Chapter 8

Switching

Introduction

This chapter gives an overview of Layer 1 (the physical layer), 2 (the data link layer), and 3 (the network layer) switching, and describes the support for switching and how to configure and operate the switching functions.

The switch, also referred to as a MAC (media access control) bridge, a data link relay, or a Layer 2 switch, can connect multiple Local Area Network (LAN) segments together to form an extended LAN. Stations connected to different LANs can be configured to communicate with one another as if they were on the same LAN. It can also divide one physical LAN into multiple Virtual LANs (VLANs). Stations connected to each other on the same extended LAN can be grouped in separate VLANs, so that a station in one VLAN can communicate directly with other stations in the same VLAN, but must go through higher layer routing protocols to communicate with stations in other VLANs.

The switch 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. A bridge accesses each physical link according to the rules for that particular network. Access may not always be instant, so a bridge must be capable of storing and forwarding frames. Since the switch can store and forward frames, it can examine and discard or admit frames according to their VLAN tag fields. The switch can also examine the address fields of the frames and forward the frames based on knowledge of which network contains the station with an address matching the frame's destination address. In this way, the switch can act as an intelligent filtering device, redirecting or blocking the movement of frames between networks.

Because the switch may receive frames faster than it can forward them, the switch has Quality of Service (QoS) queues in which frames await transmission according to their priority.

The switch can be used to:

- 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 switch 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 switch overcomes this limitation by joining LAN segments together to form an extended LAN capable of supporting more stations than either of the individual LANs.

- Connect LANs that have a common data link layer protocol but different physical media, for example, Ethernet 10BASET, 100BASET, and 10BASEF.

- Increase the availability of LANs by allowing multiple redundant paths to be physically configured, and selected dynamically, using the Spanning Tree algorithm.

- Reduce the load on a LAN or increase the effective bandwidth of a LAN, by filtering traffic.

- Prioritise the transmission of data with high Quality of Service requirements.

By using Virtual LANs (VLANs), a single physical LAN can be separated into multiple Virtual LANs. VLANs can be used to:

- Further improve LAN performance, as broadcast traffic is limited to LAN segments serving members of the VLAN to which the sender belongs.
- Provide security, as frames are forwarded to those stations belonging to the sender's VLAN, and not to stations in other VLANs on the same physical LAN.
- Reduce the cost of moving or adding stations to function or security based LANs, as this generally requires only a change in the VLAN configuration.

Switch Ports

The term *port* is used frequently in switch terminology. Each port in a switch is associated with one of the physical interfaces on the switch. Each port is uniquely identified by a port number. The switch supports a number of features at the physical level that allows it to be connected in a variety of physical networks. This physical layer (Layer 1) versatility includes:

- Enabling and disabling Ethernet ports.
- Autonegotiation of port speed and duplex mode for all 10/100 Ethernet ports and copper gigabit ports.
- Manual setting of port speed and duplex mode for all 10/100 Ethernet ports and copper gigabit ports.
- Port trunking.
- Packet storm protection.
- Port mirroring.
- Support for SNMP management.
- Link triggers for fibre ports.

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, a port that is disabled is not available for packet reception and transmission. It does not send or receive frames and its administrative status in the Interfaces MIB is DOWN. Every port on the switch is enabled by default. A switch port that has been disabled by the Port Security feature cannot be enabled using the **enable switch port** command on page 8-138.

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

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

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

Resetting ports at the hardware level discards all frames queued for reception or transmission on the port, and restarts autonegotiation of port speed and duplex mode. Ports are reset using the command:

```
reset switch port={port-list|all} [counter]
```

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 transmits and receives data simultaneously. In half duplex mode, the port either transmits or receives, 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 switch. This versatility also requires that each port on the switch know which speed and mode to use.

Autonegotiation allows the ports to adjust their speed and duplex mode to accommodate 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 switch, they negotiate the highest possible common speed and duplex mode. Setting the port to a fixed speed and duplex mode allows it to support equipment that cannot autonegotiate.

If you override a port's autonegotiation on Rapier i Series switches by setting it to a fixed speed/duplex setting, automatic MDI/MDI-X detection is also overridden. The port defaults to MDI-X.

It is also possible to require a port to operate at a single speed without disabling autonegotiation by allowing the port to autonegotiate but constrain the speed/duplex options to the desired combination. For example, if one end of a link is set to **auto** and the other to **100mfull**, then the **auto** end selects **100mhalf** operation because without the other end autonegotiating, the **auto** end has no way of knowing that the fixed end is full duplex capable. If a particular speed is required, it is better to fix the speed/duplex combination using one of the autonegotiating speed values. Therefore, using **100mfauto** at one end of a link allows the **auto** end to autonegotiate **100mfull**.

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|10mhauto|10mfauto|100mhalf|100mfull|100mhauto|
   100mfauto|1000mhalf|1000mfull|1000mhauto|1000mfauto}
```

Settings available on different models are shown in Table 8-1 on page 8-8. Autonegotiation can also be activated at any time after this, on any port that is set to autonegotiate by using the command:

```
activate switch port={port-list|all} autonegotiate
```

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

Table 8-1: Port speed and duplex settings for switch ports

Speed	Rapier 24i Rapier 48i 10/100	Rapier G6f	Rapier G6	Rapier 16f Rapier 16fi	Rapier 16f AT-A39 uplink	Rapier 24i Rapier 48i Rapier G6x AT-A39 uplink	Rapier 24i Rapier 48i Rapier 16f Rapier G6x AT-A35 AT-A42 uplinks	Rapier 24i Rapier 48i Rapier G6x AT-A40 AT-A41 uplinks
10MHALF	Yes	No	Yes	No	No	Yes	No	No
10MFULL	Yes	No	Yes	No	No	Yes	No	No
100MHALF	Yes	No	Yes	Yes	No	Yes	No	Yes
100MFULL	Yes	No	Yes	Yes	No	Yes	No	Yes
1000MHALF	No	No	Yes	No	Yes	Yes	No	No
1000MFULL	No	Yes	Yes	No	Yes	Yes	Yes	No
10MHAUTO	Yes	No	Yes	No	No	Yes	No	No
10MFAUTO	Yes	No	Yes	No	No	Yes	No	No
100MHAUTO	Yes	No	Yes	No	No	Yes	No	Yes
100MFAUTO	Yes	No	Yes	No	No	Yes	No	Yes
1000MHAUTO	No	No	Yes	No	Yes	Yes	No	No
1000MFAUTO	No	Yes	Yes	No	Yes	Yes	Yes	No
AUTONEGOTIATE	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes

Port Trunking

Port trunking, also known as *port bundling* or *link aggregation*, allows a number of ports to be configured to join together to make a single logical connection of higher bandwidth. This can be used where a higher performance link is required, and makes links even more reliable. Port trunking must be configured on both ends of the link, or network loops may result.

The switch supports static 802.3ad link aggregation, and is also compatible with third party devices that do not support static 802.3ad link aggregation.

The switch supports up to 6 trunk groups, of up to 8 switch ports each. The two gigabit Ethernet ports can also be grouped together to form a trunk group. For trunking to work properly, avoid having a trunk group that spans multiple switch instances. It is not possible for a trunk group to include both 10/100 Ethernet and gigabit Ethernet ports. Ports in the trunk group do not have to be contiguous.

To create or destroy port trunk groups on the switch, use the commands:

```
create switch trunk=trunk [port=port-list] [select={macsrc|
   macdest|macboth|ipsrc|ipdest|ipboth}] [speed={10m|100m|
   1000m}]

destroy switch trunk=trunk
```

Port trunk groups can be destroyed on the switch only when no ports belong to them.

All the ports in a trunk group must have the same VLAN configuration: they must belong to the same VLANs and have the same tagging status. All ports in a trunk group must be added to VLANs together, and can only be deleted from a VLAN as a group. Similarly, if the tagged or untagged status of the ports is changed, it must be changed for all ports in the trunk group at the same time.

The members of a trunk group can be specified when it is created, and ports can be added to or removed from a trunk group by using the commands:

```
add switch trunk=trunk port=port-list

delete switch trunk=trunk port={port-list|all}
```

Ports in a trunk group are set to autonegotiate at the trunk speed at full duplex. When a port is added to a trunk group, the speed setting for the group overrides the speed setting previously configured for the port. When a port is removed from a trunk group, the port returns to its previously configured speed and duplex mode settings.

The speed of the trunk group can either be specified when it is created or set by using the command:

```
set switch trunk=trunk [select={macsrc|macdest|macboth|ipsrc|
   ipdest|ipboth}] [speed={10m|100m|1000m}]
```

To display information about trunks on the switch, use the command:

```
show switch trunk[=trunk]
```

To display the VLANs to which the ports in the trunk groups belong, use the command:

```
show vlan[=all]
```

Link Aggregation Control Protocol (LACP)

The implementation of the Link Aggregation Control Protocol (LACP) follows the IEEE Standard 802.3-2002, *CSMA/CD access method and physical layer specifications*.

LACP operates where systems are connected over multiple communications links. Once LACP has been initially configured and enabled, it automatically creates trunk groups and assigns appropriate links to their membership. LACP continues to monitor these groups and dynamically adds or removes links to them as network changes occur.

LACP achieves this by determining the following:

- which ports are under LACP control
- whether each port is in *LACP active* or *LACP passive* mode
- which system has the highest LACP priority
- the LACP priority of ports
- whether the periodic timeout is fast or slow

Aggregation criteria

For individual links to be formed into an aggregated group they must meet the following criteria:

- originate on the same device

- terminate on the same device
- be members of the same VLANs
- have the same data rate
- share the same admin port key (assigned by using the command, **add lacp port** command on page 8-71).

The hardware must also be capable and have the capacity to handle the number of links to be aggregated.

Aggregated group identification

In order to identify particular aggregated groups, each group is assigned a link aggregation identifier called a *lag ID*. The lag ID comprises the following components for both the local system (called the Actor) followed by their equivalent components for the remote system (called the Partner):

- *system priority* - set by the **set lacp priority** command on page 8-147.
- *system identifier* - the MAC address of the system
- *port key* - An identifier - created by the LACP software
- *port priority* - set by the command, **add lacp port** command on page 8-71.
- *port number* - determined by the device connection

The lag ID can be displayed for each aggregated link by entering the command, **show lacp trunk** command on page 8-186

Packet Storm Protection

The packet storm protection feature allows the user to set limits on the reception rate of broadcast, multicast and destination lookup failure packets. The software allows separate limits to be set for each port, beyond which each of the different packet types are discarded. The software also allows separate limits to be set for each of the packet types. Which of these options can be implemented depends on the model of switch hardware.

By default, packet storm protection is set to **none**, that is, disabled. It can be enabled, and each of the limits can be set using the command:

```
set switch port=port-list [bclimit={none|limit}]
   [dlflimit={none|limit}] [mclimit={none|limit}]
```

Packet storm protection limits cannot be set for each individual port on the switch, but can be set for each processing block of ports. The processing blocks are sets of 8 ports (e.g. as many as are applicable of ports 1-8, 9-16 and 17-24) and each uplink port is a further processing block. Therefore, a 16-port switch has four processing blocks and a 24-port switch has five. The two uplink ports are numbered sequentially after the last port, and therefore are 17 and 18 for a 16-port switch, and 25 and 26 for a 24-port switch. Only one limit can be set per processing block, and then applies to all three packet types. Thus each of the packet types are either limited to this value or unlimited (**none**).

For the Rapier G6 series switches, each port is a processing block, and therefore packet storm protection limits can be set for each port individually.

The **show switch port** command displays the packet storm protection settings.

Port Mirroring

Port mirroring allows traffic being received and transmitted on a switch port to be sent to another switch port, the mirror port, usually to capture data with a protocol analyser. The mirror port is the only switch port that belongs to no VLANs, and therefore does not participate in any other switching. Before the mirror port can be set, it must be removed from all VLANs except the default VLAN. The port cannot be part of a trunk group. Mirroring four or more ports may significantly reduce switch performance.

To set a mirror port (and remove it from the default VLAN) use the command:

```
set switch mirror={none|port}
```

If another port was previously set as the mirror port, this command returns the previous mirror port to the default VLAN as an untagged port. Return this port to any VLANs to which it should belong, by using the **add vlan port** command, or set it as a tagged port using the **set vlan port** command if required.

Either traffic received on a port or traffic transmitted by the port, or both, can be mirrored. To set a source port whose traffic is to be sent to a mirror port, use the command:

```
set switch port={port-list|all} mirror={none|rx|tx|both}
```

To send packets that match particular criteria to the mirror port, first create a filter match by using the command:

```
add switch l3filter match
```

Then create a filter entry with the **action** parameter set to **sendmirror** by using the command:

```
add switch l3filter=filter-id entry action=sendmirror.
```

By default, when mirroring is disabled, no mirror port is set and no source ports are set to be mirrored. Mirroring functions when a switch mirror port is set to a valid port. When mirroring is enabled and the switch mirror port is set to **none**, then mirroring can be disabled by using the commands:

```
enable switch mirror
```

```
disable switch mirror
```

The **show switch port** and **show switch** commands display the switch and port mirroring settings.

Port Security

The port security feature allows control over the stations connected to each switch port, by MAC address. If enabled on a port, the switch learns MAC addresses up to a user-defined limit from 1 to 256, then locks out all other MAC addresses. One of the following options can be specified for the action taken when an unknown MAC address is detected on a locked port:

- Discard the packet and take no further action,
- Discard the packet and notify management with an SNMP trap,
- Discard the packet, notify management with an SNMP trap and disable the port.

To enable port security on a port, set the limit for learned MAC addresses to a value greater than zero, and specify the action to take for unknown MAC

addresses on a locked port. To disable port security on a port, set the limit for learned MAC addresses to zero or **none**. Port security can be enabled or disabled on a port by using the command:

```
set switch port={port-list|all} learn={none|0|1..256}
   [intrusionaction={discard|trap|disable}]
```

If **intrusionaction** is set to **trap** or **disable**, a list of MAC addresses for devices that are active on a port, but which are not allowed or learned for the port, can be displayed (Figure 8-46 on page 8-228) by using the command:

```
show switch port={port-list|all} intrusion
```

A switch port can be manually locked before it reaches the learning limit by using the command:

```
activate switch port={port-list|all} lock
```

Addresses can be manually added to a port locked list up to a total of 256 MAC addresses, and the learning limit can be extended to accommodate them. Use the command:

```
add switch filter action={forward|discard} destaddress=macadd
   port=port [entry=entry] [learn] [vlan={vlan-name|1..4094}]
```

Learned addresses on locked ports can be saved as part of the switch configuration, so that they become part of the configuration after a power cycle. Use the command:

```
create config=filename
```

If the configuration is not saved when there is a locked list for a port, the learning process begins again after the switch is restarted.

Virtual Local Area Networks (VLANs)

A Virtual LAN (VLAN) is a logical, software-defined subnetwork. It allows similar devices on the network to be grouped together into one broadcast domain, irrespective of their physical position in the network. Multiple VLANs can be used to group workstations, servers, stacks, and other network equipment connected to the switch, according to similar data and security requirements.

Decoupling logical broadcast domains from the physical wiring topology offers several advantages, including the ability to:

- Move devices and people with minimal, or no, reconfiguration
- Change a device's broadcast domain and access to resources without physically moving the device, by software reconfiguration or by moving its cable from one switch port to another
- Isolate parts of the network from other parts by placing them in different VLANs
- Share servers and other network resources without losing data isolation or security
- Direct broadcast traffic to only those devices that need to receive it thereby reducing traffic across the network

- Connect 802.1q-compatible switches together through one port on each switch

Devices that are members of the same VLAN exchange data with each other through the switch's switching capabilities. To exchange data between devices in separate VLANs, the switch's routing capabilities are used. The switch passes VLAN status information, indicating whether a VLAN is up or down, to the Internet Protocol (IP) module. IP uses this information to determine route availability.

The switch has a maximum of 63 VLANs, or 255 for a Rapier *i* Series switch ranging from a VLAN identifier (VID) of 1 to 4094.

When the switch is first powered up, a "default" VLAN is created and all ports are added to it. In this initial unconfigured state, the switch broadcasts all the packets it receives to the default VLAN. This VLAN has a VID of 1 and an interface name of vlan1. It cannot be deleted, and ports can be removed from it only when they also belong to at least one other VLAN. When all devices on the physical LAN belong to the same logical LAN (same broadcast domain), the default settings are acceptable and no additional VLAN configuration is necessary.

Dynamic VLAN Assignment

Dynamic VLAN assignment allows a supplicant to be placed into a specific VLAN based on information returned from the RADIUS server during authentication. This limits the network access of a supplicant to a specific VLAN that is tied to their authentication, and prevents supplicants from connecting to VLANs for which they are not authorised. A port's VLAN assignment is determined by the first supplicant to be authenticated on the port.

VLAN assignment is enabled or disabled using the **vlanassignment** parameter of port authentication commands.

The Configured and Actual fields of the **show vlan** command show which ports are configured for the VLAN and which have been dynamically assigned to the VLAN.

Radius attributes

The RADIUS server provides information to the authenticator using RADIUS tunnel attributes, as defined in RFC 2868, *RADIUS Attributes for Tunnel Protocol Support*. The tunnel attributes that must be configured for VLAN assignment are:

- **Tunnel-Type**
  The protocol to be used for the tunnel specified by Tunnel-Private-Group-Id. VLAN (13) is the only supported value.
- **Tunnel-Medium-Type**
  The transport medium to be used for the tunnel specified by Tunnel-Private-Group-Id. 802 (6) is the only supported value.
- **Tunnel-Private-Group-ID**
  The ID of the tunnel the authenticated user should use. This must be the name or ID number of a VLAN on the switch.

These tunnel attributes are included in the Access-Accept message from the RADIUS server to the Authenticator.

Single-host mode

In single host mode, VLAN assignment is as follows:

- If authentication fails, the supplicant is denied access to the port. The port is placed in its configured access VLAN, that is, the VLAN it was set up for in the **add vlan** command.
- If the RADIUS server supplies valid VLAN information, the port is placed in the specified VLAN after configuration.
- If the RADIUS server supplies invalid VLAN information, the port is returned to the Unauthorised state, and placed in its configured access VLAN.
- If the RADIUS server supplies no VLAN information, the port is placed in its configured access VLAN after successful authentication.
- If port authentication is disabled on the port, the port is returned to its configured access VLAN.
- When the port is in the Force Authorized, Force Unauthorized or the Unauthorized state, it is placed in its configured access VLAN.

While the port is in a RADIUS server assigned VLAN, changes to the port's configured access VLAN do not take effect until the port leaves the assigned VLAN. This can occur if:

- the last authentication session on the port expires
- the link goes down
- port authentication is disabled on the port
- port authentication is disabled on the system

Multi-supplicant mode

VLAN assignment can be run in multi-supplicant mode, if the multi-supplicant mode is enabled. In multi-supplicant mode, the behaviour is dictated by which supplicant is authenticated first.

If the multi-supplicant mode is enabled on a port authentication port, the behaviour of the first authenticated supplicant is the same as that of a supplicant in single-supplicant mode. For all further supplicants, the **securevlan** parameter specifies the action that is taken when authenticating any supplicants after the first supplicant has authenticated. There are two possible actions:

- **securevlan=on**
  Only those supplicants with a VLAN that is the same as that of the first authenticated supplicant are authenticated. This is the default, and is the more secure action.
- **securevlan=off**
  All further authenticated supplicants are placed in the same VLAN as the first authenticated supplicant. This action is less secure.

802.1x Guest VLAN

802.1x ports can be configured with a limited access guest VLAN, which is used when no 802.1x host is currently attached to the port. This limited access VLAN is defined using the **guestvlan** parameter.

As soon as a single 802.1x packet is received on the port, it is removed from the guest VLAN, and put into its configured access VLAN in the Unauthenticated

state. This effectively disables the guest VLAN on the port until the port's link goes down.

A guest VLAN can only be configured for a port that is running in single-supplicant mode.

VLAN Tagging

An Ethernet packet can contain a *VLAN tag* with fields that specify VLAN membership and user priority. The VLAN tag is described in IEEE Standard 802.3ac, and is four octets that can be inserted between the Source Address and the Type/Length fields in the Ethernet packet (Figure 8-1 on page 8-16). To accommodate the tag, IEEE Standard 802.3ac also increased the maximum allowable length for an Ethernet frame to 1522 octets (the minimum size is 64 octets). IEEE Standard 802.1q specifies how the data in the VLAN tag switches frames. VLAN-aware devices are able to add the VLAN tag to the packet header. VLAN-unaware devices cannot set or read the VLAN tag.

Table 8-2 on page 8-15 lists the meaning and use of the fields in the Ethernet frame. Figure 8-1 on page 8-16 shows the format of VLAN data in an Ethernet frame. Twelve bits of the tag are the VLAN Identifier (VID), which indicates the VLAN to which the packet belongs. Table 8-3 on page 8-16 lists the VLAN Identifier values that have specific meaning.

Table 8-2: Fields in the Ethernet frame for QoS and VLAN switching

Field	Length	Meaning and use
TPID	2 octets	The Tag Protocol Identifier (TPID) 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, which can be used by the switch to determine the Quality of Service to apply to the frame. The three bit binary number represents eight priority levels, 0 to 7.
CFI	1 bit	The Canonical Format Indicator (CFI flag) indicates 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.

Figure 8-1: Format of user priority and VLAN data in an Ethernet frame

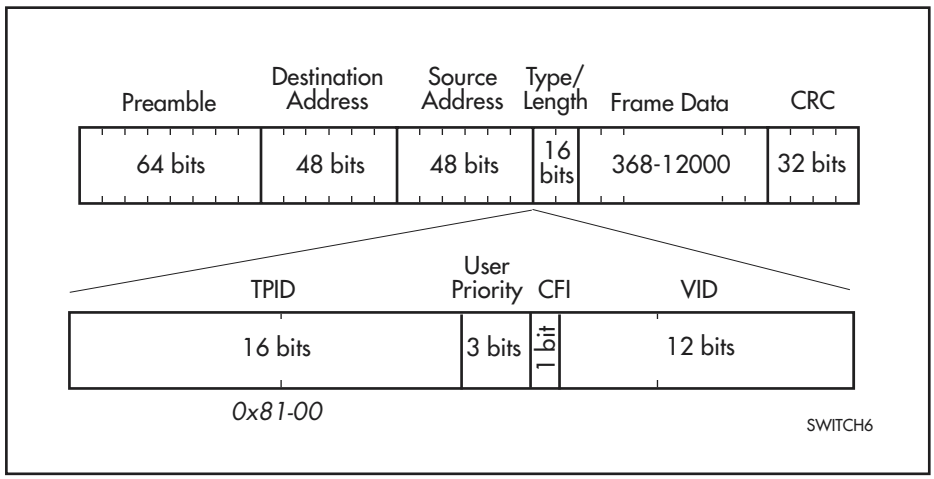


Table 8-3: Reserved VID values

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.

Ethernet packets that contain a VLAN tag are referred to as *tagged* frames, and switch ports that transmit tagged frames are referred to as *tagged ports*. Ethernet packets that do not contain a VLAN tag are referred to as *untagged* frames, and switch ports that transmit untagged frames are referred to as *untagged ports*. VLANs can consist of simple logical groupings of untagged ports in which the ports receive and transmit untagged packets. Alternatively, VLANs can contain only tagged ports or a mixture of tagged and untagged ports.

The switch is VLAN-aware. It can accept VLAN tagged frames, and supports the VLAN switching required by such tags. A network can contain a mixture of VLAN-aware devices, for example, other 802.1q-compatible switches, and VLAN-unaware devices, for example, workstations and legacy switches that do not support VLAN tagging. The switch 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. By assigning a port to two different VLANs, to one as an untagged port and to another as a tagged port, it is possible for the port to transmit both VLAN-tagged and untagged frames. A port must belong to a VLAN at all times unless the port has been set as the mirror port for the switch.

Every frame admitted by the switch has a VID associated with it. When a frame arrives on a tagged port, the associated VID is determined from the VLAN tag the frame had when it arrived. When a frame arrives on an untagged port, it is

associated with the VID of the VLAN for which the incoming port is untagged. When the switch forwards a frame over a tagged port, it adds a VLAN tag to the frame. When the switch forwards the frame over an untagged port, it transmits the frame as a VLAN-untagged frame, not including the VID in the frame.

The VLAN tag that the switch adds to a frame on egress depends on whether the frame is switched in Layer 2 or Layer 3. In Layer 3 switching, the switch determines the destination VLAN from its routing tables. The VID of the destination VLAN is added to the frame on egress. In Layer 2 switching, the frame's source and destination VLANs are the same. The VID that was associated with the frame on ingress is associated with it on egress.

VLAN membership using VLAN tags

Ports can belong to many VLANs as tagged ports. Because VLAN tags determine to which VLAN a packet belongs, it is easy to:

- Share network resources, such as servers and printers, across several VLANs
- Configure VLANs that span several switches

For tagged ports, the switch uses the VID of incoming frames, and the frame's destination field to switch traffic through a VLAN aware network. Frames are transmitted only on ports belonging to the required VLAN. Other vendors' VLAN-aware devices on the network can be configured to accept traffic from one or more VLANs. A VLAN-aware server can be configured to accept traffic from many different VLANs, and then return data to each VLAN without mixing or leaking data into the wrong VLANs.

Figure 8-2 on page 8-18 shows a network configured with VLAN tagging. Table 8-4 on page 8-18 shows the VLAN membership. The server on port 2 on Switch A belongs to both the *admin* and *marketing* VLANs. The two switches are connected through uplink port 26 on Switch A and uplink port 25 on Switch B, which belong to both the *marketing* VLAN and the *training* VLAN, so devices on both VLANs can use this link.

Figure 8-2: VLANs with tagged ports

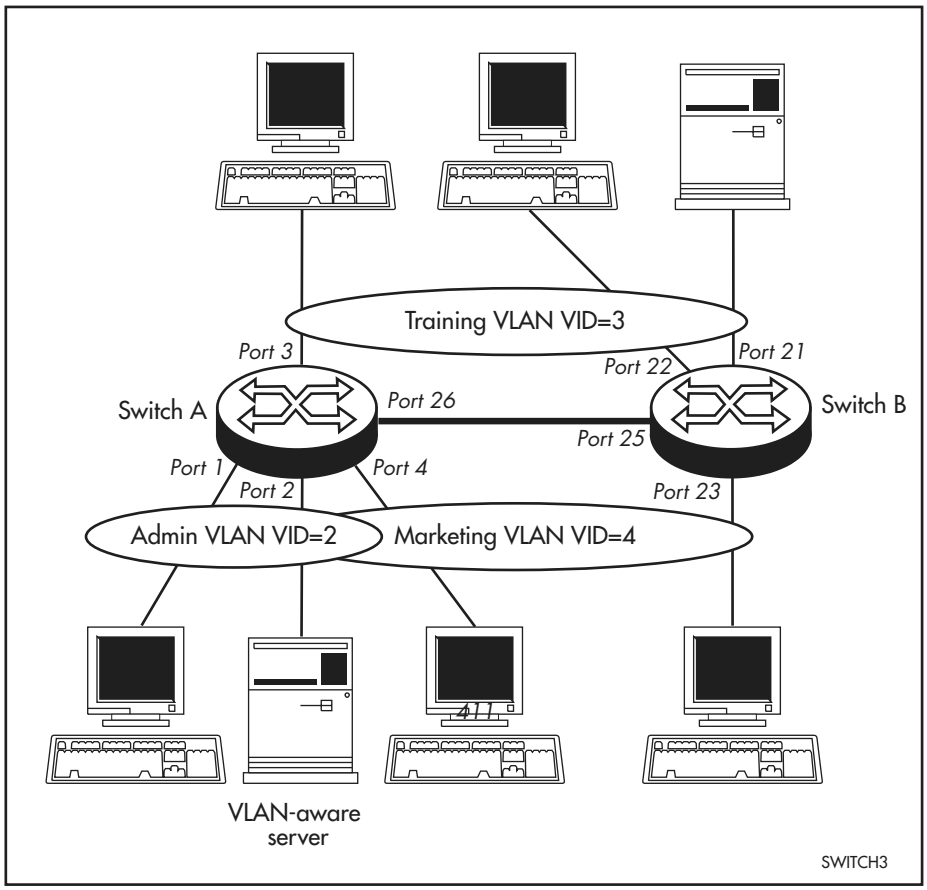


Table 8-4: VLAN membership of example of a network using tagged ports

VLAN	Member ports
Training	3, 26 on Switch A 21, 22, 25 on Switch B
Marketing	2, 4, 26 on Switch A 23, 25 on Switch B
Admin	1, 2 on Switch A

VLAN Membership of Untagged Packets

A VLAN that does not send VLAN-tagged frames is a logical grouping of ports. All untagged traffic arriving at those ports belongs to that VLAN.

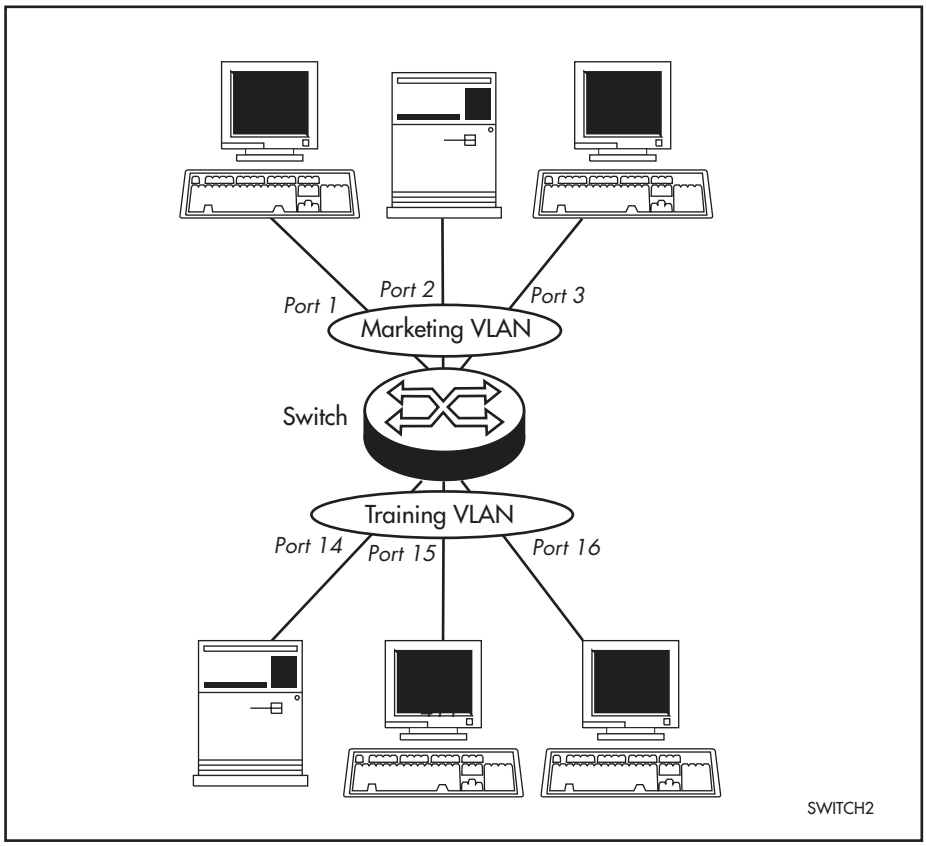
VLANs based on untagged ports are limited because each port can belong only to one VLAN as an untagged port. Limitations include:

- It is difficult to share network resources, such as servers and printers, across several VLANs. The routing functions in the switch must be configured to interconnect using untagged ports only.
- A VLAN that spans several switches requires a port on each switch for the interconnection of the various parts of the VLAN. When there are several VLANs in the switch that span more than one switch, then many ports are occupied with connecting the VLANs, and so are unavailable for other devices.

If the network includes VLANs that do not need to share network resources or span several switches, VLAN membership can usefully be based on untagged ports. Otherwise, VLAN membership should be determined by tagging (see "VLAN Tagging" on page 8-15).

Figure 8-3 on page 8-19 shows two port-based VLANs with untagged ports. Ports 1-3 belong to the *marketing* VLAN, and ports 14-16 belong to the *training* VLAN. The switch acts as two separate bridges: one that forwards traffic between the ports belonging to the *marketing* VLAN, and a second one that forwards traffic between the ports belonging to the *training* VLAN. Devices in the *marketing* VLAN can communicate with devices in the *training* VLAN only by using the switch's routing functions.

Figure 8-3: VLANs with untagged ports



Creating VLANs

To summarise the process:

1. Create the VLAN.
2. Add tagged ports to the VLAN, if required.
3. Add untagged ports to the VLAN, if required.

To create a VLAN, use the command:

```
create vlan=vlan-name vid=2..4094
```

Every port must belong to a VLAN unless it is the mirror port. By default, all ports belong to the default VLAN as untagged ports.

To add tagged ports to a VLAN, use the command:

```
add vlan={vlan-name|1..4094} port={port-list|all}
   frame=tagged
```

A port can be tagged for any number of VLANs.

To add untagged ports to a VLAN, use the command:

```
add vlan={vlan-name|1..4094} port={port-list|all}
   [frame=untagged]
```

A port can be untagged for zero or one VLAN. A port can be added only to the default VLAN as an untagged port when it is not untagged for another VLAN. A port cannot transmit both tagged and untagged frames for the same VLAN (that is, it cannot be added to a VLAN as both a tagged and an untagged port).

To remove ports from a VLAN, use the command:

```
delete vlan={vlan-name|1..4094} port={port-list|all}
```

Removing an untagged port from a VLAN returns it to the default VLAN unless it is a tagged port for another static VLAN. An untagged port can be deleted from the default VLAN only when the port is a tagged port for another static VLAN.

Ports tagged for some VLANs and left in the default VLAN as untagged ports transmit broadcast traffic for the default VLAN. If this is not required, the unnecessary traffic in the switch can be reduced by deleting those ports from the default VLAN.

To change the tagging status of a port in a VLAN, use the command:

