configured as half duplex.
Back Pressure	Whether Back Pressure is enabled for ports that are configured as half duplex.
Broadcast Frame Limit	Maximum line rate percentage level of Broadcast frames that are forwarded to mitigate the effects of broadcast storms.
Buffer Pool Settings	Maximum number of buffers allocated to any one port for packet buffering.
Excessive Collision Drop	Whether packets are dropped or resent (retry) when 16 successive collisions have been experienced on transmission.
Flow Control	Whether full duplex pause frame flow control is enabled.
UpTime	Hours:minutes:seconds since the router was last powered up, rebooted, or restarted. This is the same as the value of the MIB object sysUpTime.
Config Time	Hours:minutes:seconds since the switching process was last powered up or re-configured.

Example To display the configuration of the switch module, use the command:

```
show switch
```

Related Commands reset switch

show switch counter

Syntax `SHow SWItch COUnter`

Description This command displays counters associated with the switch (Figure 2-4 on page 2-27, Table 2-9 on page 2-28).

Figure 2-4: Example output from the **show switch counter** command

```
Switch Counters
-------------------------------------------------------------------------------
Switch instance:        0

Packet DMA counters:
 Receive:                                Transmit:
  Octets                          486     Octets                          482
  Packets                           6     Packets                           6
  Discards                          0     Discards                          0
  TooFewBuffers                     0     Aborts                            0
  NonOctetAlignedFrames             0     DescriptorAreaFilleds             0
  FIFOOverruns                      0     FIFOUnderruns                     0
  FrameTooLongs                     0     QueueLength                       0
  FrameTooShorts                    0
  CRCErrors                         0
  QueueLength                       0

General counters:
  Resets                            1
-------------------------------------------------------------------------------
```

Table 2-9: Parameters in the output of the **show switch counter** command

Parameters	Meaning
Packet DMA Counters	
Receive	Counters for packets received.
Octets	Number of octets received by the CPU from the switch chip.
Packets	Number of packets received by the CPU from the switch chip.
Discards	Number of packets received from the switch chip that were discarded because either the receive queue was too long, or because the free buffers in the switch were below BufferLevel3, or because there were no data bytes in the packet.
TooFewBuffers	Number of packets received from the switch chip that were discarded because the free buffers in the switch were below BufferLevel3.
NonOctetAlignedFrames	Number of received frames with alignment and CRC errors.
FIFOOverruns	The number of times reception of a packet failed because of a FIFO overrun.
rameTooLongs	The number of received packets that exceeded the maximum permitted frame size.
FrameTooShorts	The number of received packets that their lengths were less than the minimum permitted frame size.
CRCErrors	The number of received frames with CRC but not alignment errors.
QueueLength	The number of packets received from the switch chip waiting to be processed by the CPU.
Transmit	Counters for packets transmitted.
Octets	The number of octets transferred from the CPU to the switch chip, including framing.
Packets	The number of packets transferred from the CPU to the switch chip.
Discards	The number of packets waiting for transmission that were discarded when the DMA process was reset due to an error.
Aborts	The number of times the transmission of a packet was aborted due to it taking an excessive length of time for the transmission to complete.
DescriptorAreaFilleds	The number of times the transmit descriptors are filled due to a high rate of transfer of packets from the CPU to the switch chip.
FIFOUnderruns	The number of times transmission of a packet failed because of a FIFO underrun.
QueueLength	The number of packets currently queued for transmission, or that have been transmitted and are waiting to be purged from the transmit queue.
General Counters	
Resets	The number of times the switch chip has been reset due to a switch configuration change.

Example To display the switching counters, use the command:

```
show switch counter
```

Related Commands **reset switch**
show switch

show switch debug

Syntax `SHow SWItch DEBug`

Description This command displays debugging information for switching (Figure 2-5 on page 2-29, Table 2-10 on page 2-29).

Figure 2-5: Example output from the **show switch debug** command

```
SWITCH information
-------------------------------------------------------------------------------
  Port Configuration Info..... Port1  Port2  Port3  Port4  Port5(CPU)
     Control Register ........ 12     12     52     52     14
     VLAN Mask Register ...... 1f     1f     1f     1f     0f
     VLAN Tag Register ....... 0001   0001   0001   0001   0001

     Configuration Pins Data .........501576ab

  MAC Address ................... 00-00-cd-01-00-f9
  Switch Debug................... Enabled
-------------------------------------------------------------------------------
```

Table 2-10: Parameters in the output of the **show switch debug** command

Parameter	Meaning
Port Configuration Info	A human readable representation of the values for the various configuration registers associated with the switching device.
Switch Debug	The status of switch debug output.

Example To display information about the switch configuration data, use the command:

```
show switch debug
```

Related Commands **disable switch debug**
enable switch debug

show switch port

Syntax `SHow SWItch POrt[={`*`port-list`*`|ALL}]`

where *port-list* is a port number, range (specified as *n-m*), or comma-separated list of port numbers and/or ranges. Port numbers start at 1 and end at *m*, where *m* is the highest numbered switch port.

Description This command displays general information about the specified switch ports or all switch ports (Figure 2-6 on page 2-30, Table 2-11 on page 2-30).