```
set vlan={vlan-name|1..4094} port={port-list|all}
   frame=tagged
```

To destroy a VLAN, use the command:

```
destroy vlan={vlan-name|2..4094|all}
```

VLANs can be destroyed only when no ports belong to them.

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

```
show vlan[={vlan-name|1..4094|all}]
```

Information that may be useful for troubleshooting a network can be displayed with the VLAN debugging mode. This is disabled by default, and can be enabled for a specified time, disabled, and displayed using the commands:

```
enable vlan={vlan-name|1..4094|all} debug={pkt|all}
   [output=console] [timeout={1..4000000000|none}]

disable vlan={vlan-name|1..4094|all} debug={pkt|all}

show vlan debug
```

To view packet reception and transmission counters for a VLAN, use the command (see the *Interfaces* chapter of the switch's Software Reference):

```
show interface=vlann counter
```

Summary of VLAN Tagging Rules

When designing a VLAN and adding ports to VLANs, consider the following rules:

- Except for the mirror port, each port must belong to at least one static VLAN. By default, a port is an untagged member of the default VLAN.
- A port can be untagged for zero or one VLAN. A port that is untagged for a VLAN transmits frames destined for that VLAN without a VLAN tag in the Ethernet frame.
- A port can be tagged for zero or more VLANs. A port that is tagged for a VLAN transmits frames destined for that VLAN with a VLAN tag, including the numerical VLAN Identifier of the VLAN.
- A port cannot be untagged and tagged for the same VLAN.
- The mirror port, if present, is not a member of any VLAN.

VLAN Interaction with Trunk Groups

All the ports in a trunk group must have the same VLAN configuration. They must belong to the same VLANs and have the same tagging status; and they must be operated on as a group.

Static and Dynamic VLANs

All VLANs created by the user on the command line are static VLANs. The default VLAN is also a static VLAN. A port must belong to at least one static VLAN.

Dynamic VLANs are created by GVRP, a GARP application whose purpose is to propagate VLAN information between VLAN aware switches (see the *Generic Attribute Registration Protocol (GARP)* chapter). These dynamic VLANs are entitled gvrpxxx, where xxx is the VLAN's VLAN Identifier. Dynamic VLANs are created only when GVRP is enabled on the switch. GVRP is disabled by default.

All static VLANs except for the default VLAN can be destroyed by the user. Dynamic VLANs cannot be directly destroyed by the user, but may be destroyed according to the operations of GVRP by using the **reset garp** command on page 9-15 of Chapter 9, Generic Attribute Registration Protocol (GARP) or by disabling the GVRP instance.

A user can add, delete, or modify ports for a static VLAN, but not for a dynamic VLAN. Dynamic VLANs created by GVRP include only tagged ports.

Protected VLANs

If a VLAN is protected, Layer 2 traffic between ports that are members of a protected VLAN is blocked. Traffic can be Layer 3 switched to another VLAN. This feature prevents members of a protected VLAN from communicating with each other yet still allows members to access another network. Layer 3 Routing between ports in a protected VLAN can be prevented by adding a Layer 3 filter. The protected VLAN feature also allows all of the members of the protected VLAN to be in the same subnet.

A typical application is a hotel installation where each room has a port that can be used to access the Internet. In this situation it is undesirable to allow communication between rooms.

To create a protected VLAN, use the **create vlan** command on page 8-95 with the **protected** parameter.

Private VLANs

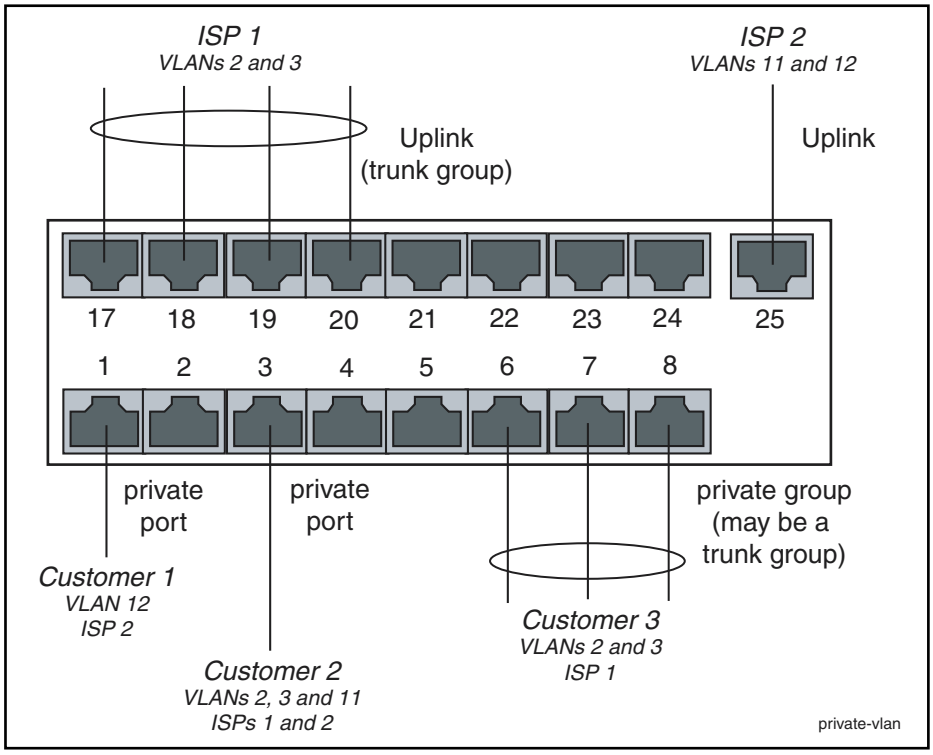
A private VLAN contains switch ports that are isolated from other ports in the VLAN, but can access another network through an uplink port or uplink trunk group. These ports are called *private ports.* Private ports may be standalone or be combined into groups. Standalone private ports can only communicate with the uplink port, not with other ports in the VLAN. Private ports that are in a group can communicate with other ports in the group and with the uplink port, but cannot communicate with the other private ports in the VLAN.

The switch forwards traffic between private ports and the uplink port, and between private ports within a group, according to its normal forwarding rules. The only difference is that forwarding to other private ports is blocked unless the ports are in the same group. Note that all traffic between private ports is blocked, not only Layer 2 traffic.

A typical application is a hotel installation where each room has a port that can access the Internet. In this situation it is undesirable to allow communication between rooms. Another application is to simplify IP address assignment. Ports can be isolated from each other while belonging to the same subnet.

Figure 8-4 on page 8-23 shows an example of a network using private VLANs. In this scenario, two service providers are each providing multiple services through multiple VLANs over separate uplinks. Customers are subscribed to services from one or both service providers. Each customer's ports are isolated from other customers, but communicate with the ISP or ISPs through the appropriate uplink port. A single customer may use multiple ports, connected to individual PCs or trunked together to increase bandwidth. If a customer uses multiple ports, these ports are able to communicate with each other.

Figure 8-4: Example network configuration using private VLANs



Membership Rules for Private VLANs

Each private VLAN:

- Must contain one uplink port or uplink trunk group
- May contain multiple private ports
- Cannot contain any non-private ports
- Cannot be the Default VLAN (vlan1)

Each private port:

- Can be a member of multiple private VLANs
- Cannot be a private port in some VLANs and a non-private port in other VLANs
- Cannot be an uplink port in another VLAN

Each uplink port:

- Can be a member of multiple private VLANs
- Cannot be a member of both private and non-private VLANs

Each private or uplink port:

- May be tagged or untagged but can only be an untagged member of one port-based VLAN
- May be trunked with other ports of the same type

Private VLANs on Rapier 48i Switches

The ports on Rapier 48i switches are divided into two instances:

- ports 1-24 plus uplink port 49
- ports 25-48 plus uplink port 50

Private VLANs on a Rapier 48i switch can consist of only ports from one instance. Both the private ports and the uplink port must be in the same instance.

Configuring Private VLANs

To create a private VLAN and add ports to it:

1. Create the VLAN

To create a VLAN and specify that it is private, use the command:

```
create vlan=vlan-name vid=2..4094 private
```

2. Add the uplink port or trunk group

To add the uplink to a private VLAN, use one of the commands:

```
add vlan={vlan-name|1..4094} port=port-list
   [frame={untagged|tagged}] uplink
```

where *port-list* is either a single port number for a single uplink port, or a list of port numbers for a trunk group. If you are adding a trunk group to the VLAN as an uplink, the ports must already be trunked together, and you must specify all the ports.

3. Add the private ports

To add a private port or ports to a private VLAN, use one of the commands:

```
add vlan={vlan-name|1..4094} port={port-list|all}
   [frame={untagged|tagged}] [group]
```

The **group** parameter specifies that the listed ports may communicate with each other, but not with any other private ports in the VLAN.

4. Delete ports from a private VLAN as necessary

To delete private ports from a private VLAN, use one of the commands:

```
delete vlan={vlan-name|1..4094} port=port-list
```

```
delete vlan={vlan-name|1..4094} port=all
```

A private VLAN cannot contain private ports when an uplink is deleted from the VLAN, because a private VLAN must always have an uplink. To delete the uplink port or ports and any private ports from a private VLAN, use the **port=all** option in the above command.

If the port is a member of a private group, you must delete all ports in the group at once. This stops groups from having different member ports in different VLANs.

VLAN Relaying

VLAN relaying allows the passage of traffic between the VLANs on one switch, for protocols that are not processed by the switch's routing functions. Particular protocols or protocol groups can be specified, and filtering occurs on the basis of protocol identification number. VLAN relaying is similar to the bridging function of an Allied Telesyn router.

Protocol names have been predefined for many protocol types. Those protocols that are transferred by VLAN relay and that have predefined names are given in Table 8-5 on page 8-25, with their associated protocol identification numbers. Other protocols can be specified by entering their protocol identification numbers. Protocols that are routed by the switch, including IP, IPX, AppleTalk, STP, and GARP, cannot be VLAN relayed.

Table 8-5: Predefined protocol types implemented by VLAN relay

Protocol Name	Protocol Number	Encapsulation
All802	all SAP protocols	SAP
Netbeui	F0	SAP
SNA Path Control	04	SAP
PROWAY-LAN	0E	SAP
EIA-RS	4E	SAP
PROWAY	8E	SAP
ISO CLNS IS	FE	SAP
AllEthII	all EthII protocols	EthII
XEROX PUP	0200	EthII
PUP Addr Trans	0201	EthII
XEROX NS IDP	0600	EthII
X.75 Internet	0801	EthII
NBS Internet	0802	EthII
ECMA Internet	0803	EthII
Chaosnet	0804	EthII
X.25 Level 3	0805	EthII
XNS Compat	0807	EthII
Banyan Systems	0BAD	EthII
BBN Simnet	5208	EthII
DEC MOP Dump/Ld	6001	EthII
DEC MOP Rem Cons	6002	EthII
DEC LAT	6004	EthII
DEC Diagnostic	6005	EthII
DEC Customer	6006	EthII
DEC LAVC	6007	EthII
RARP	8035	EthII
DEC LANBridge	8038	EthII
DEC Encryption	803D	EthII

Table 8-5: Predefined protocol types implemented by VLAN relay (Continued)

Protocol Name	Protocol Number	Encapsulation
IBM SNA	80D5	EthII
SNMP	814C	EthII
AllSNAP	all SNAP protocols	SNAP

VLAN relaying operates in the following stages:

1. The user creates one or more VLAN relay entities and adds the required VLANs and protocols to each entity.
2. The VLAN relay entity attaches to each specified VLAN and receives traffic. If more than one VLAN relay entity is attached to the same VLAN for the same protocol type, an intermediate attachment level receives the packet, duplicates it, and sends it to separate VLAN relay entities as required.
3. The VLAN relay entity sends the packet to the appropriate destination VLAN. Destination addresses are determined from the switch's learned address tables. If the destination address cannot be found, the packet is sent to all ports on all VLANs that are part of the VLAN relay entity. If the packet is destined for the VLAN on which it was received, the relaying entity does not send it to that VLAN because the packet causes a destination lookup failure, and the switch itself sends the packet to all ports in the VLAN.

Configuring VLAN Relaying

To configure VLAN relaying on the switch, first create a VLAN relay entity and give it a unique name, using the command:

```
create vlanrelay=name
```

An existing VLAN relay entity can be disabled or destroyed using the commands:

```
disable vlanrelay=name
```

```
destroy vlanrelay=name
```

In many networks, only one VLAN relay entity is required. The following configurations are examples of situations when more than one VLAN relay entity is used.

- If a number of protocols and VLANs are part of VLAN relaying but not all protocols on all VLANs, then setting up a number of VLAN relay entities allows only relevant protocols and VLANs to be part of relaying.
- If traffic is to be relayed between certain VLANs but not others (for example, between VLAN 1 and VLAN 2, and between VLAN 1 and VLAN 3, but not between VLAN 2 and VLAN 3), then separate VLAN relay entities are required.

To initiate relaying, add the VLANs which packets are to be sent between, and the desired protocols, to the VLAN relay entity, by using the command:

```
add vlanrelay=name [protocol=protocoltype] [vlan={vlan-name|
   1..4094}]
```

Protocols are specified by protocol type and number, or by allowing all protocols of a certain type. A predefined list of common protocols is provided in Table 8-5 on page 8-25.

VLANs and/or protocols can be removed from an existing VLAN relay entity by using the command:

```
delete vlanrelay=name [protocol=protocoltype] vlan=[{vlan-
    name|1..4094}]
```

A count of the packets relayed by the VLAN relay entity or entities, which shows the packets relayed from and to each VLAN, can be displayed by using the command:

```
show vlanrelay[=name]
```

The traffic being relayed, including the source and destination VLANs and the relevant VLAN relay entity, can be displayed by using the command:

```
enable vlanrelay debug
```

VLAN relay debugging can be disabled by using the command:

```
disable vlanrelay debug
```

Debugging is disabled by default. It can be enabled for one specified VLAN relay entity, and can be disabled for all entities or for a specified entity.

The Layer 2 Switching Process

The Layer 2 switching process comprises related but separate processes:

- **The Ingress Rules**
- **The Learning Process**
- **The Forwarding Process**
- **The Egress Rules**

Ingress rules admit or discard frames based on their VLAN tagging.

The Learning process learns the MAC addresses and VLAN membership of frames admitted on each port.

The Forwarding process determines to which ports the frames are forwarded, and the Quality of Service priority with which they are transmitted.

Finally, Egress rules determine for each frame whether VLAN tags are included in the Ethernet frames that are transmitted. These processes assume that each station on the extended LAN has a unique data link layer address, and that all data link layer frames have a header that includes the source (sender's) MAC address and destination (recipient's) MAC address.

The Ingress Rules

When a frame first arrives at a port, ingress rules for the port check the VLAN tagging in the frame to determine whether to discard it or forward it to the learning process.

The first check depends on whether the Acceptable Frame Types parameter is set to Admit All Frames or to Admit Only VLAN Tagged Frames. A port that transmits only VLAN tagged frames is automatically set to Admit Only VLAN Tagged Frames regardless of the VLAN to which the port belongs. The user cannot change this setting. Frames with a null numerical VLAN Identifier (VID) are VLAN-untagged frames or frames with priority tagging only.

Every frame received by the switch must be associated with a VLAN. When a frame is admitted by the Acceptable Frame Types parameter, the second part of the Ingress Rules associates each untagged frame admitted with the VID of the VLAN for which the port is untagged.

Every port belongs to one or more VLANs so every incoming frame has a VID that shows to which VLAN it belongs. The final part of the Ingress Rules depends on whether *Ingress Filtering* is enabled for the port. If Ingress Filtering is disabled, all frames are passed on to the Learning Process, regardless of which VLAN they belong to. If Ingress Filtering is enabled, frames are admitted only when they have the VID of a VLAN to which the port belongs. Otherwise, they are discarded.

The default settings for the Ingress Rules are to Admit All Frames, and for Ingress Filtering to be off. This means that if no VLAN configuration has been done, all incoming frames pass to the learning process, regardless of whether not they are VLAN tagged. The parameters for each port's ingress rules can be configured by using the command:

```
set switch port={port-list|all} [acceptable={vlan|all}]
   [infiltering={on|off}]
```

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 and numerical VLAN Identifier (VID) are compared with entries in the forwarding database for the VLAN (also known as a MAC address table, or a forwarding table) maintained by the switch. The forwarding database contains one entry for every unique station MAC address the switch knows in each VLAN.

If the frame's source address is not already in the forwarding database for the VLAN, 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. Switch learning is enabled by default; it can be disabled or enabled by using the commands:

```
DISable SWItch LEarning

ENAble SWItch LEarning
```

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. The ageing timer is enabled by default; it can be disabled or enabled by using the commands:

```
ENAble SWItch AGEingtimer

DISable SWItch AGEingtimer
```

If switch learning is disabled and the ageing timer has aged out all dynamically learned filter entries, only statically entered MAC source addresses are used to decide which packets to forward or discard. If the switch finds no matching entries in the forwarding database during the Forwarding Process, then all switch ports in the VLAN are flooded with the packet, except the port on which the packet was received.

The default of the ageing timer is 300 seconds (5 minutes) but can be modified by using the command:

```
SET SWItch AGEingtimer=10..1000000
```

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

To display the contents of the forwarding database, use the command:

```
show switch fdb [address=macadd] [discard={source|
   destination}] [hit={yes|no}] [l3={yes|no}]
   [port={portlist|all}] [status={static|dynamic}]
   [vlan={vlan-name|1..4094}]
```

To display general switch settings, including settings for switch learning and 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, filtering out frames on the basis of information contained in the station map and on the state of the ports. When a frame is received on the port for a destination in a different VLAN, it is either Layer 3 switched if it is an IP packet, or looked up in the Layer 3 routing tables.

Forwarding occurs only when the port on which the frame was received is in the Spanning Tree forwarding or disabled states. The destination address is then looked up in the forwarding database for the VLAN. If the destination address is not found, the switch 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 switch discards the frame if the port is not in the STP forwarding or disabled states, if the destination address is on the same port as the source address, or if there is a static filter entry for the destination address set to **discard** (see "Layer 2 Filtering" on page 8-31). Otherwise, the frame is forwarded on the indicated port.

This whole process can further be modified by the action of static switch filters. These are configurable filters that allow switched frames to be checked against a number of entries.

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. The transmission queue where a frame is sent is determined by the user priority tag in the Ethernet frame and the Quality of Service mapping (see "Quality of Service" on page 8-30).

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 frames in the second QOS egress queue, and so on, until frames in the last QOS egress queue, which are 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 by using the command:

```
SET SWItch QOS=P0,P1,P2,P3,P4,P5,P6,P7
```

The switch has four QOS egress queues. It has a default mapping of priority levels to QOS egress queues as defined in IEEE Standard 802.1q (Table 8-35 on page 8-179).

Table 8-6: Default priority level to queue mapping for four QOS egress queues

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

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

```
show switch qos
```

The QoS commands described in Chapter 35, Quality of Service (QoS) on Switch Ports are available on Rapier i Series models only.

The Egress Rules

After the forwarding process determines the ports and transmission queues from which a frame is forwarded, the Egress Rules for each port determine whether the outgoing frame is VLAN-tagged with its numerical VLAN Identifier (VID).

When you add a port to a VLAN, configure it to transmit either untagged or VLAN tagged packets by using the command:

```
add vlan={vlan-name|1..4094} port={port-list|all}
    [frame={tagged|untagged}]
```

To change this setting for a port that is already part of a VLAN, use the command:

```
set vlan={vlan-name|1..4094} port={port-list|all}
    frame={untagged|tagged}
```

Layer 2 Filtering

The switch has a forwarding database, entries that determine whether frames are forwarded or discarded over each port. Entries in this forwarding database are created dynamically by the learning process. A dynamic entry is automatically deleted from the Forwarding Database when its ageing timer expires. Filtering is specified in the IEEE Standard 802.1d.

The user can configure static switch filter entries using the command line interface. Static switch filter entries associate a MAC address with a VLAN and a port in the VLAN. When the switch receives a frame with a destination address and VLAN Identifier that match those of a static filter entry, the frame can be either forwarded to the port specified in the static filter entry, or discarded.

The forwarding database supports queries by the forwarding process as to whether frames with given values of the destination MAC address field should be forwarded to a given port.

To add or delete a static switch filter entry, use the command:

```
add switch filter action={forward|discard} destaddress=macadd
    port=port [entry=entry] [learn] [vlan={vlan-name|1..4094}]

delete switch filter port=port entry=entry-list
```

To display current static and learned switch filter entries, use the command:

```
show switch filter [port={port-list|all}]
    [destaddress=macadd] [entry=entrylist] [vlan={vlan-name|
    1..4094}]
```

For each VLAN, the destination MAC address of a frame to be forwarded is checked against the forwarding database. If there is no entry for the destination address and VLAN, the frame is transmitted on all ports in the VLAN that are in the forwarding or disabled states, except the port on which the frame was received. This process is referred to as *flooding*. If an entry is found in the forwarding database, but the entry is not marked as forwarding or it points to the same port the frame was received on, the frame is discarded. Otherwise,

the frame is transmitted on the port specified by the entry in the forwarding database.

Spanning Tree Protocol (STP)

The Spanning Tree Protocol (STP) automatically disables redundant paths in a network to avoid loops, and enables them when a fault in the network means they are needed to keep traffic flowing.

A sequence of LANs and switches may be connected together in an arbitrary physical topology resulting in more than one path between any two switches. If a loop exists, frames transmitted onto the extended LAN would circulate around the loop indefinitely, decreasing the performance of the extended LAN. On the other hand, multiple paths through the extended LAN provide the opportunity for redundancy and backup in the event of a bridge experiencing a fatal error condition. The spanning tree is created through the exchange of Bridge Protocol Data Units (BPDUs) between the bridges in the LAN when they start up, or when a change in the configuration of the network is detected.

The spanning tree algorithm ensures that the extended LAN contains no loops and that all LANs are connected by:

- Detecting the presence of loops and automatically computing a logical loop-free portion of the topology, called a *spanning tree*. The topology is dynamically pruned to a spanning tree by declaring the ports on a switch redundant, and placing the ports into a 'Blocking' state.
- Automatically recovering from a switch failure that would partition the extended LAN by reconfiguring the spanning tree to use redundant paths, if available.

The logical tree computed by the spanning tree algorithm has the following properties:

- A single switch, called the *root bridge*, forms a unique root to the tree. The root bridge is the bridge with the lowest Bridge ID. Each switch in an extended LAN is uniquely identified by its Bridge ID, which comprises the switch's root priority (a spanning tree parameter) and its MAC address.
- Each switch or LAN in the tree, except the root bridge, has a unique parent, known as the *designated bridge.* Each LAN has a single switch, called the designated bridge, that logically connects the LAN to which the switch is attached, to the next LAN closer to the root bridge.
- Each port connecting a switch to a LAN has an associated *cost*. The *root path cost* is the sum of the costs for each port between the switch and the root bridge. The designated bridge for a LAN is the switch on the LAN with the lowest root path cost, and therefore logically closer to the root bridge. If two switches on the same LAN have the same lowest root path cost, the switch with the lowest bridge ID is elected the designated bridge.

The spanning tree computation is a continuous, distributed process. The algorithm uses the following process to establish the spanning tree:

1. A unique *root bridge* is elected by the switches in the LAN.
2. A *designated bridge* is elected for each LAN in the extended LAN by the switches in the LAN.
3. The logical spanning tree is computed and redundant paths are removed.

Once the spanning tree is established, it is maintained by:

1. Replacing a failed path with a redundant backup path, if one is available.
2. Detecting and removing loops by declaring ports redundant and removing them from the logical spanning tree.
3. Maintaining timers that control the ageing of the forwarding database entries.

The logical spanning tree, sometimes called the *active topology*, includes the root bridge and all designated bridges, meaning all ports that are to be used for communication within the STP. These ports are in the forwarding state. Ports removed from the logical spanning tree are not in the forwarding state. To implement the spanning tree algorithm, switches communicate with one another using the Spanning Tree Protocol. The primary protocol data unit (PDU) is the *Hello message* or *Configuration Bridge Protocol Data Unit* (BPDU). It includes the following information:

- The bridge ID of the root bridge.
- The distance (or cost) from this switch to the root bridge.
- The bridge ID of the designated bridge on this LAN.
- Hello messages are initiated at regular intervals by the root bridge and propagate through the extended LAN.

Electing a Root Bridge and Designated Bridge

Each spanning tree (in STP) has a *Root Bridge*, which initiates the propagation of hello messages through the extended LAN, and sets the values of parameters that control the spanning tree computation process. Whereas, in RSTP and MSTP each bridge can control the transmission of their own periodic hello messages.

The root bridge is the switch with the lowest bridge ID and is elected by the exchange of *hello* packets. When a switch receives a hello packet it compares the value of the root bridge ID in the message to the value of the root bridge ID parameter in its own spanning tree database. If the value in the message is better, the switch stores the new value in its database and sends Hello messages with the new value out on its other ports. Otherwise, the switch continues to send Hello messages with the value currently stored in its spanning tree database. By this process, all switches in the extended LAN eventually learn the bridge ID of the root bridge.

Each LAN has a single switch, called the *designated bridge*, that logically connects the LAN to the next LAN closer to the root bridge. The designated bridge for a LAN is the switch on the LAN with the lowest root path cost and bridge ID. The designated bridge is elected by the exchange of Hello messages, in the same way that the root bridge is elected. The election of a new root bridge or a switch becoming unavailable due to a fatal error condition, typically results in the election of a new designated bridge in the next few rounds of Hello messages.

Spanning Tree Modes

STP can run in *standard* mode or *rapid* mode. Rapid mode allows rapid configuration of the spanning tree. The Rapid Spanning Tree Protocol (RSTP) is specified in IEEE Standard 802.1w.

A spanning tree running in standard mode can take up to one minute to rebuild after a topology or configuration change. The Rapid Spanning Tree algorithm provides for a more rapid recovery of connectivity following the failure of a bridge, bridge port, or a LAN. RSTP provides rapid recovery by including port roles in the computation of port states, and by allowing neighbouring bridges to explicitly acknowledge signals on a point-to-point link that indicate that a port wants to enter the forwarding mode.

In rapid mode, the rapid transition of a port to the forwarding state is possible when the port is considered to be part of a Point-to-Point link, or when the port is considered to be an *Edge* port. An edge port is a port that attaches to a LAN that is known to have no other bridges attached.

To ensure that rapid transitions take place on an edge port, the port must be explicitly configured with the **set stp port= {*port-list*|all} edgeport=true** command.

Rapid Mode Spanning Tree Types

The RSTP algorithm has two types of operation: *normal* and *stp compatible*. If normal is specified, the algorithm uses rapid port role transitions and transmits and receives RST BPDUs. If STP compatible is specified, then rapid transitions are disabled and RST BPDUs are discarded. The default is normal. Setting the RSTP type to be STP compatible allows RSTP to support applications and protocols that may be sensitive to frame duplication and misordering, for example NetBeui.

Setting **rstptype** to **normal**, when normal has already been set, sets all ports to the "sending RSTP" state. This is referred to in IEEE Standard 802.1w as *mCheck*, and is useful for restoring full rapid mode operation when one or more ports on the switch has entered the "sending STP" state. RSTP capable devices operating with RSTP set to **normal** that receive the RST BPDUs enter the "sending RSTP" state. After the mCheck operation, if an STP BPDU is received, either as a result of a device operating in rapid mode with **rstptype** set to **stpcompatible**, or as a result of a device operating in standard mode, the ports that received the STP BPDUs reverts to the "sending STP" state.

mCheck is most effective on switches acting as designated bridges for LANs because they regularly propagate BPDUs. Other bridges in the LAN do not transmit BPDUs as frequently.

Spanning Tree and Rapid Spanning Tree Port States

If STP is running in *standard* mode, then each port can be in one of five spanning tree states, and one of two switch states. If STP is running in *rapid* mode, then each port can be in one of four states. The state of a switch port is taken into account by STP. To be involved in STP negotiations, STP must be enabled on the switch, the port must be enabled on the switch, and enabled for the STP it belongs to.

The Spanning Tree port states (Table 8-7 on page 8-35 and Table 8-8 on page 8-35) affect the behaviour of ports whose switch state is enabled.

Table 8-7: Spanning Tree port states

State	Meaning
DISABLED	STP operations are disabled on the port. The port does not participate in frame relay or the operation of the Spanning Tree Algorithm and Protocol. The port can still switch if its switch state is enabled.
BLOCKING	The port does not participate in frame relay. The forwarding process discards received frames and does not submit forwarded frames for transmission. This is the "standby" mode.
LISTENING	The port is enabled for receiving frames only. The port is preparing to participate in frame relay. The forwarding process discards received frames and does not submit forwarded frames for transmission.
LEARNING	The port is enabled for receiving frames only, and the Learning Process can add new source address information to the Forwarding Database.
FORWARDING	The normal state for a switch port. The forwarding process and the Spanning Tree entity are enabled for transmit and receive operations on the port.

Table 8-8: Rapid Spanning Tree port states

State	Meaning
DISABLED	STP operations are disabled on the port.
DISCARDING	The port does not participate in frame relay. The forwarding process discards received frames and does not submit forwarded frames for transmission.
LEARNING	The port is enabled for receiving frames only, and the learning process can add new source address information to the forwarding database. The port does not forward any frames.
FORWARDING	The normal state for a switch port. The forwarding process and the Spanning Tree entity are enabled for transmit and receive operations on the port.

Multiple Spanning Trees and STP Interaction with VLANs

In a legacy network that has no VLANs configured, and has STP enabled, switches in the LAN run a distributed Spanning Tree Algorithm to create a single Spanning Tree.

In a network of switches with VLANs configured, all VLANs belong to a default Spanning Tree called *default*. Multiple Spanning Trees can be created with each Spanning Tree encompassing multiple VLANs. Spanning Tree Protocol entities, called STPs here, operate independently of each other; each STP has its own root bridge and active path. Once an STP is created, one or more VLANs can be assigned to it. In operation, additional STPs in the switch place no significant burden on the CPU.

If creating multiple STPs in a network, consider the following:

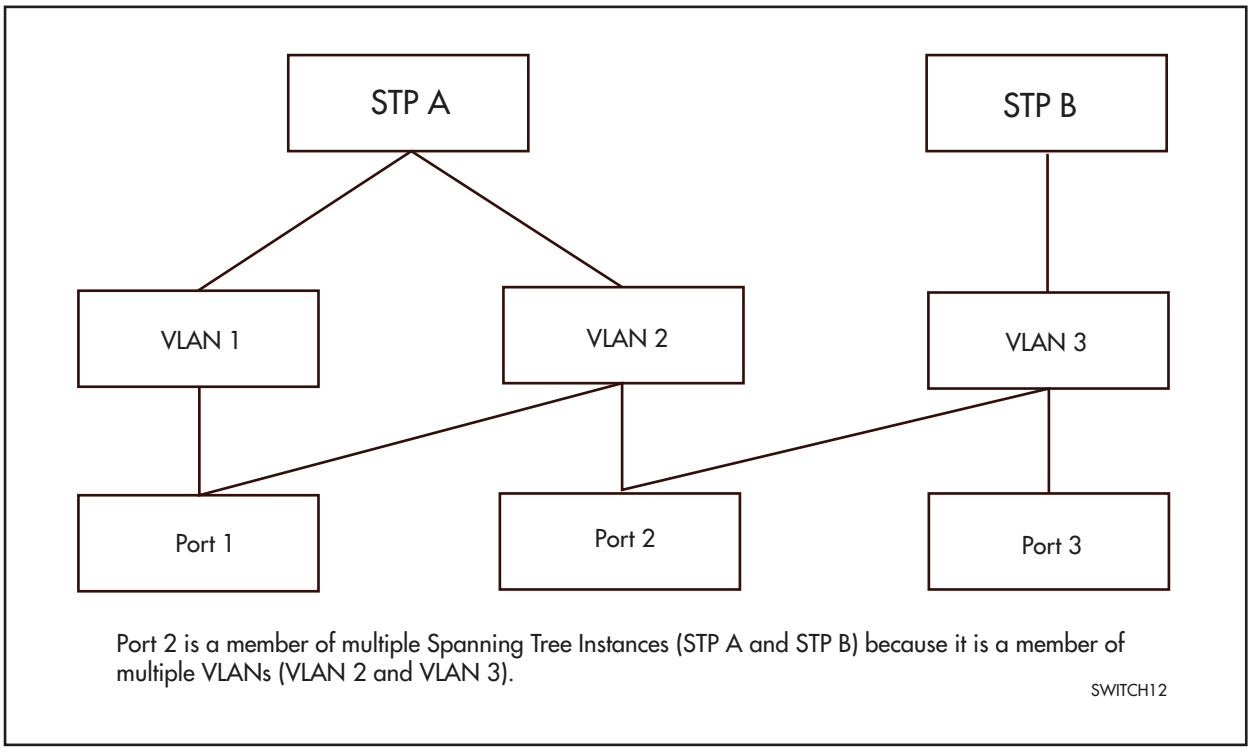
- A VLAN can only belong to a single STP.
- Except on the Rapier *i* Series switches, any port in the switch must belong only to a single STP. When a port is a member of multiple VLANs, all these VLANs must belong to the same STP. Within any given STP, all VLANs belonging to it use the same Spanning Tree. On the Rapier *i* Series switches only, a port can belong to multiple STPs when the port is a member of more than one VLAN.

Overlapping VLANs belonging to Multiple Spanning Tree Instances

The Rapier *i* Series switch supports cases where a port can be in more than one Spanning Tree instance when the port is a member of more than one VLAN and those VLANs belong to different STPs (Figure 8-5 on page 8-36).

On the Rapier *i* Series switches only, the number of STPs that can be configured is 255.

Figure 8-5: Port membership of VLANs which belong to different spanning tree instances (on Rapier i Series switches only)



Configuring STP

By default, the switch has one default STP which cannot be destroyed. In most situations this default STP suffice. However, further instances of the Spanning Tree Protocol (STPs) can be created and destroyed using the commands:

```
create stp=stp-name
destroy stp={stp-name|all}
```

By default, all VLANs, and therefore all ports, belong to the default STP. To add or delete a VLAN and all the ports belonging to it from any other STP, use the commands:

```
add stp=stp-name vlan={vlan-name|2..4094}

delete stp=stp-name vlan={vlan-name|2..4094|all}
```

The default STP is disabled by default at switch start up, and STPs created by a user are disabled by default when they are created. To enable or disable STPs, use the commands:

```
enable stp={stp-name|all}

disable stp={stp-name|all}
```

The Spanning Tree Protocol uses three configurable parameters for the time intervals that control the flow of STP information on which the dynamic STP topology depends: the **hellotime**, **forwarddelay**, and **maxage** parameters. All switches in the same spanning tree topology must use the same values for these parameters, but can themselves be configured with different, and potentially incompatible time intervals. The parameter values actually used by each switch are those sent by the root bridge, and forwarded to all other switches by the designated Bridges.

The **hellotime** parameter, with a default of 2 seconds, determines how often the switch sends hello messages containing spanning tree configuration information if it is the *Root Bridge*, or is trying to become the Root Bridge in the network. Setting a shorter value for **hellotime** than the default of 2 seconds makes the network more robust; setting a longer time uses less processing overhead.

The **maxage** parameter, with a default of 20 seconds, determines the maximum time that dynamic STP configuration information is stored in the switch, before it is considered too old, and discarded. The value can be set at approximately two seconds for every hop across the network. If this value is too small, the STP may sometimes configure unnecessarily. If it is too long, there can be delays in adapting to a change in the topology, for instance when a fault occurs.

The **forwarddelay** parameter is used to prevent temporary loops in the network occurring in the briefly unstable topology while a topology change is propagated through the network. When STP is running in standard mode and a port that has been in the Blocking state is to move into the forwarding state, it must first pass through the listening and learning states. The **forwarddelay** parameter determines how long a port remains in each of these intermediate states before moving to the forwarding state in the active topology; that is, half the time between when it is decided that the port will become part of the spanning tree, and when it is allowed to forward traffic. When STP is running in rapid mode, a port must pass from the discarding state through the learning state to reach the forwarding state. In this case, the **forwarddelay** parameter should be at least half the time it takes for a topology change message to reach the whole network. A value that is too short risks the temporary creation of loops, which can seriously degrade switch performance. A longer value can result in delays in the network after topology changes. The default **forwarddelay** value is 15 seconds.

*The **forwarddelay**, **maxage** and **hellotime** parameters should be set according to the following formulae, as specified in IEEE 802.1d:*
*2 x (**forwarddelay** - 1.0 seconds) >= **maxage***
***maxage** >= 2 x (**hellotime** + 1.0 seconds)*

To modify the parameters controlling these time intervals, use the command:

```
set stp={stp-name|all} [forwarddelay=4..30] [hellotime=1..10]
   [maxage=6..40]
```

The value of the **priority** parameter is used to set the writable portion of the bridge ID, i.e. the first two octets of the (8-octet long) Bridge Identifier. The remaining 6 octets of the bridge ID are given by the MAC address of the switches. The Bridge Identifier parameter is used in all configuration Spanning Tree Protocol packets transmitted by the switch. The first two octets, specified by the **priority** parameter, determine the switch's priority for becoming the *Root Bridge* or a *Designated Bridge* in the network, with a lower number indicating a higher priority. In fairly simple networks, for instance those with a small number of switches in a meshed topology, it may make little difference which switch is selected to be the Root Bridge, and no modifications may be needed to the default **priority** parameter, which has a default of 32768. In more complex networks, one or more switches are likely to be more suitable candidates for the root bridge role, for instance by virtue of being more central in the physical topology of the network. In these cases the **priority** parameters for at least one of the switches should be modified.

To change the STP priority value, use the command:

```
set stp={stp-name|all} priority=0..65535
```

To restore STP timer and priority defaults, use the command:

```
set stp={stp-name|all} default
```

Changing the **priority** using either of the previous commands initialises the STP, so that elections for the root bridge and designated bridges begin again, without resetting STP counters. To display general information about STPs on the switch, use the command:

```
show stp[={stp-name|all}]
```

Each port has a port priority, with a default of 128, used to determine which port should be the root port for the STP if two ports are connected in a loop. A lower number indicates the higher priority.

```
set stp={stp-name|all} port={port-list|all}
   portpriority=0..255
```

Each port also has a path cost, which is used if the port is the root port for the STP on the switch. The path cost is added to the root path cost field in configuration messages received on the port to determine the total cost of the path to the Root Bridge. The default **pathcost** values and the range of recommended **pathcost** values depend on the port speed and mode, see Table 8-9 and Table 8-10. If the path cost for a port is not explicitly set, it varies as the speed of the port varies.

Table 8-9: Path cost values and port speed for standard mode

Port speed	Default PATHCOST	Recommended PATHCOST range
10Mbps	100	50-600
100Mbps	19	10-60
1Gbps	4	3-10

Table 8-10: Path cost values and port speed for rapid mode

Port Speed	Default PATHCOST	Recommended PATHCOST range
Less than 100 Kb/s	200,000,000	20,000,000-200,000,000
1Mbps	20,000,000	2,000,000-20,000,000
10Mbps	2,000,000	200,000-2,000,000
100 Mbps	200,000	20,000-200,000
1 Gbps	20,000	2,000-20,000
10 Gbps	2,000	200-2,000
100 Gbps	200	20-200
1Tbps	20	2-200
10 Tbps	2	2-20

Setting the path cost to a larger value on a particular port is likely to reduce the traffic over the LAN connected to it. This may be appropriate if the LAN has a lower bandwidth, or if there are reasons for limiting the traffic across it. To modify the STP port path cost, use the command:

```
set stp={stp-name|all} port={port-list|all}
   pathcost=1..200000000
```

If the path cost of a port has been explicitly set to a particular value, it can be returned to its self-adjusting default path cost and priority, using the command:

```
set stp={stp-name|all} port={port-list|all} default
```

When an STP is enabled in a looped or meshed network, it disables and enables particular ports belonging to it dynamically, to eliminate redundant links. All ports in a VLAN belong to the same STP, and their participation in STP configuration, and hence the possibility of them being elected to the STP's active topology is enabled by default. To enable or disable particular ports, use the commands:

```
enable stp port={port-list|all}
```

```
disable stp port={port-list|all}
```

STP treats a trunk group configured on both ends of a link as a single path.

To display STP port information, use the command:

```
show stp[={stp-name|all}] port={port-list|all}
```

The spanning tree algorithm can be recalculated at any time, and all timers and counters be initialised, using the command:

```
reset stp={stp-name|all}
```

To display STP counters, use the command:

```
show stp={stp-name|all} counter
```

Enabling one or more STP debugging modes for a period of time displays information for STP troubleshooting (Table 8-11) to the port on which the switch received the command, or to the console.

Table 8-11: STP debugging options

Option	Debug Mode	Description
MSG	Message	Decoded display of received and transmitted STP packets
PKT	Packet	Raw ASCII display of received and transmitted STP packets
STATE	State	Port state transitions.
ALL	All	All debug options

To enable, disable or show the debug modes, use the commands:

```
enable stp={stp-name|all} debug={msg|pkt|state|all}
   [output=console] [timeout={1..4000000000|none}]

enable stp debug={msg|pkt|state|all} port={port-list|all}
   [output=console] [timeout={1..4000000000|none}]

disable stp={stp-name|all} debug={msg|pkt|state|all}

disable stp debug={msg|pkt|state|all} port={port-list|all}

show stp debug
```

STP debugging can be enabled or disabled for either a specific port or a specific STP. Using one of these commands overrides the other.

Set **output** to **console** if this command is in a script. Each of the debug modes can be enabled or disabled independently. Use the **timeout** parameter to prevent the switch or the display from being overloaded with debugging data.

f necessary, all the STP configuration that users create on a switch can be removed so that all STPs except the default STP are destroyed and all other defaults are restored. Use the command:

```
purge stp
```

The purge stp command should be used with caution, and generally only before major reconfiguration of the switch, as it removes all STP configuration entered on the switch.

Multiple Spanning Tree Protocol (MSTP)

The multiple spanning tree protocol (MSTP) was developed to address the limitations in the existing spanning tree protocols, STP and RSTP. These limitations apply mainly to networks that use multiple VLANs with topologies employing alternative physical links. MSTP is defined in IEEE Standard 802.1Q 2003. The protocol builds on, and remains compatible with, the following previous standards:

- IEEE Standard 802.1w 2001, which defines the rapid spanning tree protocol (RSTP)
- IEEE Standard 802.1D/D4 2003, which defines a draft standard for local and metropolitan area networks

Multiple Spanning Tree Regions

Conceptually, MSTP views the total bridged network as one that comprises a number of *Multiple Spanning Tree Regions* (MSTRs), where each region can contain up to 64 spanning trees that operate locally, called *Multiple Spanning Tree Instances* (MSTIs). The task of assigning each bridge to a particular region is achieved by the member bridges each comparing their MST configuration identifiers. More information on configuration identifiers is provided in Table 8-12 on page 8-42, but for the moment an *MST configuration identifier* can simply be thought of as an identifier that represents the mapping of VLANs to MSTIs within each bridge. Therefore, bridges with identical MST configuration identifiers, must have identical MSTI mapping tables.

While each MSTI can contain up to 4094 VLANs, each VLAN can be associated with only one MSTI. Once these associations have been made, the bridges in each region can transmit their spanning tree algorithms and advertise their MSTIs. This in turn establishes the active data paths between the bridges for each group of VLANs (i.e. for each MSTI) and block any duplicate paths. A particular advantage of this enhancement applies where a large number of VLANs share a few internetwork paths. In this situation there need only be as many Multiple Spanning Tree Instances (MSTIs) as there are source and destination bridge pairs, remembering that a pair of bridges probably has multiple paths between them.

In order to ensure that each bridge within a region maintains the same configuration information (particularly their VID to MSTI mappings) and to ensure each bridge's membership of a particular region, the bridges exchange configuration information in the form of "MST Configuration Identifiers. Table 8-12 on page 8-42 provides a breakdown of an MST configuration identifier. A detailed explanation of bridge configuration identifiers can be found in Section 13.7 of the IEEE 802.1Q-2003 standard

Table 8-12: MST Configuration identifier

Field Name	Description
Format Selector	A single octet field whose value of 0 indicates MSTP operation
Configuration Name	A name (up to 32 characters long) that identifies a particular MST region. The configuration name is defined using the SET MSTP command.
Revision Level	A number representing the region's revision level. This value is normally set to 0.
Configuration Digest	A 16 octet (HMAC-MD5 based) signature created from the MST configuration table.

Bridge Protocol Data Units (BPDUs)

The main function of bridge protocol data units is to enable MSTP to select its root bridges for the CIST and each MSTI. MSTP is compatible with earlier spanning tree versions; its Bridge Protocol Data Unit (BPDU) formats build on earlier versions; see "Compatibility with Previous Spanning Tree Protocols" on page 8-44. Table 8-13 on page 42 shows the standardised format for MSTP BPDU messages. The general format of the BPDUs comprise a common generic portion—octets 1 to 36—that are based on those defined in IEEE Standard 802.1D, 1998, followed by components that are specific to CIST—octets 37 to 102. Components specific to each MSTI are added to this BPDU data block. These are shown in Table 8-13.

Table 8-13: MST Bridge Protocol Data Units (BPDUs)

Field Name	Octets	Description
Protocol Identifier	1–2	Protocol being used. The value 0000 0000 0000 0000 identifies the spanning tree algorithm and protocol.
Protocol Version Identifier	3	Identifies the protocol version used.
BPDU Type	4	Value 0000 0000 specifies a configuration BPDU.
CIST Flags	5	Bit1 is the topology change flag. Bit 2 conveys the CIST proposal flag in RST and MST BPDUs - unused in STP. Bits 3 & 4 convey the CIST port role in RST, and MST BPDUs - unused in STP. Bit 5 conveys the CIST learning flag in RST and MST BPDUs - unused in STP. Bit 6 conveys the CIST forwarding flag in RST and MST BPDUs - unused in STP. Bit 7 conveys the CIST agreement flag in RST and MST BPDUs - unused in STP. Bit 8 conveys the topology change acknowledge flag in STP configuration BPDUs - unused in RSTP and MSTP BPDUs.
CIST Root Identifier	6–13	The Bridge identifier of the CIST Root
CIST External Path Cost	14–17	The path cost between MST regions from the transmitting bridge to the CIST root.

Table 8-13: MST Bridge Protocol Data Units (BPDUs) (Continued)

CIST Regional Root Identifier	18–25	ID of the current CIST regional root bridge.
CIST Port Identifier	26–27	CIST port identifier of the transmitting bridge port.
Message Age	28–29	Message age timer value.
Max Age	30–31	Timeout value to be used by all bridges in the bridged network. This value is set by the root. Some implementations of MSTP may choose not to use this value.
Hello Time	32–33	Time interval between the generation of configuration BPDUs by the root bridge.
Forward Delay	34–35	A timeout value used to ensure forward delay timer consistency when transferring a port to the forwarding state. It is also used for ageing filtering database dynamic entries following changes in the active topology.
Version 1 Length	36	Used to convey the Version 1 length. It is always transmitted as 0.
Version 3 Length	37–38	Used to convey the Version 3 length. It is the number of octets taken by the parameters that follow in the BPDU.
MST Configuration Identifier	39–89	An identifier comprising elements of the following: Format Selector Configuration Name Revision Level Configuration Digest.
CIST Internal Root Path Cost	90–93	Path cost to the CIST regional root.
CIST Bridge Identifier	94–101	CIST bridge identifier of the transmitting bridge.
CIST Remaining Hops	102	Remaining hops which limits the propagation and longevity of received spanning tree information for the CIST.
MSTI Configuration Messages (may be absent)	103–39 plus Version 3 Length	See Table 8-14 on page 8-43.

Table 8-14: MSTI configuration messages

Field Name	**Octets**	**Description**
MSTI Flags	1	Bits 1 through 8, convey the topology change flag, proposal flag, port role (two bits), Learning flag, forwarding flag, agreement flag, and master flag for this MSTI.
MSTI Regional Root Identifier	2–9	This includes the value of the MSTID for this configuration message encoded in bits 4 through 1 of octet 1, and bits 8 through 1 of octet 2.
MSTI Internal Root Path Cost	10-13	Internal Root Path Cost.
MSTI Bridge Priority	14	Bits 5 through 8 convey the value of the bridge identifier priority for this MSTI. Bits 1 through 4 of Octet 14 are transmitted as 0, and ignored on receipt.

Table 8-14: MSTI configuration messages

MSTI Port Priority	15	Bits 5 through 8 are used to convey the value of the port identifier priority for this MSTI. Bits 1 through 4 are transmitted as 0, and ignored on receipt.
MSTI Remaining Hops	16	Value of remaining hops for this MSTI.

Compatibility with Previous Spanning Tree Protocols

MSTP provides for compatibility with older spanning tree protocols in several ways. In addition to the MST region described in the previous section, the protocol provides for single spanning tree systems by employing a common and internal spanning tree (CIST) protocol. The CIST applies a common and internal spanning tree protocol to the whole of the bridged network and is a direct equivalent the internal spanning tree (IST) protocol of earlier versions.

In common with legacy spanning tree systems, the CIST protocol first determines its root bridge from all the bridges on the network. This is the bridge that contains the lowest bridge identifier. The protocol then selects a regional root bridge for each MSTR. This is the bridge that provides the best path to the CIST root. After the MSTR root bridges have been chosen, they then act on the region's behalf in such a way that the region appears to the CST as a virtual bridge. So in addition to having multiple MSTIs, each region **must** operate as a bridge in a CST.

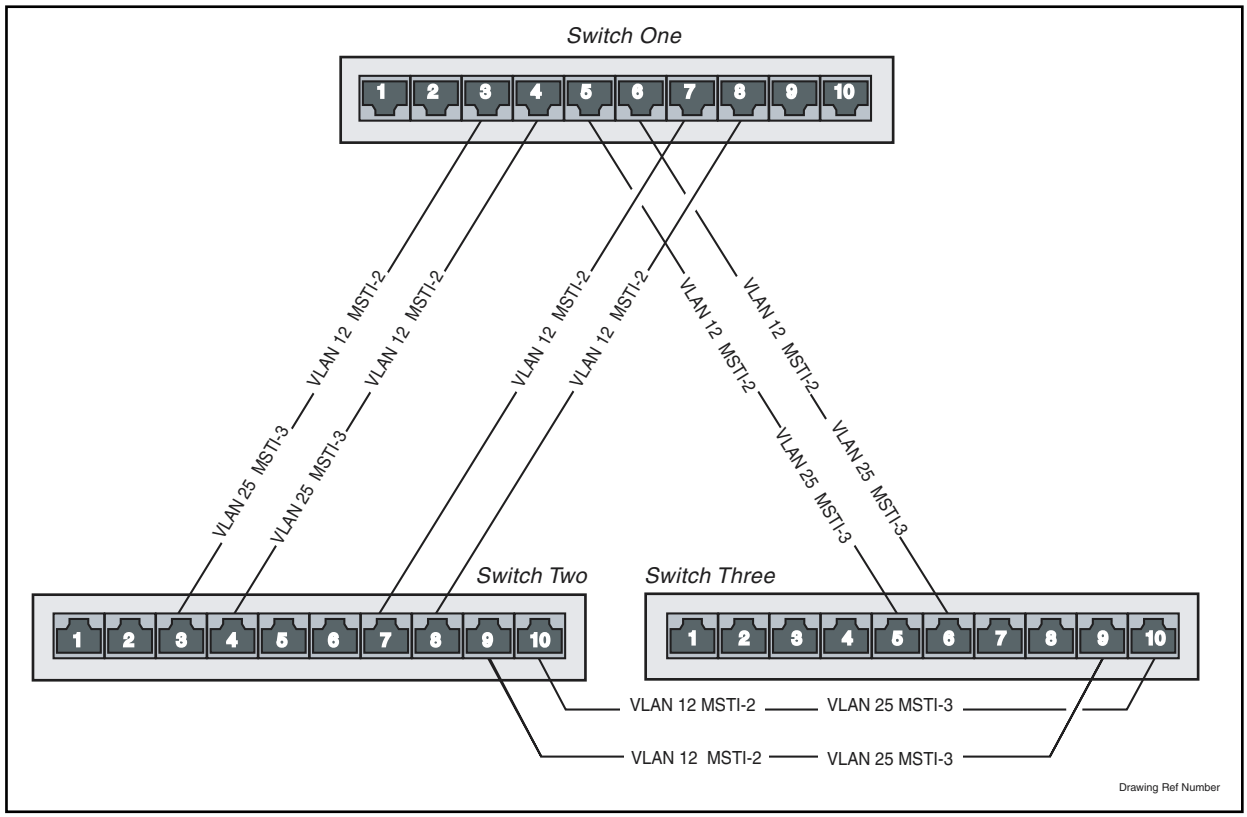
Configuring MSTP

The configuration examples in this section are based on the network shown in Figure 8-6 on page 8-45. This simple network comprises three LAN bridges connected in a multi-linked mesh configuration.

The network is configured as a single MSTP region, called a MSTR, and given the name, Head Office. Two spanning tree instances (MSTIs) are created within this region called MSTI 2 and MSTI 3. For simplicity only two VLANs are configured VLAN 12 and VLAN 25; however, a typical MSTI network could have many more VLANs.

Two MSTIs are created (MSTI 2 and MSTI 3). MSTI 2 is assigned to VLAN12 and MSTI 3 is assigned to VLAN25. The network has several alternative links. By using MSTP each VLAN can be configured to use its own preferred set of links

Figure 8-6: Example configuration with MSTP



Configure Switch 1

1. **Name the system and set manager port.**

```
set system name=switch1
set manager asyn=0
```

2. **Create VLAN 12 and assign it a VID of 12.**

```
create vlan=vlan12 vid=12
```

3. **Create VLAN 25 and assign it a VID of 25.**

```
create vlan=vlan25 vid=25
```

4. **Add VLAN 12 to the required ports, as tagged ports.**

```
add vlan=12 po=3,4,5,6,7,8 frame=tagged
```

5. **Add VLAN 25 to the required ports, as tagged ports.**

```
add vlan=25 po=3,4,5,6 frame=tagged
```

6. **Set MSTP on Switch 1. Name the region Head Office and assign it a revision level of 0 (the value recommended in the IEEE standard).**

```
set mstp configname=headoffice revision=0
```

7. **Enable static VLAN support on MSTP.**

```
set mstp staticvlans=on
```

8. **Create the MSTIs 2 and 3.**

```
create mstp msti=2
create mstp msti=3
```

9. **Add MSTI 2 to VLAN 12, and MSTI 3 to VLAN 25.**

```
add mstp msti=2 vlan=12
add mstp msti=3 vlan=25
```

10. **Assign priorities to each MSTI. These values are compared with those set on the other switches in order to determine the root bridge for each MSTI.**

```
set mstp msti=2 prio=8192
set mstp msti=3 prio=8192
```

11. **Enable MSTP on the switch.**

```
ena mstp
```

Configure Switch 2

1. **Name the system and set manager port.**

```
set system name=switch2
set manager asyn=0
```

2. **Create VLAN 12 and assign it a VID of 12.**

```
create vlan=vlan12 vid=12
```

3. **Create VLAN 25 and assign it a VID of 25.**

```
create vlan=vlan25 vid=25
```

4. **Add VLAN 12 to the required ports, as tagged ports.**

```
add vlan=12 po=3,4,5,6,7,8,9,10 frame=tagged
```

5. **Add VLAN 25 to the required ports, as tagged ports.**

```
add vlan=25 po=3,4,9,10 frame=tagged
```

6. **Set MSTP on Switch2. Name the region Head Office and assign it a revision level of 0 (the value recommended in the IEEE standard).**

```
set mstp configname=headoffice revision=0
```

7. **Enable static VLAN support on MSTP.**

```
set mstp staticvlans=on
```

8. **Create the MSTIs 2 and 3.**

```
create mstp msti=2
create mstp msti=3
```

9. **Add MSTI 2 to VLAN 12, and MSTI 3 to VLAN 25.**

```
add mstp msti=2 vlan=12
add mstp msti=3 vlan=25
```

10. **Assign priorities to each MSTI. These values are compared with those set on the other switches in order to determine the root bridge for each MSTI.**

```
set mstp msti=2 prio=8192
set mstp msti=3 prio=4096
```

11. **Enable MSTP on the switch.**

```
ena mstp
```

Configure Switch 3

1. **Name the system and set manager port.**

```
set system name=switch3
set manager asyn=0
```

2. **Create VLAN 12 and assign it a VID of 12.**

```
create vlan=vlan12 vid=12
```

3. **Create VLAN 25 and assign it a VID of 25.**

```
create vlan=vlan25 vid=25
```

4. **Add VLAN 12 to the required ports, as tagged ports.**

```
add vlan=12 po=5,6,9,10 frame=tagged
```

5. **Add VLAN 25 to the required ports, as tagged ports.**

```
add vlan=25 po=5,6,9,10 frame=tagged
```

6. **Set MSTP on Switch 3. Name the region Head Office and assign it a revision level of 0 (the value recommended in the IEEE standard).**

```
set mstp configname=headoffice revision=0
```

7. **Enable static VLAN support on MSTP.**

```
set mstp staticvlans=on
```

8. **Create the MSTIs 2 and 3.**

```
create mstp msti=2
create mstp msti=3
```

9. **Add MSTI 2 to VLAN 12, and MSTI 3 to VLAN 25.**

```
add mstp msti=2 vlan=12
add mstp msti=3 vlan=25
```

10. **Assign priorities to each MSTI. These values are compared with those set on the other switches in order to determine the root bridge for each MSTI.**

```
set mstp msti=2 prio=4096
set mstp msti=3 prio=8192
```

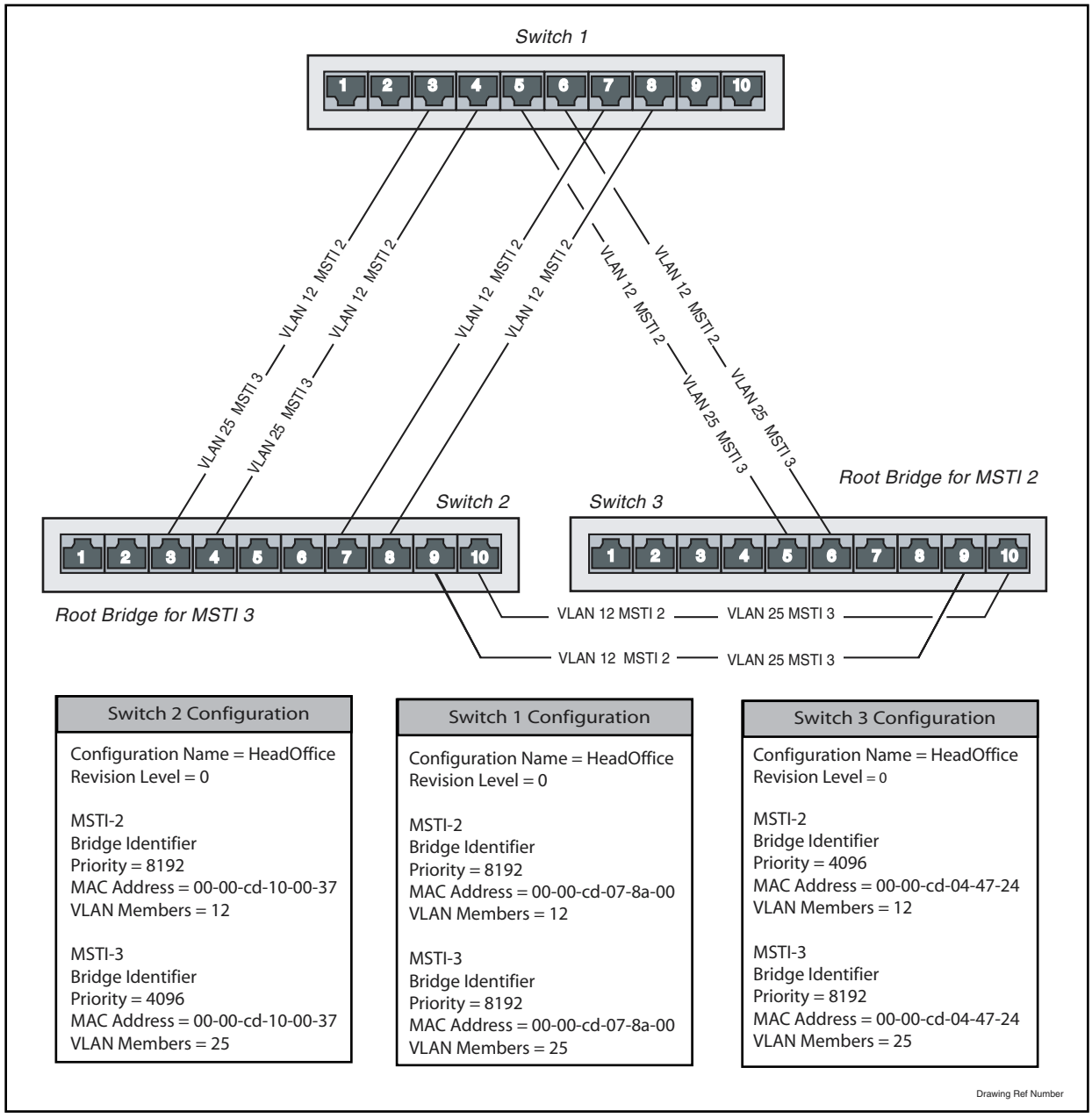
11. **Enable MSTP on the switch.**

```
ena mstp
```

Root bridge selection for MSTP MSTIs

The MSTP protocol will select its root bridges for each MSTI. It does this by selecting, for each MSTI, the bridge that contains (numerically) the lowest bridge identifier. This is shown in Figure 8-7 on page 8-49.

Figure 8-7: Example MSTP MSTI configuration



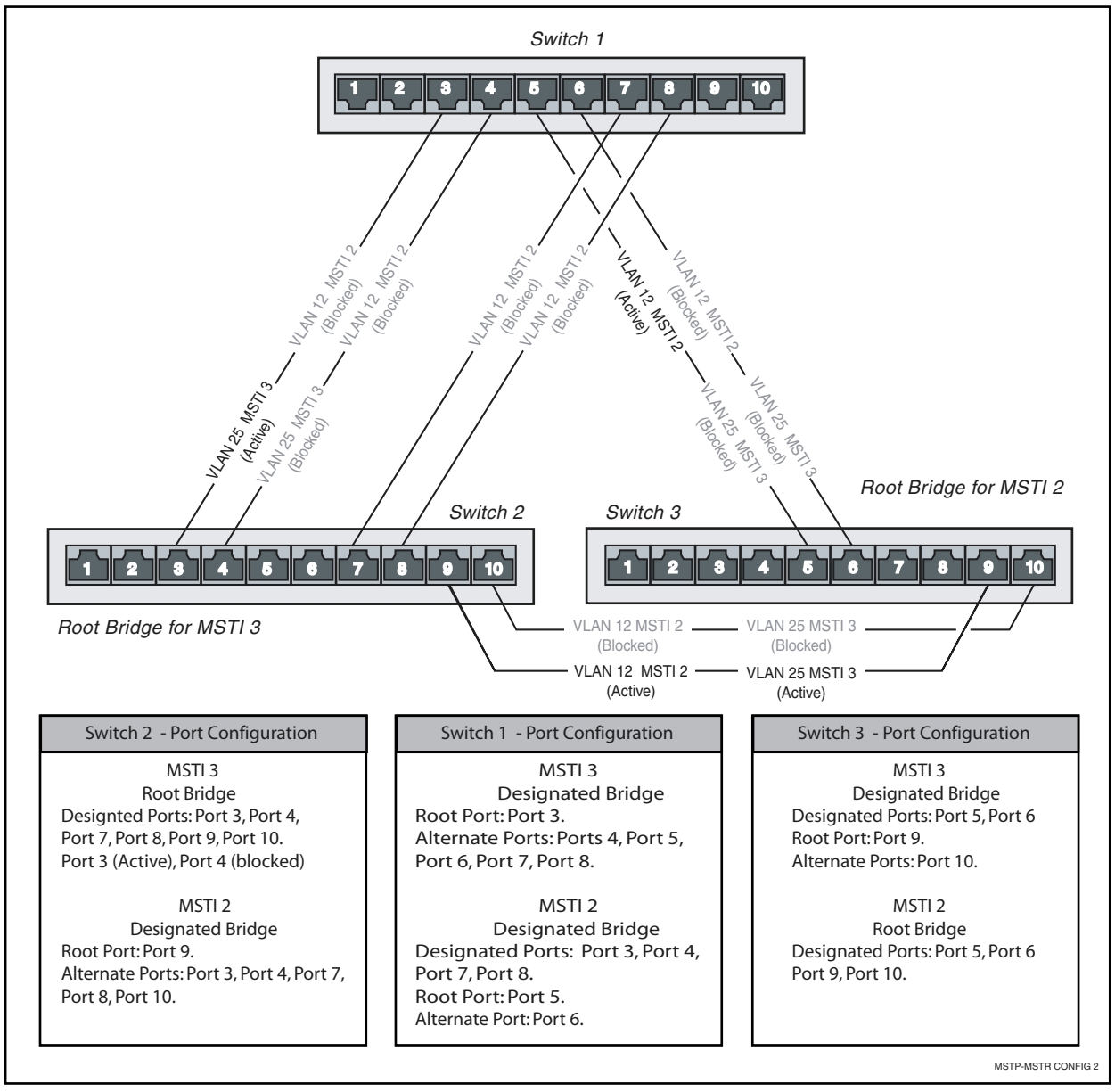
Notice that the root bridges are different for the two MSTIs. The root bridge for MSTI 2 is Switch 3 and the root bridge for MSTI 3 is Switch 2. This is because for MSTI 2 Switch 3 it has been given the lowest MSTI priority value, 4096, compared with 8192 for Switches 1 and 2.

Similarly, the root bridge for MSTI 3 is Switch 2 because its MSTI priority value has been set to 4096, compared with the value 8192 set for Switches 1 and 2. If all three bridges were configured with the same priority value for a particular MSTI, then Switch 3 would become the root bridge for that MSTI, because it has the lowest MAC address of the three switches.

Path selection for MSTP MSTIs

After the protocol has selected its root bridge for each MSTI, it selects which are to be the active and blocked paths for each MSTI. The port with the best path to the root bridge is selected as the foot port and becomes active. Other ports that also lead to the root bridge, but via a path that is better than the path back through the switch, are selected as alternate ports and are blocked to prevent loops. Ports that are connected to another port on the same switch, where that port has a better priority value, are backup ports and are blocked to prevent a loop. All other ports that are not disabled are selected as designated ports and are eventually made active. Figure 8-8 on page 8-50 shows which paths have been selected.

Figure 8-8: Example MSTP MSTI Path Configuration



For MSTI 3
Between Switches 1 and 2 there are two paths available, Port 3 to Port 3, and Port 4 to Port 4. Since no port priority has been explicitly applied, all port configurations have their defaults. Since all ports have the same speed (100 MBPS), each port has a Port Path Cost of 200,000. Since Port 3 is numerically lower than Port 4, the active path is the one between Switch 1 Port 3, and the

other path is blocked. Similarly, the active path between Switches 2 and 3 is between Port 9 on each switch.

For MSTI 2
Between Switches 1 and 3 there are two paths available, Port 5 to Port 5, and Port 6 to Port 6. Since no port priority has been explicitly applied, all port configurations have their defaults. Since all ports have the same speed (100 MBPS) each port has a Port Path Cost of 200,000. Since Port 5 is numerically lower than Port 6, the active path is the one between Switch 1 Port 5 and Switch 2 Port 5, and the other path is blocked. Similarly, the active path between Switches 2 and 3, is between Port 9 on each switch.

If you want to make a particular path the active one, use the **set mstp msti port** command.

Example:

To balance the load between Switches 2 and 3, set the active path for MSTI 2 to be between Ports 10 and 10 of each switch. Use the following command to set the port path cost less than the present default of 200000:

For Switch 2

```
set mstp msti=2 port=10 pathcost=1000
```

For Switch 3

```
set mstp msti=2 port=10 pathcost=1000
```

Configuration Check

To check the status of the paths and to see which are forwarding and which are blocked run the **show mstp msti port** command on page 8-198, for a particular MSTI and port. From the output, note whether the port is a Root and whether its status is forwarding or blocking. If the port is a root port and is in the forwarding state, then its path is Active.

Common and Internal Spanning Tree (CIST)

In addition to the individual MSTIs within each MSTR region, the MSTR contains a network-wide spanning tree called the Common and Internal Spanning Tree (CIST). Conceptually, each region represents a virtual bridge. Internal and external bridge connectivity are two independent functions.

Frames with VIDs allocated to the CIST are subject to the rules and path costs of the complete bridged LAN as determined by the CIST's vectors. Frames other than these are subject to the CIST when travelling outside their region, and subject to its particular MSTI inside the region.

The following operational rules apply:

- Each bridge can be a member of only one region.
- A data frame is associated with a single VID.
- Data frames with a given VID are associated with either the CIST or their particular MSTI, but not both.

The configuration examples in this section are based on the network shown in Figure 8-9 on page 8-54. This simple network comprises six LAN bridges and is basically two networks of the type used in the previous examples, that are connected back to back.

Configuring the CIST Example

Configuring this network involves the same basic steps used in the previous examples. Note that the only VLAN that is common to both regions is VLAN 12, which uses MSTI 3. These must be explicitly configured to Ports 1 and 10 of Switches 3 and 4.

For Switch 3

1. **Add VLAN 12 to the required ports, as tagged ports.**

```
add vlan=12 po=1,10 frame=tagged
set mstp msti=2 port=10 pathcost=1000
```

For Switch 4

1. **Add VLAN 12 to the required ports, as tagged ports.**

```
add vlan=12 po=1,10 frame=tagged
set mstp msti=2 port=10 pathcost=1000
```

If you configured the network using the steps in the previous example, and added the shared VLANs to the connecting ports as shown above, the network now has two regions: Region One representing a company's Head Office; and Region Two, representing the company's Manufacturing Plant. Note that although each network region is separate, with each of its MSTIs only having local significance within the region, the data itself still flows between the two networks and the VLANs in each are still recognised across MSTR boundaries.

The task of preventing loops within the wider network, is the role of CIST. By inspecting the example network, it is clear that there is a potential loop between the two regions that CIST must handle.

CIST first allocates root and designated bridges by selecting the bridge with the lowest identifier as the root. As far as the physical topology is concerned a good choice for the root bridge would be either of Switches 3 or 4. The network has been designed to force Switch 3 to become the root by assigning it the lowest priority identifier in the network (12288), and of course it is also the root bridge for Region One. Similarly, assigning Switch 4 the priority identifier of 20480 ensures that this bridge becomes the root bridge for Region 2 (because its priority identifier of 20480 is lower than any other bridge in its region). Switch 4 is also the CIST regional bridge since it offers the lowest path cost from Region 2 to Switch 3 (the CIST root bridge).

Note that the bridge identifier comprises two parts: a bridge priority part (more significant), and a bridge MAC address part (less significant). The multiple spanning tree algorithm uses the bridge identifier when determining the role of a switch within each spanning tree. The switch with a lower priority is considered to have better bridge identifier, and is therefore more likely to be chosen as the root bridge. You can set the CIST bridge priority using the **set mstp cist** command.