Figure 2-6: Example output from the **show switch port** command

```
Switch Port Information
---------------------------------------------------------------
Port................................ 1
  Description....................... To upstairs hub port 4
  Link State ....................... Up
  Configured speed/duplex........... Autonegotiate
  Actual speed/duplex .............. 10Mbps, half duplex
  Port-based VLAN................... Design (2)
  Send tagged packets............... Yes
---------------------------------------------------------------
```

Table 2-11: Parameters in the output of the **show switch port** command

Parameter	Meaning
Description	A human readable identifier of this port
Link State	The link state of the port, one of "Up" or "Down".
Configured speed/duplex	The port speed and duplex mode configured for this port. Either "Autonegotiate" or a combination of a speed (one of "10 Mbps" or "100 Mbps") and a duplex mode (one of "half duplex" or "full duplex").
Actual speed/duplex	The port speed and duplex mode that this port is actually running at, if the port is Up. If the port is Up then one of "Autonegotiate" or a combination of a speed (one of "10Mbps" or "100Mbps") and a duplex mode (one of "half duplex" or "full duplex").
Port-based VLAN	Name and VLAN Identifier (VID) of the port-based VLAN to which the port belongs.
Send tagged packets for VLAN	Whether this port transmits packets with VLAN tags attached.

Example To show the status of the settings for all the ports, use the command:

```
show switch port=all
```

Related Commands

set switch backoff
set switch backpressure
set switch broadcastlimit
set switch bufferpool
set switch excessivecollision
set switch flowcontrol
set switch port

show switch qos

Syntax `SHow SWItch QOS`

Description This command displays the current mapping of user priority level to QOS egress queue for the switch ports (Figure 2-7 on page 2-31, Table 2-12 on page 2-31).

For the AR400 series, packets that originate on the router or are routed by the router's software have been assigned a Quality of Service priority of 7.

Figure 2-7: Example output from the **show switch qos** command

```
Priority Level       QOS egress queue
-------------------------------------
0 ................... 0
1 ................... 0
2 ................... 0
3 ................... 1
4 ................... 1
5 ................... 1
6 ................... 1
7 ................... 1
```

Table 2-12: Parameters in the output of the **show switch qos** command

Parameter	Meaning
Priority level	The priority level of the received frame.
QOS egress queue	The Quality Of Service egress queue that frames with this priority level join.

Example To display the current configuration of the priority level to QOS egress queue mappings, use the command:

```
show switch qos
```

Related Commands **set switch qos**

show vlan

Syntax `SHow VLAN[={`*`vlanname`*`|1..4094|ALL}]`

where *vlanname* is a unique name for the VLAN 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0-9), the underscore character ("_"), and the hyphen (-). The *vlanname* cannot be a number or ALL.

Description This command displays information about the specified VLAN. If no VLAN or ALL is specified, then all VLANs are displayed (Figure 2-8 on page 2-32, Table 2-13 on page 2-32).

Figure 2-8: Example output from the **show vlan** command

```
VLAN information
--------------------------------------------------------------------------------
Name............................. default
Identifier....................... 1
Tagged Ports ..................... -
Untagged Ports.................... 1-2
Attachments:
Module        Protocol         Format         Discrim           MAC address
--------------------------------------------------------------------------------
IP            IP               Ethernet       0800              -
IP            ARP              Ethernet       0806              -
--------------------------------------------------------------------------------


Name............................. DMZ
Identifier....................... 2
Tagged Ports ..................... -
Untagged Ports.................... 3
Attachments:
Module        Protocol         Format         Discrim           MAC address
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------


Name............................. WAN
Identifier....................... 3
Tagged Ports ..................... -
Untagged Ports.................... 4
Attachments:
Module        Protocol         Format         Discrim           MAC address
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
```

Table 2-13: Parameters in the output of the **show vlan** command

Parameter	Meaning
Name	The name of the VLAN.
Identifier	The identifier of the VLAN.
Tagged Ports	A list of tagged ports that belong to the VLAN.
Untagged Ports	A list of untagged ports that belong to the VLAN.
Attachments	This section contains information about attachments to the VLAN made by other modules in the router.
Module	The name of the software module attached to the VLAN.
Protocol	The name of the protocol, which is determined from the format and discriminator.
Format	The encapsulation format specified by the module.
Discrim	The discriminator specified by the module to identify which packets of the given format should be received.
MAC Address	The Media Access Control source address for which the module wishes to receive packets. This is commonly known as the Ethernet address.

Examples To display information on the *default* VLAN, use the command:

```
show vlan=default
```

show vlan debug

Syntax `SHow VLAN DEBug`

Description This command displays debug information for all VLANs (Figure 2-9 on page 2-33, Table 2-14 on page 2-33).

Figure 2-9: Example output from the **show vlan debug** command

```
Vlan      Enabled Debug Modes       Output     Timeout
-------------------------------------------------------------
Vlan1     PKT                       16         NONE
-------------------------------------------------------------

Vlan      Enabled Debug Modes       Output     Timeout
-------------------------------------------------------------
Vlan4094  None
-------------------------------------------------------------
```

Table 2-14: Parameters in the output of the **show vlan debug** command

Parameter	Meaning
VLAN	String comprising the constant "Vlan" and the VLAN Identifier of the VLAN.
Enabled Debug Modes	Whether the debugging option for the VLAN is PKT or none.
Output	Output device for the VLAN. Shown when a debug mode is presently enabled.
Timeout	Number of seconds that the debugging options for the VLAN is enabled. Shown when a debug mode is presently enabled.

Examples To display debugging information for all VLANs, use the command:

```
show vlan debug
```

Related Commands **disable vlan debug**
enable vlan debug