```
set mstp cist priority=20480
```

CIST Vectors

Having selected the CIST Root and Designated bridge, the CIST will then deal with any loops that exist between the regions. It will do this by considering the following entities, called “vectors” in the following order:

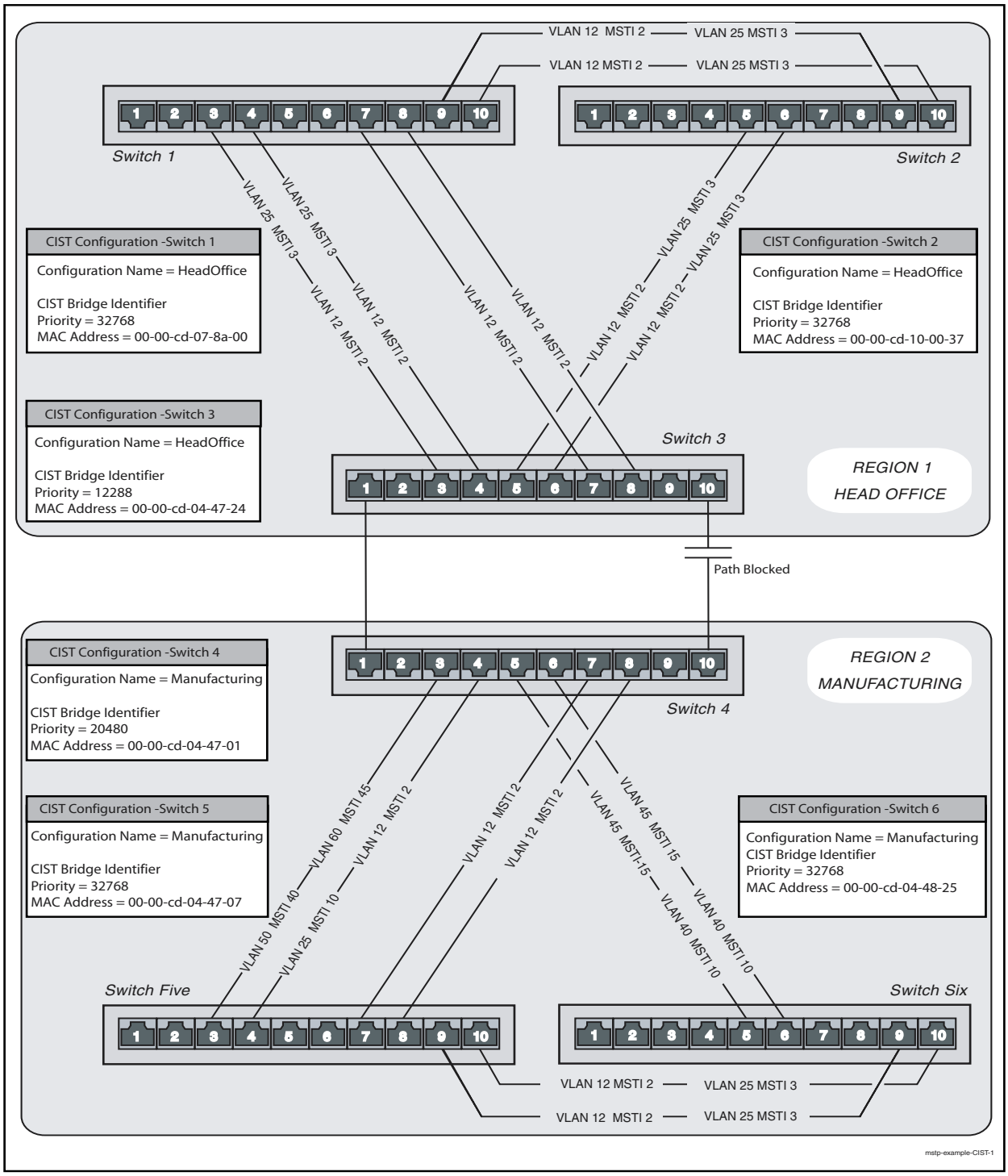
1. CIST External Root Path Cost
2. CIST Regional Root Identifier
3. CIST Internal Root Path Cost
4. CIST Designated Bridge Identifier
5. CIST Designated Port Identifier
6. CIST Receiving Port Identifier

Since there is clearly a loop condition between Switches 3 and 4, the CIST will inspect each of the vectors. Assuming the two links from the same bridge have equal path costs, the active link will be selected as the one from the port with the lowest port number. Hence the path between Port 10 on each switch will be blocked.

Note the situation if the connections on Switch 4 were reversed, i.e. port 1 of Switch 3 being connected to port 10 of Switch 4, and port 1 of Switch 4 being connected to port 10 of Switch 3.

In the above situation, metric 5 above would apply (since metrics 1 through 4 would have the same value). The designated ports would be 1 and 10 on Switch 3, and since port 1 has the lower (numeric) value, this port would provide the active link, and the path from its port 10 would be blocked.

Figure 8-9: MSTP - CIST Configuration Example



The Relationship between Spanning Trees and Trunks

If multiple links are trunked together, either manually or by using an automatic process such as LACP, the spanning tree application is notified and considers the links as a single logical path. Consequently, the spanning tree broadcast messages (BPDUs) only traverse the master trunk path.

Whether trunking offers a better solution depends on the individual network configuration. Users are recommended to consider both alternatives and select the option (Trunking or MSTP) that best meets the requirements of the particular network.

Hardware Packet Filters

The switch hardware can be configured to discard, forward, mirror, or change the priority of packets matching specified criteria at wirespeed. For Rapier *i* Series switches, filters can also be configured to provide a range of Quality of Service (QoS) controls, including changing the DSCP byte, and actions can be specified for packets that match the ingress and egress ports of the filter (if set), but do not match the filter's other parameters.

Two sets of commands are available, one based on the Packet Classifier (see Chapter 34, Generic Packet Classifier), and one based on Layer 3 filter matches and entries. These two filter types cannot be used together.

When Internet Group Management Protocol (IGMP) snooping is enabled, it uses a hardware filter, which reduces the number of available filters. IGMP snooping is enabled by default, but can be disabled to make its filter available by using the command:

```
disable igmpsnooping
```

When IGMP snooping is disabled, multicast packets flood the VLAN.

IGMP snooping cannot be enabled unless a filter is available. To enable IGMP snooping, use the command:

```
enable igmpsnooping
```

For more information, see "IGMP Snooping" on page 24-26 of Chapter 24, IP Multicasting.

Classifier-Based Packet Filters

The switch hardware can be configured through entries in the Packet Classifier to copy, drop, forward, and associate QoS attributes to Layer 3 packets that match the criteria set using the classifier (see Chapter 35, Quality of Service (QoS) and Chapter 34, Generic Packet Classifier).

Every packet passing through the switch is matched against a series of classification tables by the Packet Classifier. Packets can be classified according to:

- Packet type

- Physical source/destination port
- Layer 3 protocol
- Source/destination IP address
- Destination IPX address
- Layer 4 protocol (for example: TCP/UDP/Socket number)
- Layer 4 source/destination ports
- Any 16-bit word in the first 64 bytes of a packet

See Chapter 34, Generic Packet Classifier for information on configuring classifiers.

Hardware-based packet filters can be configured by the user to take action upon the results of the classification tables. These actions are:

- Discard the packet
- Forward the packet
- Send the packet to the mirror port
- Forward the packet to a specified egress port, for unicast packets
- Send the packet to a Class of Service queue
- Replace the packet's 802.1p priority

The filter can also perform the following Quality of Service actions for Rapier *i* Series switches only:

- Replace the packet's IP TOS value and/or the IP DSCP value.
- Direct non-unicast packets that were scheduled to be dropped or sent to the CPU to a specified port.
- Forward packets that were marked to be dropped. This option allows bandwidth limiting to be overridden for particular packets.

For Rapier *i* Series switches, all actions are also available on packets that match the ingress and egress ports of the classifier (if either or both are set), but do not match the classifier's other parameters.

For more information about the circumstances when hardware filters are useful for performing QoS on Rapier *i* Series switches, see Table 35-1 on page 35-6 in Chapter 35, Quality of Service (QoS) on Switch Ports.

A classifier-based packet filter comprises a single classifier entry. A number of filters can be created at one time with the same action by specifying a list of classifiers, but each classifier is contained in a single filter. The number of packet filters supported by the switch is determined by the switch model and how different each filter is.

How to create classifier-based filters

To create a hardware-based packet filter:

1. Create the classifier by using the command:

```
create classifier=1..9999 [classifier-options...]
```

2. Create the filter by using the command:

```
add switch hwfilter classifier=classifier-list
    [action={setpriority|sendcos|settos|deny|sendeport|
    sendmirror|movepriototos|movetostoprio|setipdscp|
    sendnonunicasttoport|nodrop|forward}[,...]]
    [newipdscp=0..63] [newtos=0..7]
    [nomatchaction={setpriority|sendcos|settos|deny|
    sendeport|sendmirror|movepriototos|movetostoprio|
    setipdscp|sendnonunicasttoport|forward}[,...]]
    [nomatchdscp=0..63] [nomatchport=port-number]
    [nomatchpriority=0..7] [nomatchtos=0..7]
    [port=port-number] [priority=0..7]
```

3. Verify the filter by using the command:

```
show switch hwfilter [classifier=classifier-list]
```

How to delete classifier-based filters

To stop the switch from filtering packets that match a particular classifier, use the command:

```
delete switch hwfilter classifier=classifier-list
```

How to disable and enable filtering

The switch automatically enables classifier-based packet filtering when you add the first filter. To disable it, use the command:

```
disable switch hwfilter
```

If the switch is not forwarding packets as you expect, disabling filtering may help with troubleshooting by indicating whether your filters are the cause of the behaviour. To enable classifier-based packet filtering again, use the command:

```
enable switch hwfilter
```

When Internet Group Management Protocol (IGMP) Snooping is enabled, hardware filtering is also enabled. IGMP snooping is enabled by default. Hardware filtering cannot be disabled unless IGMP snooping is first disabled by using the command:

```
disable igmpsnooping
```

Layer 3 Filter Matches

As an alternative to classifier-based filters, Layer 3 filter matches can be configured to determine which fields in each packet are matched, whether ingress or egress ports are to be matched, and the source and destination class of IP masks to apply to the packets. An entry added to a filter specifies the values to be matched for each field and the action to be taken on packets matching the filter entry. Layer 3 filter matches can perform the same actions as classifier-based hardware filters, but classifiers match a wider range of packet types.

Filters can be configured while Layer 3 filtering is disabled or enabled, but it must be enabled for any of the existing filters to take effect. To enable the Layer 3 filter function, use the **enable switch l3filter** command on page 8-136. Disable it with the **disable switch l3filter** command on page 8-117.

When Internet Group Management Protocol (IGMP) Snooping is enabled, Layer 3 filtering is also enabled. Layer 3 filtering cannot be disabled unless IGMP snooping is first disabled, using the command **disable igmpsnooping**

(see "IGMP Snooping" on page 24-26 of Chapter 24, IP Multicasting). IGMP snooping is enabled by default.

To add Layer 3 filter match criteria, use the **add switch l3filter match** command on page 8-83.

To display hardware-based Layer 3 filtering match criteria configured on the switch and their filter entries, use the **show switch l3filter** command on page 8-220.

Filter match criteria can be changed only when no filter entries belong to them. To change filter match criteria, delete any entries associated with them, use the **set switch l3filter match** command on page 8-171.

To delete the Layer 3 filter match criteria, first delete any entries belonging to it, use the **delete switch l3filter** command on page 8-101.

To configure a Layer 3 filter entry, first add the filter match criteria, then add a filter entry.

Layer 3 Filter Entries

Filter matches specify the aspect of the packet that the filter checks. Filter entries specify what that aspect must be set to in order for the traffic to be filtered by the filter. To add a Layer 3 switch filter entry to the match criteria described above, use the **add switch l3filter entry** command on page 8-80.

All criteria specified in the filter match should also be set in the filter entry. Criteria not in the filter match are not valid in the filter entry. The **l3filter** parameter specifies the number of the filter match to be modified. Filter match numbers are in the output of the **show switch l3filter** command on page 8-220.

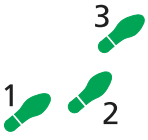
To change the parameters for a filter entry, use the **set switch l3filter entry** command on page 8-168.

To delete a Layer 3 filter entry, use the **delete switch l3filter entry** command on page 8-101.

Access Control Lists (ACLs)

On Rapier *i* Series switches, classifiers and hardware packet filters can be configured to provide Access Control List functionality.

For example, to allow WWW servers in the 192.168.10.0 subnet to be accessed only from the 192.168.20.0 subnet:



1. **Create a classifier to match all WWW traffic to the subnet**

   Create a classifier to match all WWW traffic to the 192.168.10.0 subnet.

   ```
   create classifier=1 ipdaddr=192.168.10.0/24 tcpdport=80
   ```

2. **Create a hardware packet filter to deny this traffic**

   ```
   add switch hwfilter classifier=1 action=deny
   ```

3. **Create a classifier to match the subset of this traffic that is to be allowed**

Create a classifier to match WWW traffic from the 192.168.20.0 subnet to the 192.168.10.0 subnet.

```
create classifier=2 ipdaddr=192.168.10.0/24
   ipsaddr=192.168.20.0/24 tcpdport=80
```

4. Create a hardware packet filter to allow this traffic

This filter must be created last so that it is the first filter that the switch processes.

```
add switch hwfilter classifier=2 action=nodrop
```

The **nomatchaction** parameter can create a hardware filter that acts upon traffic that does not match the classifier or any other hardware filters. For example, to allow traffic destined for TCP ports 25 and 80 and UDP port 5151, and block all other traffic, create the following set of classifiers and filters:

```
create classifier=1 tcpdport=80
add switch hwfilter classifier=1 action=forward
   nomatchaction=deny
create classifier=2 tcpdport=25
add switch hwfilter classifier=2 action=forward
   nomatchaction=deny
create classifier=3 udpdport=5151
add switch hwfilter classifier=3 action=forward
   nomatchaction=deny
```

If the **nomatchaction** is not specified in these filters, all traffic is forwarded, including traffic that matched the classifiers.

Triggers

The Trigger facility can be used to automatically run specified command scripts when particular triggers are activated. When a trigger is activated by an event, global parameters and parameters specific to the event are passed to the script that runs. For a full description of the Trigger facility, see Chapter 54, Trigger Facility.

The switch can generate triggers to activate scripts when a switch port goes up or down.

The following section lists the events that may be specified for the Switching module for the **event** parameter, the parameters that may be specified as *module-specific-parameters* for the Switching module, and the arguments passed to the script activated by the trigger.

Module Layer 3 Switching module: **module=swi**

Event **linkdown**

Description The port link specified by the **port** parameter has just gone down.

Parameters The following command parameter(s) must be specified in the **create/set trigger** commands:

Parameter	Description
port=*port*	The port where the event activates the trigger.

Script Parameters The trigger passes the following parameter(s) to the script:

Argument	Description
%1	The port number of the port that has just gone down.

Event **linkup**

Description The port link specified by the **port** parameter has just come up.

Parameters The following command parameter(s) must be specified in the **create/set trigger** commands:

Parameter	Description
port=*port*	The port where the event activates the trigger.

Script Parameters The trigger passes the following parameter to the script:

Argument	Description
%1	The port number of the port that has just come up.

To create or modify a switch trigger, use the commands:

```
create trigger=trigger-id module=switch event={linkdown|
   linkup} port=port [after=hh:mm] [before=hh:mm] [date=date|
   days=day-list] [name=name] [repeat={yes|no|once|forever|
   count}] [script=filename...] [state={enabled|disabled}]
   [test={yes|no|on|off|true|false}]

set trigger=trigger-id [port=port] [after=hh:mm]
   [before=hh:mm] [date=date|days=day-list] [name=name]
   [repeat={yes|no|once|forever|count}] [test={yes|no|on|
   off|true|false}]
```

Configuration Examples

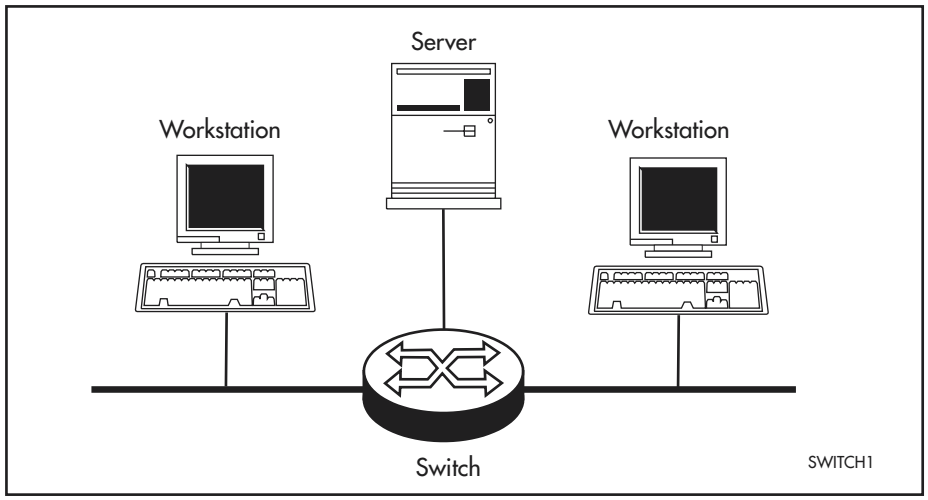
This section shows examples of configuring the Layer two switch functions on the switch. All examples assume that the switch configuration begins from factory default settings.

Note that routing, required for communication between the VLANs, is not shown in these examples.

Example Using One Switch to Extend a Local LAN

The example in Figure 8-10 on page 8-61 uses a single switch to connect two (or more) physical LANs and a server. All the devices connected belong to the same broadcast domain, and separate collision domains. The learning and forwarding processes in the switch give this topology better performance than a single LAN would give, and allow more devices to be attached than would a single physical LAN.

Figure 8-10: Example of switch with default configuration

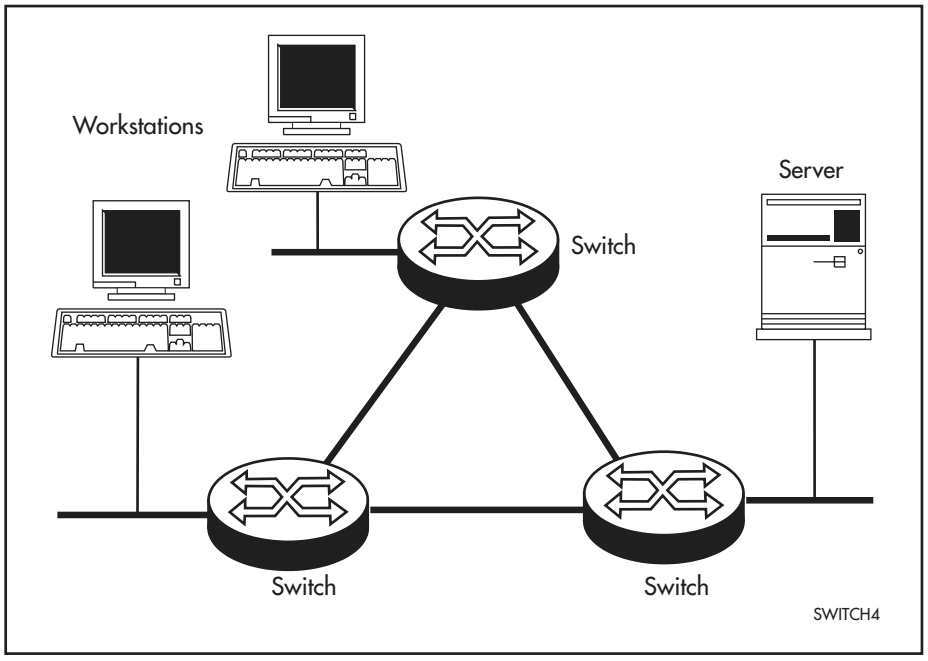


No software configuration is required. The default switch settings lets the switch learn source addresses and forward frames to correct ports as soon as it is physically connected and powered up.

Example of a meshed network without VLANs

The example in Figure 8-11 on page 8-61 has redundant links between the switches, and all ports belong only to the default VLAN. STP is needed because of the loop in the physical topology.

Figure 8-11: Example of switch with default configuration



The only software configuration required is to enable the default STP on each of the switches, to eliminate loops in the network. The switches begin switching as soon as they are physically connected and powered up.

Table 8-15: Parameters for meshed network without VLANs

All switches		
STP	default STP	Enabled

Configure all switches

1. **Enable STP**

   The default VLAN to which all ports belong by default, is a member of the default STP. Enable the default STP on each switch using the command:

   ```
   enable stp=default
   ```

VLAN example using untagged ports

The example in Figure 8-12 on page 8-62 has two VLANs using untagged ports. Ports 1-3 belong to one broadcast domain, the *marketing* VLAN, and ports 14-16 belong to another broadcast domain, the *training* VLAN. The switch acts as two separate bridges: one that forwards between the ports belonging to the *marketing* VLAN, and a second one that forwards between the ports belonging to the *training* VLAN. Devices on ports 2 and 14 can only communicate with each other by using the switch's IP routing functions.

Figure 8-12: VLANs with untagged ports

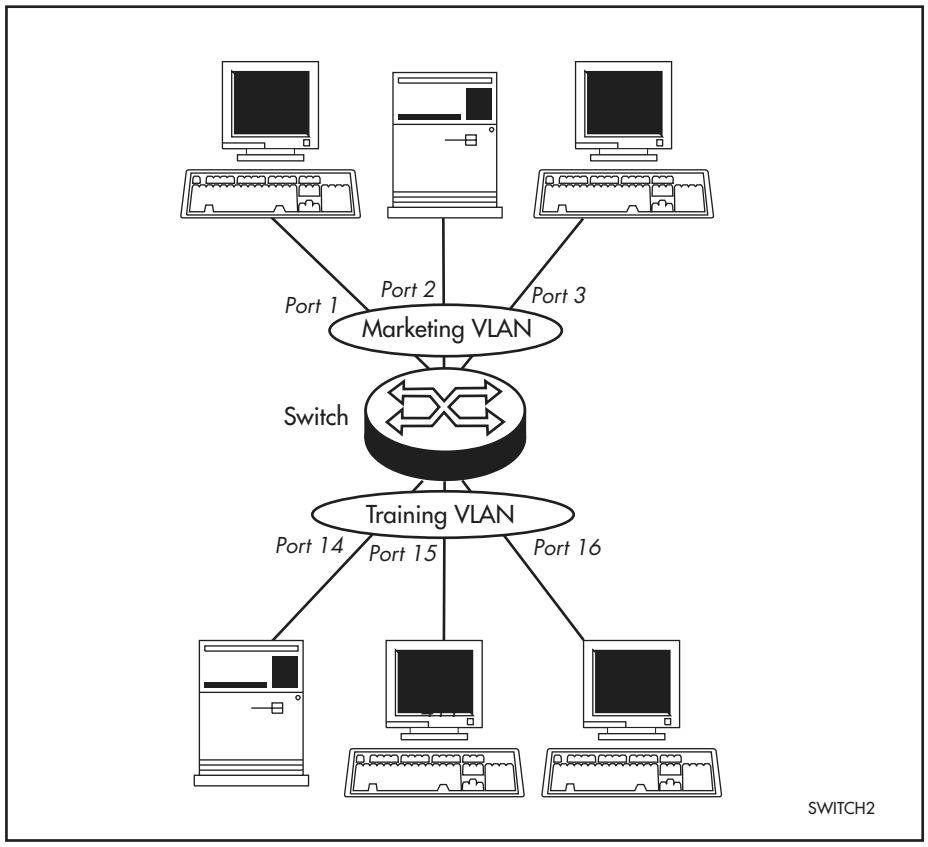


Table 8-16 on page 8-63 shows the parameters used to configure this example. Since there is only one switch and no loops in this topology, the Spanning Tree Protocol (STP) is not needed. This example assumes that the switch has factory default settings.

Table 8-16: Parameters for port-based VLAN example

VLAN name	VLAN ID	Ports
Marketing	VID=2	PORT 1-3
Training	VID=3	PORT 14-16

Configure the switch

1. **Create VLANs**

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

   ```
   create vlan=marketing vid=2
   create vlan=training vid=3
   ```

2. **Add ports to VLANs**

   Add the ports to these VLANs on the switch by using the following commands:

   ```
   add vlan=marketing port=1-3
   add vlan=training port=14-16
   ```

   Check the VLAN configuration by using the command:

   ```
   show vlan
   ```

3. **Check the switch.**

   Check that the switch is switching across the ports. Traffic on the switch can be monitored using the command:

   ```
   show switch port=1-3,14-16 counter
   ```

VLAN Example with Tagged Ports

Figure 8-13 on page 8-64 shows a network that must be configured with VLAN tagging, since the VLAN aware server on port 2 on Switch A belongs to both the *admin* VLAN and the *marketing* VLAN. Using VLAN tags, port 26 on Switch A and port 25 on Switch B belong to both the *marketing* VLAN and the *training* VLAN, so that devices on both VLANs can use this uplink to communicate with other devices in the same VLAN on the other switch. There are no loops in this topology, so STP is not needed.

Figure 8-13: VLANs with tagged ports

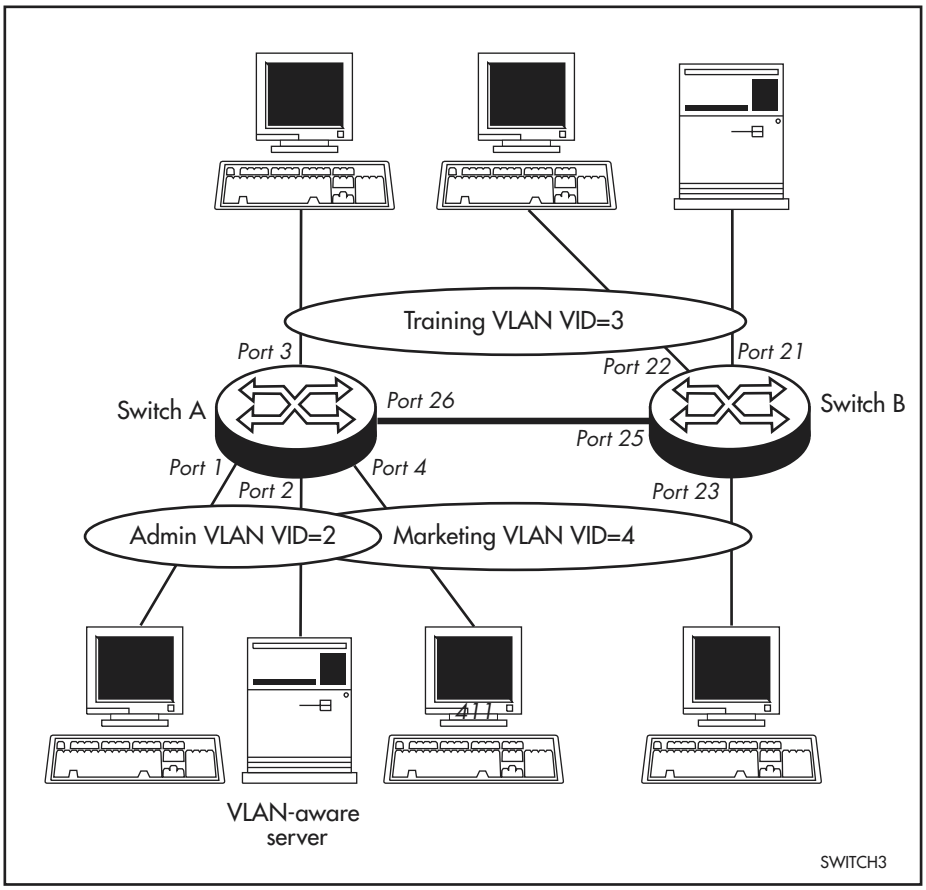


Table 8-17: Configuration example parameters for VLANs with tagged ports

		Switch A		Switch B	
VLAN name	**VID**	**Tagged ports**	**Untagged ports**	**Tagged ports**	**Untagged ports**
Admin	VID=2	PORT 2	PORT 1		
Training	VID=3	PORT 26	PORT 3	PORT 25	PORT 21,22
Marketing	VID=4	PORT 2,26	PORT 4	PORT 25	PORT 23

Configure Switch A

1. Create VLANs

Create the three VLANs using the following commands on the switch:

```
create vlan=admin vid=2
create vlan=training vid=3
create vlan=marketing vid=4
```

2. Add ports to VLANs

Add the ports to these VLANs on the switch by using the following commands:

```
add vlan=admin port=2 frame=tagged
add vlan=admin port=1
add vlan=training port=26 frame=tagged
add vlan=training port=3
add vlan=marketing port=2,26 frame=tagged
add vlan=marketing port=4
```

Check the VLAN configuration by using the command:

```
show vlan
```

Configure Switch B

1. Create VLANs

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

```
create vlan=training vid=3
create vlan=marketing vid=4
```

2. Add ports to VLANs

Add the ports to these VLANs on the switch by using the following commands:

```
add vlan=training port=25 frame=tagged
add vlan=training port=21,22
add vlan=marketing port=25 frame=tagged
add vlan=marketing port=23
```

Check the VLAN configuration by using the command:

```
show vlan
```

Check

Check that the switch is switching across the ports. Traffic on Switch A can be monitored using the command:

```
show switch port=1-4,26 counter
```

Traffic on Switch B can be monitored using the command:

```
show switch port=21-23,25 counter
```

Example of Meshed Network with VLAN Tagged Ports

In this example, the uplink ports on all three switches connect the VLANs. Server S on Switch B is VLAN aware, and is shared between all three VLANs. The other devices shown are VLAN-unaware end stations, connected to untagged ports. Because both uplink ports on all three switches belong to the *marketing* VLAN, the Spanning Tree Protocol eliminates the loop in this VLAN, and provides redundancy in case links fail. Because the VLAN-aware shared server on Switch B, and the uplink ports belong to all three VLANs, these VLANs must all belong to the same STP.

Figure 8-14: Example of meshed network with VLAN tagged ports

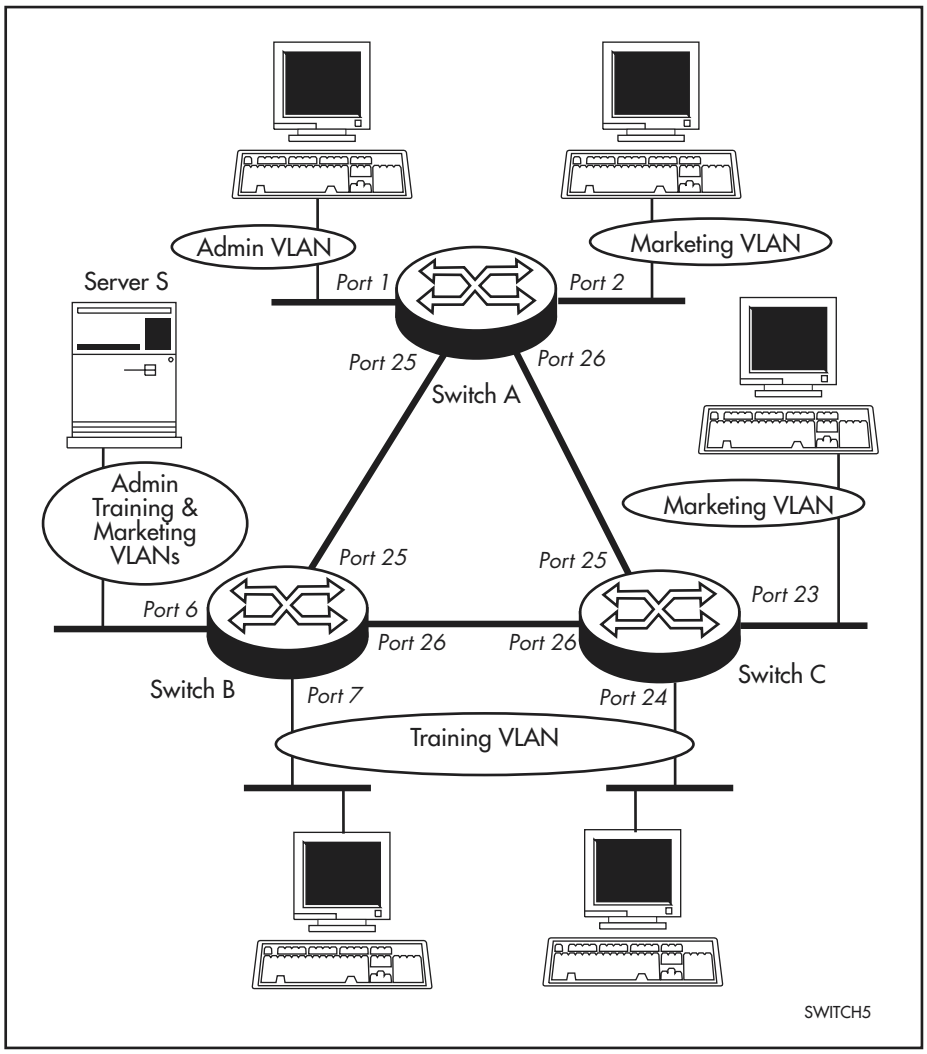


Table 8-18 on page 8-67 shows the parameters for creating the VLANs on the switches and adding ports to the VLANs. Note that by default all VLANs belong to the default STP, which is disabled at switch start-up.

Note that all three VLANs are created on all three switches, and all uplink ports belong to all three VLANs. This should be done even though the training VLAN has no devices on Switch A that need to communicate with Switch B or C, and Switch C has no devices belonging to the admin VLAN requiring links to Switch A or B. This is because STP is enabled, and inevitably blocks ports on one of the three links to prevent a loop in the marketing VLAN. This also blocks traffic over these ports for the other VLANs. Therefore the training and admin VLANs must be able to communicate over either of the links on each switch to ensure full VLAN operation. Failing to include the switches and uplink ports in the VLANs for which they have no devices attached is likely to block either the admin or training VLANs access to some of their members.

Table 8-18: Parameters for meshed VLAN network with tagged ports

		Switch A		Switch B		Switch C	
VLAN name	**VID**	**Tagged ports**	**Untagged ports**	**Tagged ports**	**Tagged ports**	**Tagged ports**	**Tagged ports**
Admin	VID=2	25,26	1	6,25,26	-	25,26	-
Training	VID=3	25,26	-	6,26,25	7	26,25	24
Marketing	VID=4	25,26	2	6,25,26	-	25,26	23
STP		**Default STP**		**Default STP**		**Default STP**	
		Enabled		Enabled		Enabled	

To configure the uplink ports in the above example, use the following commands:

Configure Switch A

1. Create VLANs

Create the three VLANs using the following commands on the switch:

```
create vlan=admin vid=2
create vlan=training vid=3
create vlan=marketing vid=4
```

2. Add ports to VLANs

Add the ports to these VLANs on the switch by using the following commands:

```
add vlan=admin port=25-26 frame=tagged
add vlan=admin port=1
add vlan=training port=25-26 frame=tagged
add vlan=marketing port=25-26 frame=tagged
add vlan=marketing port=2
```

Check the VLAN configuration by using the command:

```
show vlan
```

3. Enable STP

All VLANs belong to the default STP, which must be enabled to eliminate loops in the network. Use the command:

```
enable stp=default
```

Configure Switch B

1. Create VLANs

Create the three VLANs using the following commands on the switch:

```
create vlan=admin vid=2
create vlan=training vid=3
create vlan=marketing vid=4
```

2. Add ports to VLANs

Add the ports to these VLANs on the switch by using the following commands:

```
add vlan=admin port=6,25-26 frame=tagged
add vlan=training port=6,25-26 frame=tagged
add vlan=training port=7
add vlan=marketing port=6,25-26 frame=tagged
```

Check the VLAN configuration by using the command:

```
show vlan
```

3. Enable STP

All VLANs belong to the default STP, which must be enabled to eliminate loops in the network. Use the command:

```
enable stp=default
```

Configure Switch C

1. Create VLANs

Create the three VLANs using the following commands on the switch:

```
create vlan=admin vid=2
create vlan=training vid=3
create vlan=marketing vid=4
```

2. Add ports to VLANs

Add the ports to these VLANs on the switch by using the following commands:

```
add vlan=admin port=25-26 frame=tagged
add vlan=training port=25-26 frame=tagged
add vlan=training port=24
add vlan=marketing port=25-26 frame=tagged
add vlan=marketing port=23
```

Check the VLAN configuration by using the command:

```
show vlan
```

3. Enable STP

All VLANs belong to the default STP, which must be enabled to eliminate loops in the network. Use the command:

```
enable stp=default
```

Check that the switch is switching across the ports.

1. Check the traffic on Switch A.

```
show switch port=1,2,25,26 counter
```

2. Check the traffic on Switch B.

```
show switch port=6,7,25,26 counter
```

3. Check the traffic on Switch C.

```
show switch port=23-26 counter
```

Command Reference

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

The shortest valid command is denoted by capital letters in the Syntax section. See "Conventions" on page xcviii of About this Software Reference 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.

The Rapier *i* Series switch has additional command parameters and options that are not available for the Rapier Series switch. These are noted in the command description section as "On the Rapier *i* Series switches only...".

activate mstp migrationcheck port

Syntax

```
ACTivate MSTp MIGRationcheck 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 Ethernet switch port, including uplink ports.

Description

If an MSTP bridge detects the presence of STP data on one of its ports (from a legacy bridge) it automatically migrates the port to the STP protocol. Other MSTP and RSTP bridges connected to this port do the same. Thus all bridges that connect to this port revert to the STP protocol. However, this condition remains even after the original STP bridge has been removed.

Activating a migration check (mcheck) on such a port forces the bridge to migrate back to MSTP (or RSTP) and to transmit either MSTP (or RSTP) messages. After receiving these messages, other RSTP/MSTP bridges follow the same procedure. If no further STP bridge messages are received within a preset time period, then all the connected bridges remain in MSTP mode. The bridge decides whether to use RSTP or MSTP mode based on the setting of the **protocolversion** parameter of the MSTP command.

The **port** parameter specifies ports that are to have an mcheck applied to them. If **all** is specified, all ports in the switch are forced to the mcheck message. 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.

The **port** parameter specifies the ports to transmit the mcheck messages. If **all** is specified, then all ports in the switch have an mcheck applied to them.

Example

To transmit mcheck messages to all ports on the switch, use the command:

```
act mst migr po=all
```

Related Commands

show mstp

activate switch port

Syntax

```
ACTivate SWItch POrt={port-list|ALL} {AUTOnegotiate}
   {LOCK}
```

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 Ethernet switch port, including uplink ports.

Description

This command activates autonegotiation of port speed and duplex mode for a port or a group of ports.

The **port** parameter specifies the port or ports for which autonegotiation is to be activated. Only ports in the list that are set to autonegotiate are actually affected by this command. Ports with a fixed speed setting or that belong to a trunk group are not modified.

A port that has been added to LACP autonegotiates until it actively becomes part of an aggregated link (i.e. trunked), when it then operates at the speed of the aggregated link.

The **autonegotiate** parameter specifies that the port is to activate the autonegotiation process. The port begins to autonegotiate link speed and duplex mode.

The **lock** parameter manually locks the switch port before it reaches its learning limit so that no new addresses are automatically learned. The **learn** parameter for the port is set to the current number of learned MAC addresses.

Examples

To activate autonegotiation on ports 1-8 and port 10, use the command:

```
act swi po=1-8,10 auto
```

Related Commands

show switch port

add lacp port

Syntax

```
ADD LACP POrt=[{port-list|ALL}] [ADMinkey=key]
   [PRIOrity=priority] [MODe={ACTIve|PASsive}]
   [PERiodic={FASt|SLOw}]
```

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 port, including uplink ports.
- *key* is an integer from 0 to 65535
- *priority* is an integer from 0 to 65535

Description

This command adds a port to LACP's control thus enabling LACP to put it into an aggregated link. By default, ports are added in the active mode. If a port is added in the active mode, and its link's requirements for trunking are met, then the port and it associated link are automatically aggregated without further configuration. The same situation applies for a port configured in passive mode but whose link connects to a remote port configured in active mode.

The **port** parameter specifies the ports whose parameters are to be modified. Where none of the ports specified are presently managed by LACP, the command takes effect if it can be applied to all the specified ports. Where some of the ports specified are already managed by LACP, and additional ports are added (by specifying ALL, for example), then the LACP managed ports have their Key and other parameters changed, and the command succeeds on all the specified ports.

In the following descriptions, references to an individual port refers to all ports selected by the **port** parameter.

The **adminkey** parameter specifies the Admin LACP port key. This affects the LACP port key that is generated but does not determine its value. You can use this parameter to prevent ports from being aggregated when they might otherwise form a trunk. By default all ports that can be aggregated are given the same LACP port key. The default for **adminkey** is 1.

The **priority** parameter specifies the *LACP port priority*. The priority assigned is used where the number of physical links connecting two devices is greater than the number that can be aggregated. The priority entered is then used to determine which ports are selected for aggregation. The default of 32,768 (0 being the highest priority) is applied to all ports.

Where the port priority is the same, the port number governs which ports are selected. The lower the port number, the higher its priority. Excess ports are put into a standby mode, in which they are effectively disabled. They will remain in this state unless required to replace inoperative links within their associated aggregated group.

The **mode** parameter specifies whether the port runs in LACP *passive* or *active* mode. A port in passive mode begins sending LACPDUs in response to a received LACPDU; whereas, a port in active mode always sends LACPDUs at regular intervals specified by the **periodic** parameter.

The **periodic** parameter specifies the requested rate that the LACP port receives LACPDU *update messages* from its partner port. A port in fast mode

receives one LACPDU every second; in slow mode, a port receives one every thirty seconds.

Examples To add ports 3 and 5 to LACP, use the command:

```
add lacp po=3,5
```

Related Commands

delete lacp port
disable lacp
enable lacp
set lacp port
show lacp port

add mstp msti vlan

Syntax `ADD MSTP MSTI=`*`instance`* `VLAN={`*`vlan-name`*`|`*`vlan-list`*`|ALL}`

where:

- *instance* is an instance number from 1 to 4094 for a specific MSTI.
- *vlan-name* is a unique name for the VLAN, 1 to 15 characters in length. Valid characters are uppercase letters (A-Z), lowercase letters (a-z), digits (0-9) the underscore character ("_"), and the hyphen character (-). The vlanname cannot be a number or ALL.
- *vlan-list* is a VLAN number, a range of VLAN numbers (specified as n-m), or a comma separated list of VLAN numbers and (or) ranges. VLAN numbers start at 1 and end at 4094.

Description This command maps one or more VLANs to a specified multiple spanning tree instance (MSTI). The MST algorithm provides multiple spanning tree topologies within one MST region, so different VLANs can be forwarded in different paths.

All of the VLANs are mapped to the common internal spanning tree (CIST) by default. Once a VLAN is mapped to a specified MSTI it will be removed from the CIST.

A VLAN can be mapped to only one MSTI or the CIST. One VLAN cannot be mapped to multiple spanning trees. A VLAN must be removed from one MSTI before it can be mapped to another. VLANs follow the CIST when operating between regions.

The **msti** parameter specifies the instance number of the spanning tree. The MSTI must already exist before any VLANs can be mapped to it. The command **create mstp msti** is used to create an MSTI.

The **vlan** parameter specifies a VLAN (or VLANs) to be mapped to the specified MSTI. If **all** is specified, then all VLANs will be mapped to the MSTI. If a VLAN is already mapped to an MSTI other than the one specified in the command, then the command will fail.

Examples To map a VLAN with VID of 1 to MSTI5, use the command:

```
add mst msti=5 vlan=1
```

Related Commands

delete mstp msti vlan
create stp
show mstp
show mstp msti

add stp vlan

Syntax `ADD STP=`*`stp-name`* `VLAN={`*`vlan-name`*`|2..4094}`

where:

- *stp-name* is a character string 1 to 15 characters long.Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *stp-name* cannot be ALL.
- *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* cannot be a number or ALL.

Description This command adds a VLAN to the specified STP. If as a result of the VLAN addition, ports are moved from one STP to another STP, the two affected STPs are initialised if they are currently enabled. Any previously disabled ports in the STPs are enabled.

The default VLAN cannot be added to an STP. The default VLAN always belongs to the default STP. A VLAN cannot be explicitly added to the default STP. A VLAN is implicitly added to the default STP when it is deleted from any other STP. Only a VLAN belonging to the default STP can be added to another STP. If the VLAN already belongs to another STP, it must first be deleted from its current STP (and so be returned to the default STP), and then added to the new STP.

Within any given STP, all VLANs belonging to it use the same Spanning Tree.

A port can belong to only one STP, except on the Rapier *i* Series switches. If a port is a member of multiple VLANs, then all these VLANs must belong to the same STP.

On the Rapier *i* Series switches only, a port can belong to more than one STP if the port is a member of two or more VLANs that belong to different STPs.

The **vlan** parameter specifies the name or the numerical VLAN Identifier of the VLAN to be added to the STP. The name is not case sensitive, although the case is preserved for display purposes. The VLAN specified must exist.

When a VLAN is added to an STP, the ports in the VLAN have default STP parameter values. The ports do not retain non-default STP configurations made when the VLAN was associated with any other STP.

Examples To add the *research* VLAN to the *company* STP, use the command:

```
add stp=company vlan=research
```

Related Commands **delete stp vlan**
show stp

add switch filter

Syntax

```
ADD SWItch FILter ACtion={FORward|DIScard}
   DESTaddress=macadd PORT=port [ENTry=entry] [LEARn]
   [VLAN={vlan-name|1..4094}]
```

where:

- *entry* is a filter entry number, from 0 to n+1 where n is the highest filter entry currently defined in the permanent forwarding database. The permanent forwarding database has a maximum of 320 entries, ranging from 0 to 319. Each port has its own permanent forwarding database.
- *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* cannot be a number or **all**.
- *port* is the number of the switch port or uplink port to which this filter applies.
- *macadd* is an Ethernet six-octet MAC address, expressed as six pairs of hexadecimal digits delimited by hyphens.

Description

This command adds a single static filter entry to the permanent forwarding database for a specified port. If the static entry matches an existing dynamic entry that was learnt by the switch (a match means that the **destaddress** and **vlan** parameters are the same for both entries), the static filter overwrites the existing dynamic learnt entry. All the received frames that match the static filter entry are forwarded to the specified port with an action of **forward** or **discard**.

The **action** parameter specifies the outcome of the forwarding process for the frame. When **forward** is specified, the frame is transmitted on the given port or ports. When **discard** is specified, the frame is discarded.

The **destaddress** parameter specifies the value to be matched against the destination MAC address from frames being filtered. The destination MAC address must be an individual MAC address.

The **port** parameter specifies the outbound port over which a frame matching this filter entry is discarded or forwarded. Whether the ports are tagged ports or untagged ports is determined by the **vlan** parameter. When the **port** parameter specifies tagged ports, then the **vlan** parameter is required.

The **entry** parameter specifies where in the permanent forwarding database the new entry is added for the specified port. **entry** cannot be set greater than n+1 where n is the highest filter entry currently defined. When **entry** is not specified, the new entry is appended to the bottom of the permanent forwarding database: the default is n+1 where n is the highest filter entry currently defined. Static and dynamic entries in the forwarding database are kept in sorted order determined by their VLAN Identifier and MAC address. Therefore the **entry** parameter does not affect the order of the filters in the forwarding database. The order in which filter entries are displayed by the **show switch filter** command is dependent upon the **entry** parameter.

The **learn** parameter specifies if the filter being added should be counted and used as a learned MAC address for intrusion detection. Learned filters are not totally static, and can be lost if the learning process is stopped by setting the **learn** parameter to zero (see the **set switch port** command).

The **vlan** parameter specifies the VLAN Identifier to which the filter entry is associated. The **vlan** parameter is required when the **port** parameter specifies tagged ports. When the **port** parameter specifies untagged ports, the **vlan** parameter is not required, and defaults to the VLAN Identifier of the VLAN for which the ports are untagged. Therefore, when the **vlan** parameter is not specified, the ports are treated as untagged ports.

The switch automatically deletes static filter entries for a port if the port is deleted from the specified VLAN.

Examples To forward all frames destined for MAC address 00-00-cd-12-34-56 on the VLAN to which port 3 is an untagged port, use the command:

```
add swi fil dest=00-00-cd-12-34-56 ac=for po=3
```

To discard all frames destined for MAC address 00-00-cd-12-34-56 on port 4 in VLAN 4, use the command:

```
add swi fil dest=00-00-cd-12-34-56 po=4 ac=dis vlan=4
```

Related Commands **delete switch filter**
show switch filter

add switch hwfilter classifier

Syntax

```
ADD SWItch HWFilter CLASSifier=classifier-list
   [ACtion={SETPRIORITY|SENDCOS|SETTOS|DENY|SENDEPORT|
   SENDMIRROR|MOVEPRIOTOTOS|MOVETOSTOPRIO|SETIPDSCP|
   SENDNONUNICASTTOPORT|NODROP|FORWARD}[,...]]
   [NEWIPDscp=0..63] [NEWTos=0..7]
   [NOMATCHAction={SETPRIORITY|SENDCOS|SETTOS|DENY|
   SENDEPORT|SENDMIRROR|MOVEPRIOTOTOS|MOVETOSTOPRIO|
   SETIPDSCP|SENDNONUNICASTTOPORT|FORWARD}[,...]]
   [NOMATCHDscp=0..63] [NOMATCHPOrt=port-number]
   [NOMATCHPRiority=0..7] [NOMATCHTos=0..7]
   [POrt=port-number] [PRIOrity=0..7]
```

where:

- *classifier-list* is an integer from 1 to 9999, a range of integers (specified as 1-4), or a comma-separated list of classifier numbers and/or ranges (1, 3, 4-9).
- *port-number* is the switch port number from 1 to *m* where *m* is the highest numbered Ethernet switch port, including uplink ports.

Description

This command adds hardware based filters based on the specified classifier(s). The classifiers in the list must exist, and they must not already be specified as part of an existing filter entry, neither may they be a duplicate of another classifier that is already used by a filter entry. The **switch hwfilter classifier** commands may not be used with the **switch l3filter** commands.

The **action** parameter specifies a comma-separated list of actions to take when a packet matches the filter criteria specified in this entry. If **setpriority** is specified, the packet's 802.1p priority is set to the value specified by the **priority** parameter. If **sendcos** is specified, the packet is sent to the priority queue specified by the **priority** parameter. If **settos** is specified, the packet's TOS (Type of Service) field is set to the value specified by the newtos parameter. When **deny** is specified, the packet is discarded. If **sendeport** is specified and the frame is not a broadcast, multicast, DLF frame or marked for dropping or to be sent to the CPU, the new output port is set to the value of the **port** parameter. If **sendmirror** is specified, the packet is sent to the mirror port. If **forward** is specified, the packet is forwarded using the default Class of Service (priority). The default is **forward**. On the Rapier *i* Series switches only, the following additional parameter options are available. If **movepriototos** is specified, the IP TOS field in the frame is replaced with the 802.1 priority value. If **movetostoprio** is specified, the 802.1 priority field in the frame is replaced with the IP TOS value, this also determines the egress priority queue. If **setipdscp** is specified and the frame is an IPv4 frame, the Diffserv Codepoint field in the frame is set to the value specified by the **newipdscp** parameter. Actions that modify both the IP TOS and IP DSCP values in the frame are mutually exclusive. If **sendnonunicasttoport** is specified, matching frames that are broadcast or DLF, multicast, marked for dropping or to be sent to the CPU are sent to the egress port specified by the **port** parameter. If **nodrop** is specified, matching frames previously marked for dropping are not dropped.

If the **sendeport** action directs packets to a particular egress port, then the packet is transmitted from the mirror port with a VLAN tag.

On the Rapier *i* Series switches only, the **newipdscp** parameter indicates the value to set in an IPv4 packet Diffserv CodePoint field when the **action**

parameter is set to **setipdscp**. The range of values for this parameter is from 0 to 63.

The **newtos** parameter specifies the new type of service value, assigning a new value to the TOS precedence field in the IP Header. When this parameter is used, only when the **action** parameter is set to **settos**.

On the Rapier *i* Series switches only, the **nomatchaction** parameter specifies a comma-separated list of actions to take when a frame matches both the **iport** and **eport** values (if they are specified in the match) on an associated entry but there is no match for the frame contents. When **setpriority** is specified, the packet's 802.1p priority is set to the value specified by the **priority** parameter. When **sendcos** is specified, the packet is sent to the priority queue specified by the **priority** parameter. When **settos** is specified, the packet's TOS (Type of Service) field is set to the value specified by the **newtos** parameter. If **deny** is specified, the packet is discarded. When **sendeport** is specified and the frame is not a broadcast, multicast, DLF frame or marked for dropping or to be sent to the CPU, the new output port is set to the value of the **port** parameter. When **sendmirror** is specified, the packet is sent to the mirror port. When **forward** is specified, the packet is forwarded using the default Class of Service (priority). When **movepriototos** is specified, the IP TOS field in the frame is replaced with the 802.1 priority value. When **movetostoprio** is specified, the 802.1 priority field in the frame is replaced with the IP TOS value, this also determines the egress priority queue. When **setipdscp** is specified and the frame is an IPv4 frame, the Diffserv Codepoint field in the frame is set to the value specified by the **newipdscp** parameter. Actions that modify both the IP TOS and IP DSCP values in the frame are mutually exclusive. When **sendnonunicasttoport** is specified, matching frames that are broadcast or DLF, multicast, marked for dropping or to be sent to the CPU are sent to the egress port specified by the **port** parameter. The default is **forward**.

The **nomatchdscp** parameter indicates the value to set in an IPv4 packet Diffserv CodePoint field when the **nomatchaction** parameter is set to **setipdscp**. The range of values for this parameter is from 0 to 63. This parameter is only available on Rapier *i* Series switches.

The **nomatchport** parameter specifies the new output port number. This port overrides the egress port selected by the forwarding database. This parameter is only available on Rapier *i* Series switches.

The **nomatchpriority** parameter specifies the packet priority. There are eight levels of priority, from 0 to 7. This parameter is used when the **nomatchaction** parameter is set to **setpriority** or **sendc2os**. This parameter is only available on Rapier *i* Series switches.

The **nomatchtos** parameter specifies the new type of service value, assigning a new value to the TOS precedence field in the IP Header. This parameter is used when the **nomatchaction** parameter is set to **settos**. This parameter is only available on Rapier *i* Series switches.

The **port** parameter specifies the new output port number. This port overrides the egress port selected by the forwarding database.

The **priority** parameter specifies the packet priority. There are eight levels of priority, from 0 to 7. This parameter is used when the **action** parameter is set to **setpriority** or **sendcos**.

Examples To add hardware filtering entries to the switch based on classifier entries 1 to 5 that drop all matching packets, use the command:

```
add swi hwf class=1-5 ac=deny
```

Related Commands

delete switch hwfilter classifier
set switch hwfilter classifier
show switch hwfilter

add switch l3filter entry

Syntax

```
ADD SWItch L3Filter=filter-id ENTry [ACTION={DENY|FORWARD|
   SENDCOS|SENDEPORT|SENDMIRROR|SETPRIORITY|SETTOS|
   MOVEPRIOTOTOS|MOVETOSTOPRIO|NODROP|
   SENDNONUNICASTTOPORT|SETIPDSCP}[,...]]
   [DIPaddress=ipadd] [EPORT=port-number] [IPDSCP=number]
   [IPOrt=port-number] [NEWIPDSCP=0..63] [NEWTOS=0..7]
   [PORT=port-number] [PRIORITY=0..7] [PROTOCOL={TCP|UDP|
   ICMP|IGMP|protocol}] [SIPADDR=ipadd] [TCPAck={True|
   False}] [TCPDport=port-id] [TCPFin={True|False}]
   [TCPSport=port-id] [TCPSYn={True|False}] [TOS=0..7]
   [TTL=0..255] [TYPE=protocol-type] [UDPSPORT=port-id]
   [UDPDPORT=port-id]
```

where:

- *filter-id* is a decimal number in the range 1 to the number of filters defined.
- *ipadd* is an IP address in dotted decimal notation.
- *port-number* is the switch port number from 1 to *m* where *m* is the highest numbered Ethernet switch port, including uplink ports.
- *protocol* is an IP protocol number from 1 to 255.
- *port-id* is a TCP/UDP port number with a maximum value less than 65535.
- *protocol-type* is a valid protocol-type number. A protocol type number is 2 bytes for Ethernet type II and 802.3 (DSAP/SSAP) encapsulation, or 5 bytes for SNAP encapsulation, and is specified in hexadecimal.

Description

This command adds a filter entry to an existing filter match criteria. All criteria specified in the filter match should also be set in the filter entry, and criteria not specified in the filter match are not valid in the filter entry. Up to 127 filter entries may be created for the switch. For the Rapier *i* Series switches only, up to 126 filter entries may be created.

The **switch hwfilter classifier** commands may not be used with the **switch l3filter** commands.

The **l3filter** parameter specifies the number of the filter match (*filter-id*) for which the entry is being created. Each filter entry is automatically assigned an *entry-id* number. Filter and filter entry numbers are in the output of the **show switch l3filter** command on page 8-220.

The **action** parameter specifies a comma-separated list of actions to take when a packet matches the filter criteria specified in this entry. If **deny** is specified, the packet is discarded. If **forward** is specified, the packet is forwarded using the default Class of Service (priority). If **sendcos** is specified, the packet is sent to the priority queue specified by the **priority** parameter. If **sendeport** is specified, the new output port is set to the value of the **port** parameter. If **sendmirror** is specified, the packet is sent to the mirror port. If **setpriority** is specified, the packet's 802.1p priority is set to the value specified by the **priority** parameter. If **settos** is specified, the packet's **tos** (Type of Service) field is set to the value specified by the **newtos** parameter. The default is **forward**. On the Rapier *i* Series switches only, the following additional parameter options are available. If **movepriototos** is specified, the **ip tos** field in the frame is replaced with the 802.1 priority value. If **movetostoprio** is specified, the 802.1 priority field in the frame is replaced with the **ip tos** value, this also determines

the egress priority queue. If **nodrop** is specified, matching frames previously marked for dropping are not dropped. If **sendeport** is specified and the frame is not a broadcast, multicast, DLF frame or marked for dropping or to be sent to the CPU, the new output port is set to the value of the **port** parameter. If **sendnonunicasttoport** is specified, matching frames that are broadcast or DLF, multicast, marked for dropping or to be sent to the CPU are sent to the egress port specified by the **port** parameter. If **setipdscp** is specified and the frame is an IPv4 frame, the Diffserv Codepoint field in the frame is set to the value specified by the **newipdscp** parameter. Actions that modify both the TOS and DSCP values in the frame are mutually exclusive. The default is **forward**.

If the setpriority action changes the priority of a tagged packet that has been layer 3 switched, then the vid of the transmitted packet is corrupted. The corruption occurs when the packet is both received and transmitted with a VLAN tag. Do not use the setpriority action for layer 3 switched VLAN-tagged packets.
On Rapier i Series switches, the above warning does not apply. On Rapier i Series switches only, the setpriority action correctly transmits the VIDs of layer 3 switched packets.

If the **sendeport** action directs packets to a particular egress port, then the packet is transmitted from the mirror port with a VLAN tag.

The **dipaddr** parameter specifies the destination IP addresses to match.

The **eport** parameter specifies the egress port number to be matched by this filter entry, if the **emport** parameter in the filter match is set to **true**. The default is no port, that is, the filter entry does not apply to any egress ports. If the **emport** parameter in the filter match is set to **false**, the **eport** parameter is ignored, and the filter entry applies to all egress ports.

On the Rapier *i* Series switches only, the **ipdscp** parameter indicates the value to match to the IPv4 packet Diffserv Codepoint field for this entry. The range of values for this parameter is from 0 to 63.

The **iport** parameter specifies the ingress port number to be matched by this filter entry, if the **import** parameter in the filter match is set to **true**. The default is no port, that is, the filter entry does not apply to any ingress ports. If the **import** parameter in the filter match is set to **false**, the **iport** parameter is ignored, and the filter entry applies to all ingress ports.

On the Rapier *i* Series switches only, the **newipdscp** parameter indicates the value to set in an IPv4 packet Diffserv Codepoint field when the **action** parameter is set to **setipdscp**. The range of values for this parameter is from 0 to 63.

The **newtos** parameter specifies the new type of service value, assigning a new value to the TOS precedence field in the IP Header. This parameter is used when the **action** parameter is set to **settos**.

The **port** parameter specifies the new output port number. This port overrides the egress port selected by the forwarding database.

The **priority** parameter specifies the packet priority. There are eight levels of priority, from 0 to 7. This parameter is used when the **action** parameter is set to **setpriority** or **sendcos**.

The **protocol** parameter specifies the IP protocol to match.

The **protocol** parameter specifies the IP protocol to match if the **switch l3filter match** value is set to **protocol**.

The **sipaddr** parameter specifies the source IP address to match.

The **tcpack** parameter specifies the ACK (acknowledgement) flag in the TCP header to match, if the protocol is TCP. This parameter is required if **tcpack** is specified in the **add** or **set switch l3filter match** parameter, otherwise it is invalid.

The **tcpdport** parameter specifies the destination TCP port to match, if the protocol is TCP.

The **tcpfin** parameter specifies the FIN flag in the TCP header to match, if the protocol is TCP. This parameter is required if **tcpfin** is specified in the ADD or **set switch l3filter match** parameter, otherwise it is invalid.

The **tcpsport** parameter specifies the source TCP port to match, if the protocol is TCP.

The **tcpsyn** parameter specifies the SYN flag in the TCP header to match, if the protocol is TCP. This parameter is required if **tcpsyn** is specified in the **add** or **set switch l3filter match** parameter, otherwise it is invalid.

The **tos** parameter specifies the type of service to match.

The **ttl** parameter specifies the *Time to Live* to match.

The **type** parameter specifies a protocol-type number to match. The number is entered in hexadecimal, e.g. 0800 for an Ethernet type II IP packet. This parameter may not be used with any other packet field matching criteria, nor may it be used with the **settos** action. With all other packet matching criteria there is an implicit match to an IP protocol Ethernet type II packet.

The **udpdport** parameter specifies the UDP destination port to match, if the protocol is UDP.

The **udpsport** parameter specifies the UDP source port to match, if the protocol is UDP.

Example To add a filter to block Telnet sessions, use the commands:

```
add switch l3filter match=tcpdport,prot
add switch l3filter=1 entry action=deny prot=tcp tcpdport=23
```

Related Commands

delete switch l3filter entry
set switch l3filter entry
show switch l3filter

add switch l3filter match

Syntax

```
ADD SWItch L3Filter MAtch={DIPaddr|IPDScp|PROTocol|
   SIPaddr|TCPAck|TCPFin|TCPDport|TCPSport|TCPSYn|TOS|TTL|
   UDPDport|UDPSport}[,...] [DClass={A|B|C|Host}]
   [EMPort={YES|NO|ON|OFf|True|False}] [IMPort={YES|NO|ON|
   OFf|True|False}] [NOMATCHAction={SETPRIORITY|SENDCOS|
   SETTOS|DENY|SENDEPORT|SENDMIRROR|MOVEPRIOTOTOS|
   MOVETOSTOPRIO|SETIPDSCP|SENDNONUNICASTTOPORT|
   FORWARD}[,...]] [NOMATCHDscp=1..63]
   [NOMATCHPOrt=port-number] [NOMATCHPRiority=0..7]
   [NOMATCHTos=0..7] [SClass={A|B|C|Host}] [TYpe={802|
   Ethii|Snap}]
```

where:

- *port-number* is the switch port number from 1 to m where m is the highest numbered Ethernet switch port, including uplink ports.

Description

This command adds a filter that specifies the matching filter criteria used for the hardware-based packet filtering mechanism.

Up to 8 filters may be created. On the Rapier *i* Series switches only, up to 16 filters may be created.

Each filter is automatically assigned a *filter-id* number, which is in the output of the **show switch l3filter** command on page 8-220. Once the filter has been created, entries must be added using the **add switch l3filter entry** command on page 8-80.

Enabling the Internet Group Management Protocol (IGMP) with the ENABLE IP IGMP command also enables Layer 3 filtering. IGMP uses two Layer 3 filters, so the number of available filters is reduced by two. IGMP cannot be enabled unless two filters are still available.

The **switch hwfilter classifier** commands may not be used with the **switch l3filter** commands.

The **match** parameter specifies a comma-separated list of packet fields and/or types to match. There is no default.

The **dclass** parameter specifies the IP destination address mask to apply to the destination IP address field in packets when matching destination IP addresses. If A is specified, a Class A mask of 255.0.0.0 is used. If B is specified, a Class B mask of 255.255.0.0 is used. If C is specified, a Class C mask of 255.255.255.0 is used. If **host** is specified, a host mask of 255.255.255.255 is used. The default is for no mask to be used (a value of 0). The **dclass** parameter is required if **dipaddr** is specified by the **match** parameter.

The **emport** parameter specifies whether the filter applies to all egress ports or to a specific one. If **no**, **off**, or FALSE **is** specified, the filter is applied to all egress ports. If **yes**, **on**, or **true** is specified, the filter is applied to the egress port specified by the **eport** parameter in the **add** or **set switch l3filter entry** command. The default is **false**, meaning the filter is applied to all egress ports.

The **import** parameter specifies whether the filter applies to all ingress ports or to a specific one. If **no**, **off**, or **false** is specified, the filter is applied to all ingress ports. If **yes**, **on**, or **true** is specified, the filter is applied to the ingress port

specified by the **iport** parameter in the **add** or **set switch l3filter entry** command. The default is **false**, meaning the filter is applied to all ingress ports.

On the Rapier *i* Series switches only, the **nomatchaction** parameter specifies a comma-separated list of actions to take when a frame matches both the **iport** and **eport** values (if they are specified in the match) on an associated entry but there is no match for the frame contents. If **setpriority** is specified, the packet's 802.1p priority is set to the value specified by the **priority** parameter. If **sendcos** is specified, the packet is sent to the priority queue specified by the **priority** parameter. If **settos** is specified, the packet's TOS (Type of Service) field is set to the value specified by the **newtos** parameter. If **deny** is specified, the packet is discarded. If **sendeport** is specified and the frame is not a broadcast, multicast, DLF frame or marked for dropping or to be sent to the CPU, the new output port is set to the value of the **port** parameter. If **sendmirror** is specified, the packet is sent to the mirror port. If **forward** is specified, the packet is forwarded using the default Class of Service (priority). If **movepriototos** is specified, the IP TOS field in the frame is replaced with the 802.1p priority value. This also determines the egress priority queue. if **setipdscp** is specified and the frame is an IPv4 frame, the Diffserv Codepoint field in the frame is set to the value specified by the **newipdscp** parameter. Actions that modify both the IP TOS and the IP DSCP values in the frame are mutually exclusive. If **sendnonunicasttoport** is specified, matching frames that are broadcast or DLF, multicast, marked for dropping or to be sent to the CPU are sent to the egress port specified by the **port** parameter. The default is **forward**.

The **nomatchdscp** parameter indicates the value to set in an IPv4 packet DiffServe CodePoint field if the **nomatchaction** parameter is set to **setipdscp**. The range of values for this parameter is from 0 to 63. This parameter is only available on Rapier *i* Series switches.

The **nomatchport** parameter specifies the new output port number. This port overrides the egress port selected by the forwarding database. This parameter is only available on Rapier *i* Series switches.

The **nomatchpriority** parameter specifies the packet priority. There are eight levels of priority, from 0 to 7. This parameter is used either if the **nomatchaction** parameter is set to **setpriority** or **sendcos**. This parameter is only available on Rapier *i* Series switches.

The **nomatchtos** parameter specifies the new Type of Service value, assigning a new value to the TOS precedence field in the IP header. This parameter is used when the **nomatchaction** parameter is set to **settos**. This parameter is only available on Rapier *i* Series switches.

The **sclass** parameter specifies the IP source address mask to apply to the source IP address field in packets when matching source IP addresses. If A is specified, a Class A mask of 255.0.0.0 is used. If B is specified, a Class B mask of 255.255.0.0 is used. If C is specified, a Class C mask of 255.255.255.0 is used. If **host** is specified, a host mask of 255.255.255.255 is used. The default is to use no mask (a value of 0). The **sclass** parameter is required if **sipaddr** is specified by the **match** parameter.

The **type** parameter specifies the format of the protocol-type. This parameter may be used with the **emport** and **import** parameters, but not with the other packet matching criteria. When other criteria are used, there is an implicit match to an IP protocol Ethernet type II packet. If 802 is specified, then the match is on the 2-byte DSAP/SSAP field of an 802.3 packet. If **ethii** is specified, then the match is on the 2-byte type field of an Ethernet type II packet. If **snap**

is specified, then the match is on the 5-byte variable part of the identifier field of a SNAP packet (SNAP identifiers have the format *aa-aa-03-xx-xx-xx-xx-xx*).

Example To add a filter to block Telnet sessions, use the commands:

```
add swi l3f ma=tcpdport,prot

add swi l3f=1 ent ac=deny prot=tcp tcpd=23
```

Related Commands

add switch l3filter entry
delete switch l3filter
set switch l3filter match
show switch l3filter

add switch trunk

Syntax `ADD SWItch TRunk=`*`trunk`* `POrt=`*`port-list`*

where:

- *trunk* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.
- *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 adds ports to an existing trunk group on the switch. When a port is added to a trunk group, its current speed and duplex mode settings are ignored and the port is set to autonegotiate to the speed of the trunk group and full duplex mode. Port trunking must be configured on both ends of the link, or network loops may result.

The **trunk** parameter specifies the name of the trunk group. The name is not case sensitive. The name uniquely identifies the trunk group. The specified trunk group must already exist.

The **port** parameter specifies the switch ports to be added to the trunk group. Ports specified must not be in another trunk group, and must have the same VLAN configuration. They cannot include the switch's mirroring port. A trunk group can consist of a maximum of 8 fixed or uplink ports but not a mixture of both types.

A port that has ingress filtering enabled can be added to a trunk group only on Rapier i and Rapier G Series switches.

Example To add ports 5 and 6 to trunk group Trunk1, use the command:

```
add swi tr=trunk1 po=5,6
```

Related Commands

create switch trunk
delete switch trunk
destroy switch trunk
set switch trunk
show switch trunk

add vlan bridge

Syntax `ADD VLAN={`*`vlan-name`*`|1..4094} BRIDge`

where *vlan-name* is a unique name for the VLAN 1 to 32 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* cannot be a number or ALL.

Description This command enables bridging between switch ports that are members of the specified VLAN, and a single virtual port configured on the bridge. Bridging takes place when the VLAN is attached to the bridge, and has been configured with a single virtual port. The VLAN can attach to only a single bridge.

Examples To attach the training VLAN to the bridge use the command:

```
add vlan=training bridg
```

Related Commands
add bridge port in Chapter 16, Bridging
delete vlan bridge
enable bridge in Chapter 16, Bridging
show bridge in Chapter 16, Bridging
show vlan

add vlan port

Syntax

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

For private VLANs (only available on Rapier i Series switches):

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

where:

- *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* 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 adds ports to the specified VLAN.

A port cannot be a member of both a private VLAN and a non-private VLAN. See "Private VLANs" on page 8-22 for more information about configuring private VLANs.

The ports must belong to only one STP after being added to the VLAN, except on the Rapier *i* Series switches. This means that if the port is a member of multiple VLANs then all those VLANs must belong to the same STP.

On the Rapier *i* Series switches only, a port can belong to multiple STPs if the port is a member of more than one VLAN. If the port being added to the VLAN also belongs to another STP through concurrent membership of another VLAN, it is not removed from that VLAN or STP.

If as a result of the port addition, ports are moved from one STP to another STP, the two affected STPs are initialised if they are currently enabled. Any previously disabled ports in the STPs are enabled.

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. All the ports in a trunk group must have the same VLAN configuration. If the command requires that ports be implicitly deleted from the default VLAN and these ports belong to a trunk group, then the command fails. The ports must belong to only one STP after being added to the VLAN. When the command succeeds on a subset of the specified ports but causes errors on the others, then the command as a whole fails and has no effect. The mirror port cannot be added to a VLAN.

If the VLAN is a private VLAN and you do not specify the **uplink** or **group** parameter, then the ports are added as individual private ports. Private ports cannot be added to a private VLAN until the VLAN has an uplink port or uplink trunk group added to it. The port must not be in a non-private VLAN. See "Private VLANs" on page 8-22 for information about configuring private VLANs.

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. A port can be untagged for one and only one of the VLANs to which it belongs, or for none of the VLANs to which it belongs. A port can have the **frame** parameter set to **tagged** for zero or more VLANs to which it belongs. It is not possible to add an untagged port to a VLAN when the port is already present in another port-based VLAN, except the default VLAN. When the port is an untagged member of the default VLAN, adding it untagged to another VLAN deletes it from the default VLAN. The default setting is **untagged**.

The **group** parameter specifies that the listed ports may communicate with each other, but not with any other private ports in the VLAN, and is valid only for private VLANs. You can add a group of ports to multiple private VLANs, as long as the group contains identical ports in each VLAN. See "Private VLANs" on page 8-22 for information about configuring private VLANs. Private VLANs are only available on Rapier i Series switches.

The **uplink** parameter specifies that the ports are to be added to the VLAN as uplink ports, and is valid only for private VLANs. If more than one port is specified, then they must be a trunked group. Each private VLAN can have only one uplink. The port must not be a member of a non-private VLAN except the default VLAN. The ports can be in another private VLAN when they are the uplink for this VLAN. See "Private VLANs" on page 8-22 for information about configuring private VLANs. Private VLANs are only available on Rapier i Series switches.

Examples

To add port 4 to the port-based *marketing* VLAN, use the command:

```
add vlan=marketing po=4
```

To add port 25 to the *training* VLAN as a tagged port, use the command:

```
add vlan=training po=25 fra=tag
```

To create vlan2 with two groups of private ports (3-5 and 6-9) connected to an uplink trunk group (ports 21-24), without any Layer 3 configuration (only on Rapier i Series switches):

1. Create vlan2, making it private.

   ```
   cre vlan=vlan2 vid=2 priv
   ```

2. Add the uplink trunk group to the VLAN. The ports must already be trunked together.

   ```
   add vlan=vlan2 po=21-24 uplin
   ```

3. Define the groups and add their ports to vlan2.

   ```
   add vlan=vlan2 po=3-5 group
   add vlan=vlan2 po=6-9 group
   ```

Related Commands

delete vlan port
show vlan

add vlanrelay

Syntax

```
ADD VLANRelay=name [PROTocol=protocoltype] [VLAN={vlan-
    name|1..4094}]
```

where:

- *name* is a unique name for the VLAN relay entity 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.
- *protocoltype* is either a valid protocol number in hexadecimal notation, or a recognised protocol name. A protocol number is 1 byte for SAP, 2 bytes for ETHII, or 5 bytes for an 802.2 SNAP type packet.
- *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* cannot be a number or ALL.

Description

This command adds a protocol number and/or a VLAN to a VLAN relay entity. At least one protocol and two VLANs must be added to a VLAN relay entity before the entity can begin relaying packets.

The **vlanrelay** parameter specifies the unique identifier for the VLAN relay entity. A VLAN relay entity with this name must already exist.

The **protocol** parameter specifies an Ethernet protocol number for packets that are to be relayed. A predefined list of common protocols is provided in Table 8-5 on page 8-25. To relay one of these protocols, specify the protocol name as the value for the **protocol** parameter. There is also the option of relaying all protocols of a given encapsulation type by use of the keywords "**all802**", "**allethii**" and "**allsnap**".

Use of the "ALL802", "ALLETHII" and "ALLSNAP" protocols can cause traffic to be unexpectedly relayed where it is not desired. It is more desirable to explicitly enter the identification numbers of the protocols to be relayed.

The **vlan** parameter specifies the name or VLAN identifier of a VLAN to add to the VLAN relay entity. Adding a VLAN allows packets from that VLAN to be received and relayed, and packets from other VLANs to be relayed to that VLAN. The VLAN must already exist, and must be a static VLAN.

Example

To add the VLAN whose ID is 2, and all SAP protocols, to VLAN relay entity SNARelay, use the command:

```
add vlanr=snarelay vlan=2 prot=all802
```

Related Commands

create vlanrelay
delete vlanrelay
destroy vlanrelay
show vlanrelay

create mstp msti

Syntax `CREate MSTp MSTI=`*`instance`* `[PRIOrity=0..65535]`

where *instance* is the instance number assigned to the new MSTI. It has the range 1-4094.

Description This command creates a new multiple spanning tree instance (MSTI) on the switch. The multiple spanning tree algorithm enables a collection of VLANs to be associated with a particular spanning tree instance. Within this instance, frames belonging to this VLAN group are forwarded over the active topology established by that particular instance's spanning tree. Frames for VLAN groups belonging to other instances each have their own active topologies.

Once an MSTI has been successfully created, VLANs can be added to it by using the command **add mstp msti vlan**.

Within each MST region, the MSTP maintains multiple spanning tree instances (MSTIs). A unique instance number identifies each single MSTI.

The MSTI parameter specifies the instance number of the multiple spanning tree instance (MSTI) being created. Although numbers can be assigned within the range 1 to 4094, the maximum number of MSTIs within each region, or switch, is 64. Instance number 0 is reserved for the common internal spanning tree (CIST) instance.

The MSTI number is very useful because it identifies a particular instance within an MST region.

The **priority** parameter sets the value of the priority field contained in the bridge identifier. The bridge identifier comprises two parts: a bridge priority part (more significant), and a bridge address part (less significant). The multiple spanning tree algorithm uses the bridge identifier when determining the role of a switch within each spanning tree. The switch with a lower priority is considered to have better bridge identifier, and is therefore more likely to be chosen as the root bridge. The CIST and each MSTI have their own individual **priority** parameter, so the roles of the same switch could be different in the CIST and each MSTI by tuning the bridge priority. The priority value operates in multiples of 4096. If you specify a value that is not a multiple of 4096, this will be rounded down to the nearest multiple of 4096, see Table 8-19 on page 8-92.The default switch priority is 32768.

Table 8-19: Rounding scheme for ranges of bridge priority parameter values

Lower Boundary	Upper Boundary	Rounded Bridge Value
0	4095	0
4096	8191	4096
8192	12287	8192
12288	16383	12288
16384	20479	16384
20480	24575	20480
24576	28671	24576
28672	32767	28672
32768	36863	32768
36864	40959	36864
40960	45055	40960
45056	49151	45056
49152	53247	49152
53248	57343	53248
57344	61439	57344
61440	65535	61440

Example To create a new MSTI 5 with a priority of 8192, use the command:

```
cre mst msti=5 prio=8192
```

Related Commands

destroy mstp msti
show mstp
show mstp msti

create stp

Syntax `CREate STP=`*`stp-name`*

where *stp-name* is a character string 1 to 15 characters long.Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *stp-name* cannot be **all** or **default**.

Description This command creates a Spanning Tree Protocol entity with a unique name. The specified STP must not already exist. The name is not case sensitive, although the case is preserved for display purposes. The STP created is disabled by default.

For switches without overlapping VLANs, the maximum number of STPs is dependent on the number of ports on the switch (Table 8-20 on page 8-93) because each port can belong to a single STP and an STP is only useful when it contains more than one port. Rapier i series switches include overlapping VLANs, and a port can belong to more than one STP. The maximum number of STPs for these switches is 255.

Table 8-20: Relationship between the number of ports on the switch and maximum number of STPs permitted

Number of ports	Maximum number of STPs permitted
8	8
16	8
24	16
48	24

Example To create a new STP named *company*, use the command:

```
cre stp=company
```

Related Commands
destroy stp
enable stp
set stp
show stp

create switch trunk

Syntax

```
CREate SWItch TRunk=trunk [POrt=port-list]
   [SELect={MACSrc|MACDest|MACBoth|IPSrc|IPDest|IPBoth}]
   [SPeed={10M|100M|1000M}]
```

where:

- *trunk* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.
- *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 creates a trunk group on the switch and optionally adds ports to it and sets its speed. The maximum number of trunk groups that can be created depends on the particular switch model due to the capabilities of the switch hardware. The switch supports static 802.3ad link aggregation. Port trunking must be configured on both ends of the link, or network loops may result.

The **trunk** parameter specifies the name of the trunk group. The name is not case sensitive, although the case entered is preserved for display purposes. The name uniquely identifies the trunk group. The specified trunk group must not already exist.

The **port** parameter specifies the switch ports to be added to the trunk group. Ports specified must not be in another trunk group, and must have the same VLAN configuration. They cannot include the switch's mirroring port. A trunk group can consist of a maximum of 8 fixed or uplink ports but not a mixture of both types.

The **select** parameter specifies the port selection criterion for the trunk group. Each packet to be sent on the trunk group is checked, using the selection criterion, and a port in the trunk group chosen down which to send the packet. If **macsrc** is specified, the source MAC address is used. If **macdest** is specified, the destination MAC address is used. If **macboth** is specified, both source and destination MAC addresses are used. If IPSRC is specified, the source IP address is used. If **ipdest** is specified, the destination IP address is used. If **ipboth** is specified, both the source and destination IP addresses are used. The user of the switch should choose the value of this parameter to try to spread the load as evenly as possible on the trunk group. The default is **macboth**.

The **speed** parameter specifies the speed of the ports in the trunk group. For gigabit ports, only the 1000M value is allowed. For switch ports, 10M and 100M values are allowed. The default is 100M. When a port is added to a trunk group, its current speed and duplex mode settings are ignored and the port is set to autonegotiate to the speed of the trunk group and full duplex mode.

Example

To create a trunk group called Trunk1 containing ports 1 to 4, use the command:

```
cre swi tr=Trunk1 po=1-4
```

Related Commands

add switch trunk
delete switch trunk
destroy switch trunk
set switch trunk
show switch trunk

create vlan

Syntax

```
CREate VLAN=vlan-name VID=2..4094 [PROtected]
```

On Rapier i Series switches:

```
CREate VLAN=vlan-name VID=2..4094 [PRIvate]
```

where *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* cannot be a number or **all**.

Description

This command creates a VLAN with a unique name and VLAN identifier (VID), and assigns it to the default STP. To change the VID of an existing VLAN, that VLAN must be destroyed and created again with a modified VID.

A maximum of 62 VLANs can be created with a VID from 2 to 4094. On the Rapier *i* Series switches only, a maximum of 254 VLANs can be created with a VID from 2 to 4094.

If you create a protected VLAN, you can add ports to it that are isolated from the other ports in the VLAN. See "Protected VLANs" on page 8-22 for information about configuring protected VLANs

If you create a private or protected VLAN, you can add ports or groups of ports to it that are isolated from the other ports in the VLAN. See "Protected VLANs" on page 8-22 and "Private VLANs" on page 8-22 for more information. Private VLANs are only available on Rapier i Series switches.

The **vlan** parameter specifies a unique name for the VLAN. This name can be more meaningful than the VID and makes administration easier. The VLAN name is used within the switch; 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 with a number, for instance "vlan1" or "vlan234", then the number must be the same as the VID specified. This avoids confusion when identifying to which VLAN subsequent commands refer.

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

The **private** parameter specifies that the VLAN is a private VLAN. A private VLAN contains ports or groups of ports that are isolated from the other ports in the VLAN. See "Private VLANs" on page 8-22 for information about configuring private VLANs. Private VLANs are only available on Rapier i Series switches.

The **protected** parameter specifies that the VLAN is a protected VLAN. If a VLAN is protected, Layer 2 traffic is blocked between its ports.

Examples

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

```
cre vlan=marketing vid=2
```

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

```
cre vlan=vlan42 vid=42
```

To create vlan2 and make it a private VLAN, use the command (only available on Rapier i Series switches):

```
cre vlan=vlan2 vid=2 priv
```

To create a protected VLAN named *protvlan* with a VLAN Identifier of 3, use the command:

```
cre vlan=protvlan vid=3 pro
```

Related Commands

add vlan port
destroy vlan
show vlan

create vlanrelay

Syntax

`CREate VLANRelay=`*`name`*

where *name* is a unique name for the VLAN relay entity 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

Description

This command creates a VLAN relay entity, which can be used to relay packets of a given protocol type between VLANs. The VLAN relay entity is enabled by default.

For packet relaying to commence, VLANs and protocol types must be added to this entry, using the **add vlanrelay** command on page 8-90.

The **vlanrelay** parameter specifies the unique identifier for the VLAN relay entity. No VLAN relay entity with this name may already exist. Comparisons of VLAN relay entity names are done without regard to the case of letters, although the case of letters is preserved in order to improve readability. For example, “relaying” and “RelayOne” are treated as the same VLAN relay entity name.

Example

To create a VLAN relay entity called SNARelay, use the command:

```
cre vlanr=snarelay
```

Related Commands

add vlanrelay
delete vlanrelay
destroy vlanrelay
show vlanrelay

delete lacp port

Syntax `DELete LACP POrt={`*`port-list`*`}`

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, including uplink ports.

Description This command removes ports from LACP's control and LACP frames are no longer transmitted across the link. It is good practice to delete LACP from ports that are linked to non-LACP-capable devices.

The **port** parameter specifies switch ports to be deleted from LACP's control. Ports specified must be under the control of LACP. ALL is not a configurable option; to stop LACP on all ports, use the **disable lacp** command on page 8-108.

Examples To delete ports 3 and 5 from LACP, use the command:

```
del lacp po=3,5
```

Related Commands

add lacp port
disable lacp
enable lacp
set lacp port
show lacp port

delete mstp msti vlan

Syntax `DELete MSTp MSTI=`*`instance`* `VLAN={`*`vlan-name`*`|`*`vlan-list`*`|ALL}`

where:

- *instance* is an instance number from 1 to 4094 for a specific MSTI.
- *vlan-name* is a unique name for the VLAN, 1 to 15 characters in length. Valid characters are uppercase letters (A-Z), lowercase letters (a-z), digits (0-9) the underscore character ("_"), and the hyphen character (-). The vlanname cannot be a number or ALL.
- *vlan-list* is a VLAN number, a range of VLAN numbers (specified as n-m), or a comma separated list of VLAN numbers and (or) ranges. VLAN numbers start at 1 and end at 4094.

Description This command removes VLAN(s) from a specified MSTI. The removed VLANs will be mapped to the CIST.

Once a VLAN is unmapped from a specified MSTI, the frames belonging to that VLAN are not longer forwarded along the spanning tree associate with that instance. The frames will be forwarded along the CIST spanning tree.

The **msti** parameter specifies the instance number of the specified Multiple Spanning Tree Instance. Any VLANs that are not assigned to a specific MSTI explicitly are mapped to the CIST by default. There is no command to remove VLANs from the CIST.

The **vlan** parameter specifies the VLAN mapped to a specified MSTI. To unmap a VLAN from an MSTI it must have previously been mapped to the MSTI. If **all** is specified, all VLANs mapped to the MSTI will be unmapped and remapped to the CIST.

Examples To delete the mapping of all VLANs from MSTI5, use the command:

```
del mst msti=5 vlan=all
```

Related Commands **add mstp msti vlan**
show mstp
show mstp msti

delete stp vlan

Syntax `DELete STP=`*`stp-name`* `VLAN={`*`vlan-name`*`|2..4094|ALL}`

where:

- *stp-name* is a character string 1 to 15 characters long.Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *stp-name* cannot be **all**.
- *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* cannot be a number or **all**.

Description This command deletes one or all VLANs from the specified STP, and returns the VLANs to the default STP. A VLAN cannot be explicitly deleted from the default STP. The default VLAN cannot be deleted.

Ports in the VLAN may belong to only one STP after the deletion except for the Rapier *i* Series switches.

On the Rapier *i* Series switches only, a port can belong to more than one STP after deletion. When a port belongs to multiple VLANs in the same STP, the port remains a member of this STP when a VLAN it was a member of is returned to the default STP.

If as a result of the VLAN deletion, ports are moved from one STP to another STP, the two affected STPs are initialised when they are currently enabled. Any previously disabled ports in the STPs are enabled.

When returned to the default STP, the ports of the VLAN have the default STP parameter values. The ports do not retain any non-default STP configuration that was made when the VLAN was associated with any other STP.

The **vlan** parameter specifies the name or numerical VLAN Identifier (VID) of the VLAN to be deleted. If **all** is specified, then all VLANs are deleted from the STP.

Example To delete the Research VLAN from the *company* STP, use the command:

```
del stp=company vlan=research
```

Related Commands **add stp vlan**
show stp

delete switch filter

Syntax `DELete SWItch FILter POrt=`*`port`* `ENTry=`*`entry-list`*

where:

- *entry-list* is an entry number, range (specified as *n-m*), or comma-separated list of numbers and/or ranges. Entry numbers start at 0 and end at *m*, where *m* is the highest filter entry currently defined in the permanent forwarding database. Each port has its own permanent forwarding database.
- *port* is the number of one of the switch ports or an uplink port.

Description This command deletes the specified static filter entry port from the permanent forwarding database. The static filter is deleted on the port specified by the **port** parameter. The **entry** parameter must specify an existing filter entry in the permanent forwarding database.

Example To delete filter entry 9 on port 2, use the command:

```
del swi fil po=2 ent=9
```

Related Commands **add switch filter**
show switch filter

delete switch hwfilter classifier

Syntax `DELete SWItch HWFilter CLASSifier=`*`classifier-list`*

where *classifier-list* is either an integer from 1 to 9999; a range of integers (specified as 1-4), or a comma-separated list of classifier numbers and/or ranges (1, 3, 4-9)

Description This command deletes any hardware-based filters associated with the specified classifier(s). All of the specified classifiers must exist and must already be incorporated into a filter entry. The **switch hwfilter classifier** commands may not be used with the **switch l3filter** commands.

The **classifier** parameter specifies a list of classifiers for which hardware filter entries are to be deleted.

Examples To delete hardware filtering entries based on classifiers 1 to 5 from the switch, use the command:

```
del swi hwf class=1-5
```

Related Commands **add switch hwfilter classifier**
set switch hwfilter classifier
show switch hwfilter

delete switch l3filter

Syntax `DELete SWItch L3Filter=`*`filter-id`*

where *filter-id* is a decimal number in the range 1 to the number of filters defined

Description This command deletes the specified filter match criteria. A filter match criteria cannot be deleted if it contains a filter entry. Delete the filter entries and then delete the filter.

Example To delete filter 1, use the command:

```
del swi l3f=1
```

Related Commands
add switch l3filter match
set switch l3filter match
show switch l3filter

delete switch l3filter entry

Syntax `DELete SWItch L3Filter=`*`filter-id`* `ENTry=`*`entry-id`*

where:

- *filter-id* is a decimal number in the range 1 to the number of filters defined.
- *entry-id* is a decimal number in the range 1 to the number of entries defined.

Description This command deletes the specified entry from the specified filter. Both the entry and the filter must already exist. The **l3filter** parameter specifies the number of the filter. The **entry** parameter specifies the number of the entry to delete. Filter and entry numbers are in the output of the **show switch l3filter** command on page 8-220.

Example To delete entry 3 from filter 1, use the command:

```
del swi l3f=1 ent=3
```

Related Commands
add switch l3filter entry
set switch l3filter entry
show switch l3filter

delete switch trunk

Syntax `DELete SWItch TRunk=`*`trunk`* `POrt={`*`port-list`*`|ALL}`

where:

- *trunk* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.
- *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 Ethernet port, including uplink ports.

Description This command deletes ports from an existing trunk group on the switch.

The **trunk** parameter specifies the name of the trunk group. The name is not case sensitive. The name uniquely identifies the trunk group. The specified trunk group must already exist.

The **port** parameter specifies switch ports to be deleted from the trunk group. Ports specified must be in the specified trunk group. If **all** is specified, then all ports in the trunk group are deleted.

Example To delete port 3 from trunk group Trunk1, use the command:

```
del swi tr=trunk1 po=3
```

Related Commands
add switch trunk
create switch trunk
destroy switch trunk
set switch trunk
show switch trunk

delete vlan bridge

Syntax `DElete VLAN={`*`vlan-name`*`|1..4094} BRIDge`

where *vlan-name* is a unique name for the VLAN 1 to 32 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* cannot be a number or **all**.

Description This command deletes a bridge attachment from the specified VLAN.

Examples To attach the training VLAN to the bridge use the command:

```
del vlan=training brid
```

Related Commands
add vlan bridge
show bridge
show vlan

delete vlan port

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

where:

- *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* 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 switch Ethernet port (including uplink ports).

Description This command deletes ports from the specified **vlan**. An untagged port can be deleted from a VLAN when the port is still a member of a VLAN after the deletion has occurred. If the port does not belong to a VLAN as a tagged port, then the port is implicitly added to the default VLAN as an untagged port. It is not possible to delete a port that belongs only to the default VLAN as an untagged port.

If the port becomes a tagged port as a result of the deletion; that is, the port does not belong to any VLAN as an untagged port, then the **acceptable** switch parameter for the port is set to VLAN. The user is not able to change the **acceptable** parameter for the port.

A tagged port can be deleted from a VLAN if the port is still a member of a VLAN after the deletion has occurred.

If as a result of the port deletion, ports are moved from one STP to another STP, the two affected STPs are initialised when they are presently enabled. Previously disabled ports in the STPs are enabled.

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. When the command succeeds on a subset of the specified ports but causes errors on the others, then the command as a whole fails and has no effect.

On the Rapier *i* Series switches only, a port can belong to multiple STPs when the port is a member of more than one VLAN. If the port being deleted from the VLAN also belongs to another STP through concurrent membership of another VLAN, it is not removed from that VLAN or STP.

If a port belongs to a trunk group, all the ports in the trunk group must be specified. A subset of the ports in a trunk group cannot be deleted from the VLAN unless they are first removed from the trunk group.

A private VLAN cannot contain any private ports when an uplink is deleted from the VLAN, because a private VLAN must always have an uplink. To delete the uplink port or ports and any private ports from a private VLAN, use the option **port=all**.

If the port is a member of a private group, you must delete all ports in the group at once. This stops groups from having different member ports in different VLANs.

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

```
del vlan=marketing po=3
```

Related Commands **add vlan port**
show vlan

delete vlanrelay

Syntax

```
DELete VLANRelay=name [PROTocol=protocoltype]
   [VLAN={vlan-name|1..4094}]
```

where:

- *name* is a unique name for the VLAN relay entity 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.
- *protocoltype* is either a valid protocol number in hexadecimal notation, or a recognised protocol name. A protocol number is 1 byte for SAP, 2 bytes for ETHII, or 5 bytes for an 802.2 SNAP type packet.
- *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* cannot be a number or ALL.

Description This command deletes a protocol number and/or a VLAN from a VLAN relay entity. The relay entity must still contain at least one protocol and two VLANs in order to relay packets.

The **vlanrelay** parameter specifies the unique identifier for the VLAN relay entity. A VLAN relay entity with this name must already exist.

The **protocol** parameter specifies an Ethernet protocol number for packets that are no longer to be relayed. The protocol number must be currently being relayed. Table 8-5 on page 8-25 lists predefined protocol types.

The **vlan** parameter specifies the static VLAN to remove from the VLAN relay entity. The VLAN can be referenced by name or VLAN ID. The VLAN must already exist and must currently be part of the VLAN relay entity.

Example To delete VLAN 2 from VLAN relay entity SNARelay, use the command:

```
del vlanr=snarelay vlan=2
```

Related Commands **add vlanrelay**
create vlanrelay
destroy vlanrelay
show vlanrelay

destroy mstp msti

Syntax `DESTroy MSTp MSTI=`*`instance`* `[PRIOrity=0..65535]`

where *instance* is the instance number assigned to the new MSTI. It has the range 1-4094.

Description This command destroys a specific multiple spanning tree instance (MSTI) on the switch. An MSTI cannot be destroyed when it still has VLANs mapped to it. Use th4e **delete mstp msti vlan=all** command to remove all VLANs from the specified MSTI.

Example To destroy an existing MSTI5, use the command:

```
dest mst msti=5
```

Related Commands
create stp
delete mstp msti vlan
show mstp
show mstp msti

destroy stp

Syntax `DESTroy STP={`*`stp-name`*`|ALL}`

where *stp-name* is a character string 1 to 15 characters long.Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *stp-name* cannot be **all**.

Description This command destroys the specified Spanning Tree Protocol entity, or all STPs except the default STP. An STP cannot be destroyed if VLANs still belong to the STP.

The **stp** parameter specifies the name of the STP. The name is not case sensitive, although the case is preserved for display purposes. The **stp** specified must exist. The default STP cannot be destroyed. If **all** is specified, then all STPs except the default STP are destroyed. When **all** is specified and the command succeeds on a subset of STPs but causes errors on the others, then the command as a whole fails and has no effect.

Examples To destroy the *company* STP, use the command:

```
dest stp=company
```

To remove all user created STPs from the switch, none of which have VLANs belonging to them, use the command:

```
dest stp=all
```

Related Commands
create stp
delete stp vlan
disable stp
enable stp
set stp
show stp

destroy switch trunk

Syntax `DESTroy SWItch TRunk=`*`trunk`*

where *trunk* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

Description This command destroys a trunk group on the switch. The trunk group must be empty, that is, it must not contain any ports.

The **trunk** parameter specifies the name of the trunk group. The name is not case sensitive. The name uniquely identifies the trunk group. The specified trunk group must already exist.

Example To destroy a trunk group called Trunk1, use the command:

```
dest swi tr=trunk1
```

Related Commands

add switch trunk
create switch trunk
delete switch trunk
set switch trunk
show switch trunk

destroy vlan

Syntax `DESTroy VLAN={`*`vlan-name`*`|2..4094|ALL}`

where *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* cannot be a number or **all**.

Description This command destroys the specified static VLAN or all static VLANs in the switch. The default VLAN, which has a numerical VLAN Identifier (VID) of 1, cannot be destroyed. If **all** is specified, then all VLANs except the default VLAN are destroyed. A VLAN cannot be destroyed when ports still belong to it or other modules are attached to it.

The **reset garp** command on page 9-15 of Chapter 9, Generic Attribute Registration Protocol (GARP) can be used to destroy dynamic VLANs. However, the dynamic VLANs may be recreated if the switch receives GARP packets after the RESET GARP command has been executed. Disabling a GVRP instance destroys all dynamic VLANs created by the GVRP instance. Dynamic VLANs exist only when GVRP is enabled.

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

```
dest vlan=1234
```

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

```
dest vlan=all
```

Related Commands
create vlan
show vlan

destroy vlanrelay

Syntax `DESTroy VLANRelay=`*`name`*

where *name* is a unique name for the VLAN relay entity 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

Description This command destroys a VLAN relay entity. Packet relaying as configured in this VLAN relay entity immediately stops.

The **vlanrelay** parameter specifies the unique identifier for the VLAN relay entity. A VLAN relay entity with this name must already exist.

Example To destroy the VLAN relay entity called **snarelay**, use the command:

```
dest vlanr=snarelay
```

Related Commands
add vlanrelay
create vlanrelay
delete vlanrelay

disable lacp

Syntax `DISable LACP`

Description This command disables the LACP processes on the switch. A warning message, notification message, and log message are generated when this command is executed. LACP is disabled by default. LACP port settings that are changed while LACP is disabled take effect when LACP is re-enabled.

Related Commands **enable lacp**
show lacp

disable lacp debug

Syntax `DISable LACP DEBug={MSG|PACKet|STATe|TRAce|DEV|PERSistent|ALL}`

Description This command disables the LACP debugging process, which is disabled by default. The **msg** option displays the decoded form of incoming and outgoing LACP packets. The **packet** option displays incoming and outgoing LACP packets in hex. The **state** option displays internal state machine changes. The **trace** option displays the function call tree. The **dev** option displays internal support information. The **persistent** option enables the debug state to persist over one reboot. If **all** is specified, the debugging process is disabled for all options. The default is **all**.

Related Commands **enable lacp debug**
show lacp

disable mstp

Syntax `DISable MSTp`

Description This command disables the multiple spanning tree operation on the switch. By default MSTP is disabled on switch start-up. This command overrides the following commands:

enable mstp cist port

disable mstp cist port

enable mstp msti port

disable mstp msti port

Once MSTP has been disabled, no port for the CIST or MSTIs can be enabled or disabled. MSTP must be disabled before any STP instances can be enabled.

Examples To enable MSTP, use the commands:

```
dis mst
```

Related Commands **enable mstp**
show mstp

disable mstp cist port

Syntax `DISable MSTp CIST 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 Ethernet switch port, including uplink ports.

Description This command disables operation of the Multiple Spanning Tree algorithm on specific ports or all ports for the Common Internal Spanning Tree. Disabled ports are placed in a discarding state and cannot forward frames. All of the ports are enabled for the CIST by default.

The **mstp** module must be enabled first before any port for the CIST can be enabled or disabled.

The **port** parameter specifies a list of ports to be disabled for the CIST. If all is specified, all of the ports on the switch will be disabled for the CIST. 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 will fail and have no effect.

Example To disable port 2 in the CIST, use the command:

```
disable mstp cist port=2
```

Related Commands **show mstp msti**
show mstp cist port

disable mstp debug

Syntax

```
DISable MSTp DEBug={Msg|Pkt|State|All} MSTI={CIST|
   instance|ALL} [POrt={port-list|ALL}]
```

where:

- *instance* is the instance number of the selected MSTI in a range from 1 to 4094.
- *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 Ethernet switch port, including uplink ports.

Description

This command disables MSTP debugging for a specified MST instance (MSTI) or all instances, or on specific port or ports.

The **msti** parameter specifies the instance for which the debugging mode is disabled. If **cist** is specified, then debug is disabled on the CIST. If an instance is specified, then debug is disabled on the MSTI. If ports are specified using the **port** parameter, then debug will be disabled on the specified port on the specified instance. If **all** is specified and the ports are specified using the **port** parameter, then debug mode will be disabled on all the instances for the listed ports.

The **debug** parameter specifies which debugging modes are to be disabled. If **all** is specified, then all debugging modes for the instances or ports are disabled. The other modes can be disabled independently of each other.

The **port** parameter specifies the ports on which the debug mode is disabled, or **all** ports on the switch.

Example

To disable debugging on all ports in MSTI5, use the command:

```
dis mst msti=5 po=all
```

Related Commands

show mstp msti
show mstp msti port

disable mstp msti port

Syntax `DISable MSTp MSTI=`*`instance`* `POrt={`*`port-list`*`|ALL}`

where:

- *instance* is the instance number of the specified MSTI in a range from 1 to 4094.

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 Ethernet switch port, including uplink ports.

- Description

This command disables operation of the Multiple Spanning Tree algorithm on the specified ports or all ports for the specified Multiple Spanning Tree Instance. Disabled ports are placed in a discarding state and cannot forward frames. All ports are enabled for the specified **msti** by default.

The MSTP module must be enabled first before any port for the specified **msti** can be enabled or disabled.

The **msti** parameter specifies the instance number for the specified MSTI.

The **port** parameter specifies a list of ports to be disabled for the specified **msti**. If all is specified, all of the ports on the switch will be disabled for the specified **msti**.

Example To disable port 2 in MSTI5, use the command:

```
dis mst msti=5 po=2
```

Related Commands

show mstp msti
show mstp msti port

disable stp

Syntax `DISable STP={`*`stp-name`*`|ALL}`

where *stp-name* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *stp-name* cannot be **all**.

Description This command disables operation of the Spanning Tree Algorithm for the specified STP or for the entire switch. User created STPs are disabled by default. The default STP is disabled on switch start-up. An STP should be disabled only when its part of the LAN topology is free of loops. When there is a loop in the topology, the performance of the LAN can be significantly reduced.

This command overrides the **disable stp port** and **enable stp port** commands. Once an STP has been disabled by this command, no port belonging to that STP can be enabled or disabled. The STP must be enabled before ports belonging to the STP are enabled or disabled.

Disabling an STP does not affect the debug status of that STP set by the **enable stp debug** command. However, because the STP is disabled, STP debugging produces no information.

Disabling STP operation on a port may affect the operation of GARP. Each GARP application has a GIP component whose actions depend on whether the port is in the STP forwarding state.

Examples To disable the *company* STP, use the command:

```
dis stp=company
```

To disable all STPs on the switch, use the command:

```
dis stp=all
```

Related Commands
create stp
destroy stp
enable stp
set stp
show stp

disable stp debug

Syntax

```
DISable STP[={stp-name|ALL}] DEBug={MSG|PKT|STATE|ALL}
   POrt={port-list|ALL}

DISable STP DEBug={MSG|PKT|STATE|ALL} POrt={port-list|ALL}
```

where:

- *stp-name* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *stp-name* cannot be **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 switch Ethernet port, including uplink ports.

Description

This command disables STP debugging options for the specified STP or ports. The **debug** parameter specifies the debugging modes that are to be disabled (Table 8-21 on page 8-113).

A port can belong to only one STP, except on the Rapier *i* Series switches. If a port is a member of multiple VLANs, then all these VLANs must belong to the same STP.

On the Rapier *i* Series switches only, a port can belong to more than one STP when the port is a member of two or more VLANs that belong to different STPs.

If **all** is specified, all debugging is disabled.

Table 8-21: STP debugging options

Option	Debug Mode	Description
MSG	Message	Decoded display of received and transmitted STP packets
PKT	Packet	Raw ASCII display of received and transmitted STP packets
STATE	State	Port state transitions.
ALL	All	All debug options

The **port** parameter specifies the ports where the debug mode is disabled.

On the Rapier *i* Series switch only, the **port** parameter can be supplied with the STP name. If no STP name is provided, it assumes **all**. On the port parameter, the port list does not have to perfectly match all the STP port members so the command still succeeds as a whole.

The **stp** parameter specifies the STP for which the debugging mode is disabled. If an STP is specified, then the **port** parameter is invalid and all ports in the STP have the debug mode disabled.

The debug status of a port is not changed if the port is moved out of its current STP by one of the following commands: **add vlan port, delete vlan port, add stp vlan, delete stp vlan**. This command is effective on disabled ports or disabled STPs, but produces no debugging information until the ports and the STP are enabled.

Examples To disable the **state** debugging mode for the *company* STP, use the command:

```
dis stp=company deb=state
```

To disable all debug modes for all STPs, use the command:

```
dis stp=all deb=all
```

To disable the MSG debugging mode on ports 5 to 8, use the command:

```
dis stp deb=msg po=5-8
```

Related Commands **enable stp debug**
show stp debug

disable stp port

Syntax

```
DISable STP[={stp-name|ALL}] POrt={port-list|ALL}
```

where *stp-name* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

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 Ethernet port, including uplink ports.

Description

This command disables operation of the Spanning Tree Algorithm on the specified ports – normal switch processing continues. Disabled ports that are part of an enabled STP can still forward packets. This command is effective when the STP that the port belongs to is currently enabled. Disabling the operation of STP on a port does not affect the port's ability to receive and transmit frames.

On the Rapier *i* Series switches only, a port can belong to multiple STPs when the port is a member of more than one VLAN.

A port can belong to a single STP. This means that when a port is member of multiple VLANs, all these VLANs must belong to the same STP.

Disabling the Spanning Tree Algorithm on one or more ports puts those ports in the Disabled state; all BPDUs received on these ports are discarded.

Disabling an STP port does not affect the debug status of the port as set by the **enable stp debug** command. However, no STP debugging information is produced on a disabled port.

Disabling STP operation on a port may affect the operation of GARP. Each GARP application has a GIP component whose actions depend upon whether the port is in the STP forwarding state.

On the Rapier *i* Series switches only, the STP parameter specifies the STP instance for which the port is disabled. If no value is provided, the default is **all**.

The **port** parameter specifies the ports. If **all** is specified, all ports in the switch are disabled. When the command succeeds on a subset of the specified ports but causes errors on the others, then the command as a whole fails and has no effect.

Examples

To disable the Spanning Tree Algorithm from using port 4, use the command:

```
dis stp po=4
```

To disable STP on all ports, use the command:

```
dis stp po=all
```

On Rapier *i* Series switches only, to disable STP on just the administration network and only on port 4, use the command:

```
dis stp=admin po=4
```

Related Commands

enable stp port
set stp port
show stp port

disable switch ageingtimer

Syntax `DISable SWItch AGEingtimer`

Description This command stops the ageing timer from ageing dynamically learned entries in the forwarding database. The default setting for the ageing timer is enabled.

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

```
dis swi age
```

Related Commands **enable switch ageingtimer**
set switch ageingtimer
show switch

disable switch debug

Syntax `DISable SWItch DEBug={ARL|CMIC|DMA|QOS|S5600|PHY|ALL}`

Description This command disables the specified switch debug mode or all switch debugging. The **debug** parameter specifies the switch debug mode to be disabled (Table 8-22 on page 8-116).

Table 8-22: Switch debugging options

Debug Options	Description
ARL	Operations related to the forwarding database.
CMIC	Operations at the CMIC layer
DMA	Operations related to Direct Memory Access requests.
QOS	Operations related to Quality of Service
S5600	Operations related to the switching hardware.
PHY	Operations related to the PHY port interfaces.
ALL	All debug options

Example To disable all switch debugging, use the command:

```
dis swi deb=all
```

Related Commands **enable switch debug**
show switch

disable switch hwfilter

Syntax `DISable SWItch HWFilter`

Description This command disables classifier-based packet filtering.

Hardware filtering is automatically disabled when the last filter match is removed, however this command may be used to manually disable filtering if this is required.

Some other modules and processes (such as IGMP snooping) require filtering to be enabled at all times. If any of these are active when the **disable switch hwfilter** command is entered, it has no effect and an error message results.

Example To disable existing classifier-based packet filters, use the command:

```
dis swi hwf
```

Related Commands **enable switch hwfilter**
disable switch hwfilter

disable switch l3filter

Syntax `DISable SWItch L3Filter`

Description This command disables hardware-based Layer 3 packet filtering.

On the Rapier i Series switches only, hardware filtering is automatically disabled when the last filter match is removed; however, this command may be used to manually disable filtering. Some other modules and processes (such as IGMP snooping) require filtering to be enabled at all times. If any of these are active when this command is entered, it has no effect and an error message results.

Example To disable existing hardware-based Layer 3 packet filters, use the command:

```
dis swi l3f
```

Related Commands **enable switch l3filter**
show switch l3filter

disable switch learning

Syntax `DISable SWItch LEarning`

Description This command disables the dynamic learning and updating of the forwarding database. The default setting for the learning function is enabled.

If switch learning is disabled and the ageing timer has aged out all dynamically learned filter entries, only MAC source addresses that are statically entered are used to decide which packets to forward or discard. If the switch finds no matching entries in the forwarding database during the forwarding process, then all switch ports in the VLAN are flooded with the packet, except the port on which the packet was received.

Example To disable the switch learning function, use the command:

```
dis swi le
```

Related Commands
enable switch learning
show switch

disable switch mirror

Syntax `DISable SWItch MIRRor`

Description This command disables traffic mirroring on the switch. Mirrored traffic is stopped from being sent on the switch's mirror port. The mirror port and mirror settings for the sources of mirror traffic remain configured. The default state of switch mirroring is disabled.

Example To disable traffic mirroring, use the command:

```
dis swi mirr
```

Related Commands
enable switch mirror
set switch mirror
set switch port
show switch
show switch port

disable switch port

Syntax

```
DISable SWItch POrt={port-list|ALL} [FLOw=PAUSE]
   [LINk={ENAble|DISable}]
```

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 Ethernet port, including uplink ports.

Description

This command disables one or more of:

- a port or group of ports on the switch
- flow control on the port(s)
- the link belonging to any specified port(s)

When a port is disabled, it no longer sends or receives frames. Ports should be disabled when faulty wiring or equipment is attached to them, or as a security measure to stop access from intruders. Switch ports are enabled by default.

The **port** parameter specifies the port or ports that will be affected by the command.

The **flow** parameter specifies the type of flow control to be disabled for the port. If **pause** is specified, flow control for full duplex ports by sending **pause** frames is disabled. **pause** is enabled by default.

The **link** parameter specifies whether fixed copper Ethernet ports are either enabled or disabled at the hardware level. If **disable** is specified, this is the equivalent of disconnecting the cable. If the **link** parameter is not specified, the link remains physically enabled. The default is **enable**.

Example

To disable ports 2, 3, 4 and 6, use the command:

```
dis swi po=2-4,6
```

Related Commands

enable switch port
reset switch port
show switch port

disable vlan debug

Syntax `DISable VLAN={`*`vlan-name`*`|1..4094|ALL} DEBug={PKT|ALL}`

where *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* 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 *marketing* VLAN, use the command:

```
dis vlan=marketing deb=pkt
```

Related Commands **enable vlan debug**
show vlan debug

disable vlanrelay

Syntax `DISable VLANRelay=`*`name`*

where *name* is a unique name for the VLAN relay entity 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

Description This command disables packet relaying by the VLAN relay entity. The entity must exist and must be currently enabled. VLAN relay entities are enabled by default upon creation.

Example To disable packet relaying by the VLAN relay entity SNARelay, use the command:

```
dis vlanr=snarelay
```

Related Commands **add vlanrelay**
delete vlanrelay
enable vlanrelay

disable vlanrelay debug

Syntax `DISable VLANRelay=`*`name`* `DEBug`

where *name* is a unique name for the VLAN relay entity 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

Description This command disables the output of debugging information about packets relayed by a VLAN relay entity. The relay entity must already exist and VLAN relay debugging must currently be enabled. Debugging of VLAN relay entities is disabled by default.

Example To disable the display of packets relayed by the VLAN relay entity SNARelay, use the command:

```
dis vlanr=snarelay deb
```

Related Commands
add vlanrelay
delete vlanrelay
enable vlanrelay
enable vlanrelay debug

enable lacp

Syntax `ENAble LACP`

Description This command enables LACP on the switch. A notification message and a log message file are generated when this command is executed. LACP is disabled by default.

Related Commands
disable lacp
show lacp

enable lacp debug

Syntax

```
ENAble LACP DEBug={MSG|PACKet|STAte|TRAce|DEV|PERsistent|
   ALL}}
```

Description

This command enables the LACP debugging facility, which is disabled by default. The **msg** option displays the decoded form of incoming and outgoing LACP packets.The **packet** option displays all incoming and outgoing LACP packets. The **state** option displays internal state machine changes. The **trace** option displays the function call tree. The **dev** option displays internal support information. The **persistent** option enables the debug state to persist over one reboot. If **all** is specified, the debugging process is enabled for all options. The default is **all**.

Related Commands

disable lacp debug
show lacp

enable mstp

Syntax

```
ENAble MSTp
```

Description

This command enables the operation of the multiple spanning tree algorithm on the switch. Multiple spanning tree protocol (MSTP) enables a number of VLANs to each use separate active topologies throughout a virtual bridged LAN. By default MSTP is disabled on switch start-up. MSTP must be enabled before the following commands can be used:

enable mstp cist port

disable mstp cist port

enable mstp msti port

disable mstp msti port

Once MSTP has been enabled, any port for the CIST and the existing MSTIs can be enabled or disabled. Enabling MSTP will initialise the status for the switch and all of its ports. MSTP cannot be enabled while there are also STP instances enabled. All STP instances must be disabled before MSTP can be enabled.

Examples

To enable MSTP, use the commands:

```
ena mst
```

Related Commands

disable mstp
show mstp

enable mstp cist port

Syntax `ENAble MSTp CIST 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 Ethernet switch port, including uplink ports.

Description This command enables operation of the MST algorithm on specific ports or all ports for the CIST. All ports are enabled for the CIST by default.

The MSTP module must be enabled first before any port for the CIST can be enabled or disabled. If a port is a member of a trunk group but is not the master port then this command fails.

The **port** parameter specifies a list of ports to be enabled for the CIST. If **all** is specified, all ports on the switch are enabled for the CIST. 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 a port is disabled with the **disable switch port** command on page 8-119 or has a link status of down and this port is enabled, a message is displayed indicating the condition.

.Example To enable all ports in the CIST, use the command:

```
eba mst cist po=all
```

Related Commands

show mstp cist
show mstp cist port

enable mstp debug

Syntax

```
ENAble MSTp DEBug={Msg|Pkt|State|All} MSTI={CIST|instance|
   ALL} [POrt={port-list|ALL}] [Statemachine={PTM|PRX|PPM|
   PIM|PTX|PRS|PRT|PST|TCM|ALL}] [Output=Console]
   [Timeout=1..4000000000|None]
```

where:

- *instance* is the instance number of the selected MSTI in a range from 1 to 4094.
- *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 Ethernet switch port, including uplink ports.

Description

This command enables MSTP debugging for either a specified MSTP instance or all instances, or on specific port or ports.

The **msti** parameter specifies the spanning tree instance that will have its debugging mode enabled. If **cist** is specified, then debugging will be enabled on the CIST. If an MST instance is specified, then debugging will be enabled on the **msti** specified. If ports are specified using the **port** parameter, then the debug will be enabled on the specified port on the specified instance. If **all** is specified and the ports are specified using the **port** parameter, then the debugging mode for the listed ports will be enabled on all the instances with the listed ports.

The instance number is for the specified **msti**.

The **debug** parameter specifies which debugging modes are to be enabled. If **all** is specified, then all debugging modes for the instances or ports will be enabled. The other modes can be enabled independently of each other.

The debugging modes enabled by each option are shown in Table 1 STP debugging options.

Table 8-23: STP debugging options .

Option	Description
MSG	Decoded display of BPDUs received and transmitted by MSTP
PKT	Raw ASCII display of BPDUs received and transmitted BY mstp
STATE	Port state transitions. For MSTP states for state machines specified by the **statemachine** parameter are displayed
ALL	All debug options

Setting the **output** parameter to **console** instructs the bridge to send the debugging information to the console. By default, the debugging data will be sent to the port that received the **enable mstp debug** command. This option should be selected if the **enable mstp debug** command is used in a script, because a script is not received on a port.

The **port** parameter specifies which ports on the bridge will have the debug mode enabled. If port value is not entered, the parameter defaults to **all**.

The **statemachine** parameter specifies which state machines will have debugging enabled, see Table 8-24 on page 8-125. This parameter is valid only when the debug mode is **state**. The default value is **all**.

The value of this parameter is cleared only when the **disable mstp debug** command specifies the **debug** parameter as either **state** or **all**. When the debug mode is not **state** or **all**, the **statemachine** parameter is not cleared.

The **timeout** parameter specifies the time period, in seconds, during which debugging will be enabled on the specified ports. Limiting the debugging time period reduces the risk of the switch and the display being overloaded with debugging information. Note that this parameter value overrides any previous MSTP debugging timeout values for these ports, even if they were specified for other debugging modes. If a **timeout** value is not specified, then its value by default is **none**. When the timeout expires the following events will occur:

- **output** will be redirected to the console,
- **debug** will be disabled for all modes,
- **statemachine** modes will all be disabled.
- **timeout** will be set to **none**.

Table 8-24: State Machine Mode in Debug and the State Machine

Option	Description
PTM	Port timer state machine
PRX	Port receive state machine
PPM	Port protocol migration state machine
PIM	Port information state machine
PTX	Port transmit state machine
PRS	Port role selection state machine
PRT	Port role transitions state machine
PST	Port state transition state machine
TCM	Topology change state machine

Example To enable debugging on all ports in MSTI5, use the command:

```
ena mst deb msti=5 po=all
```

Related Commands

disable mstp debug
show mstp debug

enable mstp msti port

Syntax `ENAble MSTP MSTI=`*`instance`* `PORT={`*`port-list`*`|ALL}`

where:

- *instance* is the instance number of the specified MSTI, having the range 1-4094.
- *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 Ethernet switch port, including uplink ports.

Description This command enables operation of the Multiple Spanning Tree algorithm on the specified ports or all ports for the specified Multiple Spanning Tree Instance.

The MSTP module must be enabled first before any port for the specified **msti** can be enabled or disabled.

The **msti** parameter specifies the instance number for the specified **msti**.

The **port** parameter specifies a list of ports to be enabled for the specified **msti**. If **all** is specified, all of the ports on the switch will be enabled for the specified **msti**. 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 will fail.

If a port is a member of a trunk group but is not the master port, then the **enable mstp msti port** command will fail.

If a port is either disabled by using the **disable switch port** command, or has a link status of *down* and the port is enabled, a message will be displayed indicating the condition.

All of the ports are enabled for the specified **msti** by default.

Example To enable all ports in MSTI5, use the command:

```
enable mstp msti=5 port=all
```

Related Commands **show mstp msti**
show mstp msti port

enable stp

Syntax

```
ENAble STP{=stp-name|ALL}
```

where *stp-name* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *stp-name* cannot be **all**.

Description

This enables operation of the Spanning Tree Algorithm for the specified **stp** or for the entire switch. If the Spanning Tree Algorithm is to be run on a VLAN, the VLAN must be added to an STP that is enabled. User created STPs are disabled by default. The default STP is disabled on switch start-up.

This command is required before the **disable stp port** and **enable stp port** commands can be used. Once an STP has been enabled by this command it is then possible to enable or disable any port belonging to that STP.

Enabling STP operation on a port may affect the operation of GARP. Each GARP application has a GIP component whose actions depend upon whether the port is in the STP forwarding state.

Examples

To enable the *company* STP, use the command:

```
enable stp=company
```

To enable all STPs, use the following command:

```
enable stp=all
```

Related Commands

create stp
destroy stp
disable stp
set stp
show stp

enable stp debug

Syntax

```
ENAble STP={stp-name|ALL} DEBug={MSG|PKT|STAte|ALL}
   [OUTput=CONsole] [TIMEOut={1..4000000000|NONE}]

ENAble STP={stp-name|ALL} DEBug={MSG|PKT|STAte|ALL}
   POrt={port-list|ALL} [OUTput=CONsole]
   [TIMEOut={1..4000000000|NONE}]
```

where:

- *stp-name* is a character string 1 to 15 characters long.Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *stp-name* cannot be **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 switch Ethernet port, including uplink ports.

Description

This command enables STP debugging for the specified STP, or ports. Be aware that enabling debug could flood the receiving Telnet session or asynchronous port with raw data. If an **stp** is specified, except on the Rapier *i* Series switches, the **port** parameter is invalid.

The **stp** parameter specifies the STP for which the debugging mode is enabled. On the Rapier *i* Series switches only, if an STP is specified and ports are specified with the **port** parameter, then debug is enabled on the specified port on the specified STP. If an **stp** is not specified or **all** is specified with the **stp** parameter, and ports are specified with the **port** parameter, then debug mode for the listed ports is enabled on the STPs with the listed port as a member.

The **debug** parameter specifies the debugging modes that are to be enabled. If **all** is specified, all debugging modes for the STP or ports are enabled. The other modes can be enabled independently of each other. The **debug** parameter must be specified before the **port** parameter. The debugging modes enabled by each option are shown in Table 8-25 on page 8-128.

Table 8-25: STP debugging options

Option	Description
MSG	Decoded display of received and transmitted STP packets
PKT	Raw ASCII display of received and transmitted STP packets
STATE	Port state transitions. For RSTP, states for all state machines are displayed as well the current role of the port.
ALL	All debug options

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 stp debug** command. Use this option if the **enable stp debug** command is used in a script, since a script is not received on a port.

The **port** parameter specifies the ports where the debug mode is enabled, or all ports on the switch. The **debug** parameter must be specified before the **port**

parameter. If an STP is specified, except on the Rapier *i* Series switches, the **port** parameter is invalid.

The **timeout** parameter specifies the time in seconds that debugging is enabled on the specified ports. This reduces the risk of the switch and the display being overloaded with too much debugging information. This value overrides previous STP debugging timeout values for these ports, even if they were specified for other debugging modes. If **timeout** is not specified, the time out is the most recent **timeout** value set in an **enable stp debug** command, or **none** if none had been set.

The debug status of a port is not changed if the port is moved out of its current STP by one of the following commands: the **add vlan port, delete vlan port, add stp vlan, delete stp vlan**. This command is effective on disabled ports or disabled STPs, but produces no debugging information until the ports and the STP are enabled.

Examples To view **state** debugging information for the *company* STP for the next 25 seconds, use the command:

```
enable stp=company debug=state timeout=25
```

To enable all debug modes for all STPs with output to the console and no timeout value, use this command:

```
enable stp=all debug=all output=console
```

To enable the message debug mode on ports 5 to 8 indefinitely, use the command:

```
enable stp debug=msg port=5-8 timeout=none
```

Related Commands **disable stp debug**
show stp debug

enable stp port

Syntax `ENAble STP[={`*`stp-name`*`|ALL}] POrt={`*`port-list`*`|ALL}`

where:

- *stp-name* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.
- *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 Ethernet port, including uplink ports.

Description This command enables operation of the Spanning Tree Algorithm on the specified ports.

On the Rapier *i* Series switches only, the STP parameter specifies the STP that is to have ports enabled. If no value is entered, the default is ALL.

If the **port** parameter specified is **all**, then all ports within the matching STP instance are enabled. This command is effective when the Spanning Tree Algorithm is enabled for the STP to which the port belongs.

Enabling an STP port may cause reconfiguration of the Spanning Tree to which the port belongs because STP messages (BPDUs) are generated on the port.

Enabling STP operation on a port may affect the operation of GARP. Each GARP application has a GIP component whose actions depend upon whether the port is in the STP forwarding state.

The **disable stp** command overrides the results of the **disable stp port** and **enable stp port** commands. Once a STP has been disabled by this command it is not possible to enable or disable any port belonging to that STP. The STP must be enabled first before any port belonging to that STP can be enabled or disabled.

Examples To enable the Spanning Tree Algorithm to use port 4, use the command:

```
ena atp po=4
```

To enable STP on all ports, use the command:

```
ena stp po=all
```

On a Rapier *i* Series switches only, to enable STP on just the administration network and only on port 4, use the command:

```
ena stp=admin po=4
```

Related Commands **disable stp port**
set stp port
show stp port

enable switch ageingtimer

Syntax `ENAble SWItch AGEingtimer`

Description This command enables the ageing timer to age out dynamically learned entries in the forwarding database. The default setting for the ageing timer is enabled.

If the ageing timer ages out all dynamically learned filter entries, and switch learning is disabled, only statically entered MAC source addresses are used to decide which packets to forward or discard. If the switch finds no matching entries in the forwarding database during the forwarding process, then all switch ports in the VLAN are flooded with the packet, except the port on which the packet was received.

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

```
ena swi age
```

Related Commands

disable switch ageingtimer
set switch ageingtimer
show switch

enable switch bist

Syntax `ENAble SWItch BIST=`*`bist`*

`ENAble SWItch BIST=`*`bist`* `INSTance=`*`instance`*

where:

- *bist* is a single integer number.
- *instance* is 0 or 1 and specifies a switch instance on 48 port switches.

Description This command runs a set of built in self tests on the external packet buffer memory and internal memories of a switch chip (or instance). The **instance** parameter must be specified *only* for switches with 48 ports.

For example output for a 48 port Rapier, see Figure 8-26 on page 8-132. For example output for a Rapier i with 24 ports see Figure 8-15 on page 8-133.

This procedure may only be performed by authorised service personnel. Network and switch performance are affected by the use of this command. After using this command the switch must be rebooted. The switch ports should be disconnected from any live networks before enabling the test.

Examples To enable the BIST test, use the command:

```
enable switch bist=0
```

Table 8-26: Example output from the **enable switch bist=0 instance=0** command

```
INFO - Starting built in self tests, unit 0
INFO - INITIATE1=0x00003cb0 INITIATE2=0x000000ff IN_BIST=2
INFO - Waiting for completion
INFO - INITIATE1=0x00003fff
INFO - INITIATE2=0xf7ffffff
INFO - mem=L3 addr=0x09000000
INFO - mem=CBPDATA0 addr=0x0a8a0000
INFO - mem=CBPDATA1 addr=0x0a8b0000
INFO - mem=CBPDATA2 addr=0x0a8c0000
INFO - mem=CBPDATA3 addr=0x0a8d0000
INFO - mem=CBPHEADER addr=0x0a800000
INFO - mem=CCP addr=0x0a850000
INFO - mem=CFAP addr=0x0a870000
INFO - mem=XQ0 addr=0x0b800000
INFO - mem=XQ1 addr=0x0b810000
INFO - mem=XQ2 addr=0x0b820000
INFO - mem=XQ3 addr=0x0b830000
INFO - mem=XQ4 addr=0x0b840000
INFO - mem=XQ5 addr=0x0b850000
INFO - mem=XQ6 addr=0x0b860000
INFO - mem=XQ7 addr=0x0b870000

INFO - BIST test succesful


Warning (2087309): The SWITCH MUST BE RESTARTED after running the BIST.
```

Figure 8-15: Example output from the **enable switch bist=0** command for the Rapier i

```
INFO - Starting built in self tests, unit 0

INFO - Writing incrementing pattern
.............................................................
INFO - Reading incrementing pattern
.............................................................
INFO - Writing inverted incrementing pattern
.............................................................
INFO - Reading inverted incrementing pattern
.............................................................
INFO - Memory comparison successful
Running other BIST tests
INFO - INITIATE1=0x00003fff INITIATE2=0x0bffffff IN_BIST=2
INFO - Waiting for completion
INFO - INITIATE1=0x00003fff
INFO - INITIATE2=0x0bffffff
INFO - EPIC0.DONE=2
INFO - EPIC1.DONE=2
INFO - EPIC2.DONE=2
INFO - mem=L3 addr=0x09000000
INFO - mem=CAB0 addr=0x0a610000
INFO - mem=CAB1 addr=0x0a620000
INFO - mem=CAB2 addr=0x0a630000
INFO - mem=CAB3 addr=0x0a640000
INFO - mem=CBPDATA0 addr=0x0a6a0000
INFO - mem=CBPDATA1 addr=0x0a6b0000
INFO - mem=CBPDATA2 addr=0x0a6c0000
INFO - mem=CBPDATA3 addr=0x0a6d0000
INFO - mem=CBPHEADER addr=0x0a600000
INFO - mem=CCP addr=0x0a650000
INFO - mem=CFAP addr=0x0a670000
INFO - mem=PID addr=0x0a690000
INFO - mem=PPP addr=0x0a660000
INFO - mem=SFAP addr=0x0a680000
INFO - mem=XQ0 addr=0x0b600000
INFO - mem=XQ1 addr=0x0b610000
INFO - mem=XQ10 addr=0x0b6a0000
INFO - mem=XQ11 addr=0x0b6b0000
INFO - mem=XQ12 addr=0x0b6c0000
INFO - mem=XQ13 addr=0x0b6d0000
INFO - mem=XQ14 addr=0x0b6e0000
INFO - mem=XQ15 addr=0x0b6f0000
INFO - mem=XQ2 addr=0x0b620000
INFO - mem=XQ3 addr=0x0b630000
INFO - mem=XQ4 addr=0x0b640000
INFO - mem=XQ5 addr=0x0b650000
INFO - mem=XQ6 addr=0x0b660000
INFO - mem=XQ7 addr=0x0b670000
INFO - mem=XQ8 addr=0x0b680000
INFO - mem=XQ9 addr=0x0b690000
INFO - mem=XQ16 addr=0x0c600000
INFO - mem=XQ17 addr=0x0c610000
INFO - mem=XQ18 addr=0x0c620000
INFO - mem=XQ19 addr=0x0c630000
INFO - mem=XQ20 addr=0x0c640000
INFO - mem=XQ21 addr=0x0c650000
INFO - mem=XQ22 addr=0x0c660000
INFO - mem=XQ23 addr=0x0c670000
```

Figure 8-15: Example output from the **enable switch bist=0** command for the Rapier i (Continued)

```
INFO - mem=XQ24 addr=0x0c680000
INFO - mem=XQ25 addr=0x0c690000
INFO - mem=XQ27 addr=0x0c6b0000

INFO - BIST test succesful


Warning (2087309): The SWITCH MUST BE RESTARTED after running the BIST.
```

enable switch debug

Syntax

```
ENAble SWItch DEBug={ARL|CMIC|DMA|QOS|S5600|PHY|ALL}
   [OUTput=CONsole] [TIMEOut={1..4000000000|NONE}]
```

Description

This command enables the specified switch debug mode or all switch debugging. Be aware that enabling debug may flood the receiving Telnet session or asynchronous port with raw data.

The **debug** parameter specifies the switch debug mode to be disabled (Table 8-22 on page 8-116). If **all** is specified, all switch debugging modes are enabled.

Table 8-27: Switch debugging options

Debug Options	Description
ARL	Operations related to the forwarding database.
CMIC	Operations at the CMIC layer.
DMA	Operations related to Direct Memory Access requests.
QOS	Operations related to Quality of Service.
S5600	Operations related to the switching hardware.
PHY	Operations related t the PHY port interfaces.
ALL	All debug options.

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.

The **timeout** parameter specifies the time in seconds that switch debugging is enabled. This reduces the risk of the switch and the display being overloaded with too much debugging information. This value overrides any previous switch debugging timeout values, even if they were specified for other debugging modes. If **timeout** is not specified, the time out 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 the ARL switch debugging mode, use the command:

```
enable switch debug=arl
```

Related Commands

disable switch debug
show switch

enable switch hwfilter

Syntax `ENAble SWItch HWFilter`

Description This command enables hardware-based Layer 3 packet filtering.

Hardware filtering is automatically enabled when the first filter match is added. This command may be used to re-enable filtering if it has been temporarily disabled by the **disable switch hwfilter** command, or to enable the filtering mechanism prior to the addition of the first filter match.

Example To enable existing hardware-based Layer 3 packet filters, use the command:

```
ena swi hwf
```

Related Commands **disable switch hwfilter**
show switch hwfilter

enable switch l3filter

Syntax `ENAble SWItch L3Filter`

Description This command enables hardware-based Layer 3 packet filtering.

On the Rapier i Series switch only, hardware filtering is automatically enabled when the first filter match is added. However this command may be used to re-enable filtering if it has been temporarily disabled by the **disable switch l3filter** command, or to enable the filtering mechanism prior to the addition of the first filter match.

Example To enable existing hardware-based Layer 3 packet filters, use the command:

```
ena swi l3f
```

Related Commands **disable switch l3filter**
show switch l3filter

enable switch learning

Syntax `ENAble SWItch LEarning`

Description This command enables the dynamic learning and updating of the forwarding database. The default setting for the learning function is enabled.

Example To enable the switch learning function, use the command:

```
ena swi le
```

Related Commands
disable switch learning
show switch

enable switch mirror

Syntax `ENAble SWItch MIRRor`

Description This command enables traffic mirroring on the switch. Mirrored traffic is sent on the switch's mirror port as long as a valid one is defined and sources of mirror traffic have been configured. If a packet is Layer 3 switched and mirrored, then the packet is always transmitted from the mirror port with a VLAN tag. Four or more ports set to mirror traffic to the mirror port may significantly reduce switch performance. The default state of mirroring is disabled.

Example To enable traffic mirroring, use the command:

```
ena swi mirr
```

Related Commands
disable switch mirror
set switch mirror
set switch port
show switch
show switch port

enable switch port

Syntax `ENAble SWItch POrt={`*`port-list`*`|ALL} [FLOw=PAUSE]`

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 Ethernet port, including uplink ports.

Description This command enables a port or group of ports on the switch, or enables the flow control mechanism. When the port is enabled, it sends and receives packets subject to the operation of STP. Enabling the switch port does not affect STP on the port. Switch ports are enabled by default.

To enable a port that has been disabled by the Port Security function, use the **set switch port** command on page 8-174 rather than this command.

The **port** parameter specifies the port to be enabled, or which are to have flow control methods enabled.

The **flow** parameter specifies the type of flow control to be enabled for the port. If **pause** is specified, flow control for full duplex ports by sending PAUSE frames is enabled. **pause** flow control is enabled by default.

Example To enable ports 2, 4 and 6, use the command:

```
ena swi po=2,4,6
```

Related Commands
disable switch port
reset switch port
show switch port

enable vlan debug

Syntax

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

where *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* cannot be a number or ALL.

Description

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

The **debug** parameter specifies the debugging mode that 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 when debugging is enabled on the specified VLAN. This reduces the risk of the switch and the display being overloaded with too much debugging information. This value overrides any previous VLAN debugging timeout values for the VLAN, even if they were specified for other debugging modes. If **timeout** is not specified, the time out is the most recent **timeout** value used in an **enable vlan debug** command or **none** if none had been set.

Example

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

```
enable vlan=marketing debug=all
```

Related Commands

disable vlan debug
show vlan debug

enable vlanrelay

Syntax `ENAble VLANRelay=`*`name`*

where *name* is a unique name for the VLAN relay entity 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

Description This command enables the relaying of packets by the VLAN relay entity. The relay entity must already exist and must be currently disabled. VLAN relay entities are enabled by default upon creation.

Example To enable packet relaying by the VLAN relay entity SNARelay, use the command:

```
enable vlanrelay=snarelay
```

Related Commands
add vlanrelay
delete vlanrelay
disable vlanrelay

enable vlanrelay debug

Syntax

```
ENAble VLANRelay=name DEBug
```

where *name* is a unique name for the VLAN relay entity 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

Description

This command enables the output of debugging information about packets relayed by the VLAN relay entity. The relay entity must already exist, and VLAN relay debugging must be currently disabled. Debugging of VLAN relay entities is disabled by default.

The format of the output messages from packet debugging is as follows:

```
vr: 2->3: 0000cd001234 0000cd004321 040403060708090560403
```

The first part of the output shows which VLANs the packet is being relayed between. The second part shows the packet, with destination and source MAC addresses separated from the payload of the packet.

Example

To enable the display of packets relayed by the VLAN relay entity SNARelay, use the command:

```
enable vlanrelay=snarelay debug
```

Related Commands

add vlanrelay
delete vlanrelay
disable vlanrelay debug
enable vlanrelay

purge lacp

Syntax

```
PURge LACP
```

Description

This command destroys all LACP configuration and restores the defaults to all the configurable parameters. The LACP parameters for all ports are reset to their defaults. This command returns the LACP module to the status that existed when first powered on.

Example

To purge the LACP configuration, use the command:

```
pur lacp
```

Related Commands

enable lacp
disable lacp
set lacp port

purge mstp

Syntax `PURge MSTp`

where:

- *instance* is

Description This command purges all configuration information relating to the MSTP module. All user created MSTIs will be destroyed. All VLANs will be mapped to the CIST. It will restore the default values to all the configurable parameters. This command returns the MSTP module to its status when the switch is first powered on.

Once the MSTP configuration is purged, MSTP will be disabled and return back to the initialised status.

Use with extreme caution, because all current configurations will be lost.

Example To purge the MSTP configuration, use the command:

```
purge mstp
```

Related Commands
show mstp
show mstp msti

purge stp

Syntax `PURge STP`

Description This command destroys all user created STPs, and restores the defaults to all the configurable parameters (**forwarddelay, hellotime, maxage and priority**) in the remaining default STP. The debug parameters for all ports are reset to their defaults. This command returns the STP module to its status when it is first powered on.

Example To purge all STPs, use the command:

```
purge stp
```

Related Commands
reset stp
set stp
set stp port
show stp
show stp counter

reset lacp port counter

Syntax `RESET LACP POrt[={`*`port-list`*`|ALL}] COUnter`

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 Ethernet switch port, including uplink ports.

Description This command resets all LACP counters for the specified switch ports.

The **port** parameter specifies the ports. If **all** is specified, all port counters in the switch are reset. The default value is **all**.

Examples To reset the LACP counters for all ports, use the command:

```
reset lacp po cou
```

Related Commands
purge lacp
show lacp port counter

reset mstp counter port

Syntax `RESET MSTp COUnter 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 Ethernet switch port, including uplink ports.

Description This command resets the counter value for a specified port or ports.

The **port** parameter specifies the ports. If **all** is specified, all port counters in the switch are reset. The default value is **all**.

Example To enable all ports in MSTI5, use the command:

```
reset mstp counter port=1
```

Related Commands
show mstp
show mstp cist port
show mstp msti port

reset stp

Syntax `RESET STP={`*`stp-name`*`|ALL}`

where *stp-name* is a character string 1 to 15 characters long.Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *stp-name* cannot be **all**.

Description This command resets operation of the Spanning Tree Algorithm for the specified STP, initialises all counters for the specified STP, and initialises all timers on all ports that are members of the STP. Ports remain in the state they were before the reset command was issued, for example, ports that were enabled remain enabled, ports that were disabled remain disabled.

Example To reset the *company* STP, use the command:

```
reset stp=company
```

Related Commands
purge stp
set stp
show stp
show stp counter

reset switch

Syntax `RESET SWItch`

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

Example To reset the switch module, use the command:

```
reset switch
```

Related Commands
show switch
show switch fdb

reset switch port

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

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 Ethernet switch port, including uplink ports.

Description This command resets a port or group of ports on the switch. All packets queued for reception or transmission on the port are discarded and switch port counters are reset to zero. If a port had been disabled at the hardware level with the **disable switch port** command on page 8-119, when it is enabled it is reset at the hardware level and autonegotiation of speed and duplex mode is activated. This command can be used to try to ensure that packets stuck in a queue are cleared, perhaps after a packet storm of some nature.

The **port** parameter specifies the ports to be reset.

The **counter** parameter specifies that switch port counters be reset only. If the **counter** parameter is not used, the switch port is fully reset.

Example To reset port 3, use the command:

```
reset switch port=3
```

Related Commands

disable switch port
enable switch port
show switch port

set lacp port

Syntax

```
SET LACP POrt=[{port-list|ALL}] [ADMinkey=key-number]
   [PRIOrity=priority] [MODe={ACTIve|PASsive}]
   [PERiodic={FASt|SLOw}]
```

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 Ethernet switch port, including uplink ports.
- *key-number* is a integer from 0 to 65535
- *priority* is a integer from 0 to 65535

Description

This command modifies the value of parameters for LACP ports.

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. Reference in the descriptions below to an individual port should be taken as a reference to all ports selected by the **port** parameter.

The **adminkey** parameter specifies the Admin LACP port key. This affects the LACP port key that is generated but does not determine its value. You can use this parameter to prevent ports from being aggregated when they might otherwise form a trunk. By default all ports that can be aggregated are given the same LACP port key. The default for **adminkey** is 1.

The **priority** parameter specifies the LACP port priority. This value is used to decide which ports should be selected when being added to a trunk group (where there are more links existing between the two devices than the switch is able to aggregate). The default is one. This means that port number governs which ports are selected (low port number equals high priority). Excess ports are put into a standby mode. In this mode they remain untrunked, but still able replace a link that goes down.

The **mode** parameter specifies whether the port runs in LACP passive or active mode. A port in passive mode sends an LACPDU in response to receiving one; whereas, a port in active mode sends LACPDUs at regular intervals as specified by the **periodic** parameter.

The **periodic** parameter specifies the rate at which the LACP port transmits updates. A port in fast mode transmits one LACPDU every second; a port in slow mode transmits one LACPDU every thirty seconds.

Related Commands

add lacp port
delete lacp port
show lacp port

set lacp priority

Syntax `SET LACP PRIOrity=`*`priority`*

where *priority* is an integer from 0 to 65535

Description This command modifies the relative priority of LACP enabled partners.

The **priority** parameter specifies a numeric value that is used as part of the system priority calculation. When systems with multiple links connect and use LACP to control link aggregation, each system compares its system priority data identifiers to determine which system should control the links. A system identifier comprises a system priority component (configured by this parameter) followed the system's MAC address. Link control is assigned to the system with the numerically *lower* system priority data identifier. The default is 32768.

Examples System A is to connect to system B using LACP and System B is to control their aggregated links.

System A has a MAC address of 00-00-cd-00-0d-42 and has been assigned an LACP PRIORITY value of 500. System B has a MAC address of 00-00-cd-00-0d-52.

In order to ensure that System B controls the links, its LACP PRIORITY must be set to a value **lower** than 500. The LACP PRIORITY on System B is therefore set to 300. Note that system control is determined by the values set by the LACP Priority values because these have a greater numeric significance than MAC Addresses.

```
set lacp prio=300
```

Related Commands **show lacp**

set mstp

Syntax

```
SET MSTp [CONFigname=name] [REVIsionlevel=level]
   [MAXHOPS=1..40] [MAxage=6..40] [HEllotime=1..10]
   [FOrwarddelay =4..30] [PROTocolversion ={STP|RSTP|
   MSTP}] [STATicvlans={YES|NO|ON|OFF|TRUE|FALSE}]
```

where:

- *name* is the MST configuration name. It is a string of up to 32 characters. Valid characters are uppercase and lowercase letters, digits, and the underscore. No other character types are allowed.
- *level* is the MST configuration revision level, having the range 0-65535.

Description

This command sets the MST configuration identifier values and the state machine performance parameters. The configuration identifier contains:

- the configuration name
- the revision number
- a digest of the VLAN to MSTI configuration table.

The state machine performance parameters are constants used by the CIST and MSTI state machines.

When the MST algorithm calculates the active topology, it doesn't consider the VLAN membership of the ports. It doesn't need to because IEEE 802.1Q-2003 assumes that the active topology will be determined first and that the VLANs will be configured dynamically over the active topology, via GVRP. GVRP configures the VLAN memberships of ports so that frames belonging to a VLAN will be able to traverse the spanning tree (CIST or MSTI) that the VLAN is assigned to.

When statically configured VLANs are used the process is reversed. The VLAN memberships of ports are configured statically and then the active topology is calculated. However, the MST algorithm does not consider the VLAN memberships when calculating the active topology; it may choose a port that is not a member of any of the VLANs assigned to the spanning tree to be the root port, even though an alternate port that is a member of the VLANs may exist. This would partition the network, preventing frames belonging to a VLAN assigned to the spanning tree from traversing the network. In this situation it is desirable that the algorithm considers the VLAN memberships of ports and prevents partitioning where possible. It should choose the root port from the ports that are members of the VLANs assigned to the spanning tree.

When using statically configured VLANs, each VLAN assigned to a given spanning tree should have the same port membership; otherwise, partitioning may occur.

The MST configuration identifier determines which MST region a switch belongs to. The MST configuration identifier is conveyed in the MSTP BPDUs, so the switch can check whether it is allocating VIDs to the same spanning tree instance as a neighbouring switch. If the configuration identification of two switches matches they are from the same MST region.

MSTP assigns the switch a default MST configuration identification consisting of a unique default configuration name and a default revision level.

The **configname** parameter specifies the name for the MST region. All the switches in the same MST region will have the same configuration name. If the configure name is not set explicitly by the command, the default name for the MST region is the switch's MAC address presented as text string. All switches are in their own MST region by default because MAC addresses are unique.

The **revisionlevel** parameter specifies the revision level in the MST region. All the switches in the same MST region will have the same revision number. If the revision level is not set explicitly by the command, the default revision level value will be 0.

The **forwarddelay** parameter sets a delay time, in seconds, that a port waits before changing its spanning tree state towards the forwarding state. Its purpose is to allow sufficient time for other ports to receive their spanning tree information. The delay determines the maximum time taken to transition from discarding to learning and from learning to forwarding. This value is only used when the switch is acting as the root bridge. Any switch not acting as the root bridge uses a dynamic value for the **forwarddelay** set by the root bridge. The **forwarddelay, maxage**, and **hellotime** parameters are interrelated. See the formulae below. The default for **forwarddelay** is 15 seconds.

The **hellotime** parameter sets the time period, in seconds, between the transmissions of spanning tree configuration messages. These messages are transmitted by ports with the 'designated port' role of the spanning tree, or are trying to become the root bridge. The default is 2 seconds.

The **maxage** parameter sets the maximum age, in seconds, that dynamic MSTP configuration information stored in the switch may reach before it is discarded. The default is 20 seconds.

The **forwarddelay**, **maxage**, and **hellotime** parameters should be set according to the following formulae, as specified in IEEE Standard 802.1d:

2 x (**forwarddelay** - 1.0 seconds) >= **maxage**

maxage >= 2 x (**hellotime** + 1.0 seconds)

The **maxhop** parameter specifies the maximum hop count in transmitting information within an MST region. This is in order to ensure that old information does not endlessly circulate through redundant paths in the network, thus preventing the effective propagation of the new information. The hop count is decremented by each receiving port. Received information is discarded and the port is made a designated port if the hop count reaches 0. The default value for **maxhop** is 20.

The **protocolversion** parameter specifies which version of the spanning tree protocol the switch uses.If **mstp** is specified, the switch uses the full Multiple Spanning Tree protocol and sends MSTI BPDUs. If RSTP is specified, the switch uses the Rapid Spanning Tree protocol and sends RST BPDUs. The switch operates as though it is in a region of its own. If STP is specified, the switch emulates the Spanning Tree Protocol and transmits STP configuration BPDUs. Rapid port state transitions are disabled, and the switch operates as if in a region of its own.

The **staticvlans** parameter should be turned on when the ports that link to other switches have static VLAN memberships. In simple static VLAN configurations it may be possible to operate with this option turned off provided that redundant links between any pair of switches have the same

VLAN memberships. If VLANs are being configured dynamically with GVRP, the **staticvlans** parameter should be set to **off** (**no**, or **false**). The default is **off**.

Example To set MST configuration name to mstRegion1 and the revision level to 10, use the command:

```
set mstp configname=mstregion1 revisionlevel=10
```

To set forward delay time to 20 seconds and max hop count to be 25, use the command:

```
set mstp fwddealy=20 maxhops=25
```

To set **staticvlans** to be **true**, use the command:

```
set mstp staticvlans=true
```

To set hello time to be 2 seconds and max message age to be 30 seconds, use the commands:

```
set mstp hellotime=2 maxage=30
```

Related Commands show mstp

set mstp cist

Syntax `SET MSTp CIST [PRIOrity=0..65535]`

Description This command sets parameters used by the MSTP algorithm to calculate the common internal spanning tree (CIST). The bridge level parameters of the CIST can be modified in order to force the spanning tree configuration, or tune its topology.

The **priority** parameter sets the priority of the switch to become the Root Bridge in the CIST. The lower the value of the bridge priority, the better the bridge identifier is and the more likely it is that the bridge will be selected as the root. Although any value between 0 and 65,535 can be specified, the protocol requires the priority to be multiples of 4096. Therefore, any value entered will be rounded down to its nearest multiple of 4096, see Table 8-19 on page 8-92. The default value for **priority** is 32768.

Example To set PRIORITY of 8192 to the CIST, use the command:

```
set mstp cist priority=8192
```

Related Commands **show mstp cist**
show mstp

set mstp cist port

Syntax

```
SET MSTp CIST POrt={port-list|ALL} [PRIOrity=0..255]
   [EXTPathcost=extPathCost] [INTPathcost=intPathCost]
   [EDGEport={YES|NO|ON|OFF|True|False}]
   [POINttopoint={YES|NO|ON|OFF|True|False|Auto}]
```

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 Ethernet switch port, including uplink ports.
- *extPathcost* is a value in the range 1 to 200,000,000
- *intPathcost* is a value from 1 to 200,000,000

Description

This command sets the common internal spanning tree (CIST) tuning parameters for the specified ports. Modifying parameters for a switch port will force a recalculation of the CIST port rules.

The parameters assigned for the specified ports will affect the network topology of only the CIST, and will not affect the topology other spanning tree instances on the switch.

The **port** parameter specifies a list of ports to be configured for the CIST. If **all** is specified, then all of the ports will be configured according to the new parameters for the CIST.

The **priority** parameter 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 CIST. The port with the lowest value is considered to have the highest priority and will be chosen as root port over a port - equivalent in all other aspects - but with a higher priority value. Any value in the range 0 to 255 can be entered, but the switch will round the entered value down to the nearest multiple of 16 (for example, if 17 is entered, 16 will be used). The default value is 128. See Table 8-28 on page 8-156.

The **extpathcost** parameter sets the external path cost for the ports. This parameter specifies a port's contribution to the cost of a path to the region containing the CIST root via that port. It applies when the port is a root port.

The **intpathcost** parameter sets the internal path cost for the ports. This parameter specifies a port's contribution to the cost of a path to the CIST regional root via that port. It applies when the port is a root port.

If the **extpathcost** or the **intpathcost** is not explicitly set by the user, or the default values have been restored to the port, then the default value for the port will vary as the speed of the port varies, See Table 8-29 on page 8-156. However, deleting an existing **extpathcost** or **intpathcost** value will not re-apply the "no value" condition. To re-apply the "no value" condition, enter the word "default."

The **edgeport** parameter specifies whether or not the port is an edge port. An edge port is a one that attaches to a LAN that is known to have no other bridges attached. If **no** is specified, then the port is not considered to be an edge port. The values **no, off** and **false** are equivalent. If **yes** is specified, then the port is considered to be an edge port. The values **yes, on,** and **true** are

equivalent. If **edgeport** is set to **yes** and an MSTP BPDU is received on the port, indicating that another bridge is connected to the LAN, then the port will no longer be treated as an edge port. The default is **no**. Edge ports are permitted to make rapid transitions to the forwarding state, because they are known not to be connected to another bridge and therefore cannot form part of a network loop. Edge ports that are not configured as such must make slow transitions to the forwarding state. For optimal convergence all edge ports should be identified and have **edgeport** set to **yes**. A port should be set to edge port only when it connects to a single end station.

The **pointtopoint** parameter specifies whether or not the port has a point-to-point connection to another bridge. If **auto** is specified, then the status of point-to-point link is determined automatically by the switch. If **yes** is specified, then the port will be treated as a point-to-point LAN segment. The values **yes, on** and **true** are equivalent. If **no** is specified, then the port will not be treated as a point-to-point LAN segment. The values **no, off** and **false** are equivalent. If the port is considered as a point-to-point port, then it is permitted to make rapid transitions to the forwarding state, providing it receives an agreement message from the bridge at the other end of the segment. A port should be set to point-to-point only when it connects exactly one other bridge. The default is **auto**.

Example To set port priority of 16 for port 2 in the CIST, use the command:

```
set mstp cist port=2 priority=16
```

To set external port path cost of 120 for port 2 in the CIST, use the command:

```
set mstp cist port=2 extpathcost=120
```

To set internal port path cost of 200 for port 2 in the CIST, use the command:

```
set mstp cist port=2 intpathcost=200
```

To set port 2 in the CIST as edge port, use the command:

```
set mstp cist port=2 edgeport=yes
```

To set port 2 in the CIST as point to point link, use the command:

```
set mstp cist port=2 pointtopoint=yes
```

Related Commands

show mstp cist
show mstp cist port

set mstp msti

Syntax `SET MSTp MSTI=`*`instance`* `[PRIOrity=0..65535]`

where *instance* is the instance number of a specific MSTI in a range from 1 to 4094.

Description This command sets parameters used by the Multiple Spanning Tree algorithm to calculate the spanning tree for a specified MSTI. The bridge level parameters of the MSTI can be modified in order to tune the spanning tree topology.

The **msti** parameter specifies the instance number for the specified Multiple Spanning Tree Instance.

The **priority** parameter sets the priority of the switch to become the Root Bridge in the specified MSTI. The lower the value of the bridge priority, the better the bridge identifier is, and the more likely the bridge could be selected as a root bridge. Although any value between 0 and 4096 can be specified, the switch will only process values that are multiples of 4096. Therefore, any value entered will be rounded down to its nearest multiple of 4096, see Table 8-19 on page 8-92. The default value for **priority** is 32768.

Example To set the **priority** to 8192 to MSTI5, use the command:

```
set mstp msti=5 priority=8192
```

Related Commands **show mstp**
show mstp msti

set mstp msti port

Syntax

```
SET MSTp MSTI=instance POrt={port-list|ALL}
   [PRIOrity=0..255] [PAthcost=pathCost]
```

where:

- *instance* is the instance number of the specified MSTI in a range from 1 to 4094.
- *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 Ethernet switch port, including uplink ports.
- *pathcost* is a value in the range 1 to 200,000,000.

Description

This command sets tuning parameters for the specified ports or all ports for the specified multiple spanning tree instance (MSTI). Modifying parameters for a port will force a recalculation of the port roles for the specified **msti**.

The parameters assigned for the specified ports will only affect the network topology of the specified **msti**, not any other spanning tree instances on the switch.

The **msti** parameter specifies the instance number for the selected **msti**.

The **port** parameter specifies a list of ports to be configured for the specified **msti**. If **all** is specified, all of the ports will be configured according to the new parameter values for the specified **msti**.

The **priority** parameter 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 specified **msti**. The port with the lowest value is considered to have the highest priority and will be chosen as root port over a port - equivalent in all other aspects - but with a higher priority value. Any value in the range 0 to 255 can be entered, but the switch will round the entered value down to the nearest multiple of 16 (for example, if 17 is entered, 16 will be used). The default value is 128. See Table 8-28 on page 8-156.

Table 8-28: Rounding scheme for ranges of port priority parameter values .

Lower Boundary	Upper Boundary	Rounded Port Priority Value
0 0	15	0
16	31	16
32	47	32
48	63	48
64	79	64
80	95	80
96	127	96
128	143	128
144	159	144
160	175	160
176	191	176
192	207	192
208	223	208
224	239	224
240	254	240

The **pathcost** parameter sets the internal path cost for the each port. This parameter specifies a port's contribution to the cost of a path to the MSTI regional root via that port. It applies when the port is a root port. The **pathcost** for a LAN port should be set in the range of 1 to 200000000. The default **pathcost** values and the range of recommended **pathcost** values depend on the port speed.

If the **pathcost** of a port has not been explicitly set by the user, or the default values have been restored to the port, then the default **pathcost** for the port will vary as the speed of the port varies. However, deleting an existing **pathcost** value will not reapply the "no value" condition. To reapply the "no value" condition, enter the word "default".

Table 8-29: Path cost values and port speed

Port Speed	Default pathcost	Recommended pathcost range
Less than 100 Kb/s	200,000,000	20,000,000-200,000,000
1Mbps	20,000,000	2,000,000-20,000,000
10Mbps	2,000,000	200,000-2,000,000
100 Mbps	200,000	20,000-200,000
1 Gbps	20,000	2,000-20,000
10 Gbps	2,000	200-2, 000
100 Gbps	200	20-200
1Tbps	20	2-200
10 Tbps	2	2-20

Example To set port priority of 120 for port 2 in MSTI5, use the command:

```
set mstp msti=5 port=2 priority=120
```

To set port path cost of 200 for port 2 in MSTI5, use the command:

```
set mstp msti=5 port=2 pathcost=120
```

Related Commands

show mstp msti
show mstp msti port

set stp

Syntax

```
SET STP={stp-name|ALL} [FOrwarddelay=4..30]
   [HEllotime=1..10] [MAxage=6..40] [MODe={STANDARD|
   RAPid}] [PRIOrity=0..65535] [RSTPtype={NORMAL|
   STPCompatible}]

SET STP={stp-name|ALL} DEFault
```

where *stp-name* is a character string 1 to 15 characters long.Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *stp-name* cannot be **all**.

Description

This command sets parameters used by the Spanning Tree Algorithm for the specified STP. If **all** is specified, then parameters for all STPs on the switch are set. When **all** is specified and the command succeeds on a subset of STPs but causes errors on the others, then the command as a whole fails and has no effect. Each STP has its own independent **forwarddelay**, **hellotime**, **maxage**, and **priority** parameters.

The **default** parameter sets the **forwarddelay**, **hellotime**, **maxage** and **priority** parameters back to their defaults. This parameter cannot be specified with either of the **forwarddelay**, **hellotime**, **maxage** or **priority** parameters.

The **forwarddelay** parameter sets the time in seconds to control how fast a port changes its spanning tree state when moving towards the forwarding state. If the mode is set to standard, the value determines how long the port stays in each of the listening and learning states which precede the forwarding state. If the mode is set to rapid, this value determines the maximum time taken to transition from discarding to learning and from learning to forwarding. This value is used only when the switch is acting as the root bridge. Switches not acting as the Root Bridge use a dynamic value for the **forwarddelay** set by the root bridge. The **forwarddelay**, **maxage**, and **hellotime** parameters are interrelated. See the formulas below. The default for **forwarddelay** is 15 seconds.

The **hellotime** parameter sets the time in seconds between the transmission of switch spanning tree configuration information when the switch is the Root Bridge of the spanning tree or is trying to become the Root Bridge. The default is 2 seconds.

The **maxage** parameter sets the maximum time in seconds that dynamic STP configuration information is stored in the switch before it is discarded. The default is 20 seconds.

The **forwarddelay**, **maxage** and **hellotime** parameters should be set according to the following formulae, as specified in IEEE Standard 802.1d:
2 x (**forwarddelay** - 1.0 seconds) >= **maxage**
maxage >= 2 x (**hellotime** + 1.0 seconds)

The **mode** parameter specifies whether the STP operates in standard or rapid mode. In standard mode, the Spanning Tree Algorithm is run. In rapid mode, the Rapid Spanning Tree Algorithm is run. The default is **standard**. If the mode is changed while the algorithm is running, the STP is reinitialised.

If the **mode** parameter has been set to **rapid**, values specified for the **priority** parameter must be multiples of 4096. If a value is specified that is not a

multiple of 4096, the value is rounded down to the nearest multiple of 4096. The rounding scheme is defined in Table 8-30.

Table 8-30: Rounding scheme for ranges of **priority** parameter values when the **mode** parameter is set to **rapid**

Lower boundary	Upper boundary	Rounded RSTP Bridge Priority Value
0	4095	0
4096	8191	4096
8192	12287	8192
12288	16383	12288
16384	20479	16384
20480	24575	20480
24576	28671	24576
28672	32767	28672
32768	36863	32768
36864	40959	36864
40960	45055	40960
45056	49151	45056
49152	53247	49152
53248	57343	53248
57344	61439	57344
61440	65535	61440

The **priority** parameter sets the priority of the switch to become the Root Bridge. The lower the value of the Bridge Identifier, the higher the priority. If the **priority** parameter is set by specifying the **priority** or **default** parameters, the specified STP is initialised. Counters for the STP are not affected. The default for **priority** is 32768.

The **rstptype** parameter specifies how the RSTP algorithm operates. If **normal** is specified, then the algorithm uses rapid port role transitions and transmits and receives RST BPDUs. If **stpcompatible** is specified, then rapid transitions are disabled, standard BPDUs are transmitted and RST BPDUs are discarded. Setting **rstptype** to **stpcompatible** allows RSTP to support applications and protocols that may be sensitive to frame duplication and misordering, for example NetBeui. The default is **normal**.

Setting **rstptype** to **normal** when normal has already been set, sets all ports to the "sending RSTP" state. This is referred to in the IEEE Standard 802.1w standard as *mCheck* and is useful for restoring full rapid mode operation when one or more ports on the switch has entered the "sending STP" state. RSTP-capable devices with **rstp** set to **normal** that receive the RST BPDUs enter the "sending RSTP" state. When an STP BPDU is received after the mCheck operation, either as a result of a device being in rapid mode with **rstptype** set to **stpcompatible** or as a result of a device in standard mode, the ports that received the STP BPDUs revert to the "sending STP" state.

Examples To set the forward delay to 22 seconds for the *company* STP, use the command:

```
set stp=company forwarddelay=2
```

To set the hello time to 3 seconds for the *company* STP, use the command:

```
set stp=company hellotime=3
```

To set the maximum age to 19 seconds for the *company* STP, use the command:

```
set stp=company maxage=19
```

To set the priority of the switch becoming the Root Bridge to 100 for the *company* STP, use the command:

```
set stp=company priority=100
```

To set the Forward Delay to 12 seconds for all STPs, assuming the **forwarddelay-maxage** criterion is met for all STPs, use the command:

```
set stp=all forwarddelay=12
```

To set the parameters for the *company* STP to their defaults, use the command:

```
set stp=company default
```

Related Commands

purge stp
reset stp
set stp port
show stp

set stp port

Syntax

```
SET STP[={stp-name|ALL}] POrt={port-list|ALL}
   [Pathcost=pathcost] [PORTPRIority=0..255]
   [EDGEport={YES|NO|ON|OFF|True|False}] [PTP={Auto|ON|
   OFF|YES|NO|True|False}]

SET STP[={stp-name|ALL}] POrt={port-list|ALL} DEFault
```

where:

- *stp-name* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.
- *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 Ethernet port, including uplink ports.
- *pathcost* is a value from 1 to 1,000,000 if STP is running in standard mode, and 1 to 200,000,000 if STP is running in rapid mode.

Description

This command sets various parameters used by the Spanning Tree Algorithm for the specified ports, or all ports within the specified STP, or all STPs.

A port can belong to a single STP, except on the Rapier *i* series switches. This means that when the port is member of multiple VLANs, all these VLANs must belong to the same STP.

On the Rapier *i* Series switches only, a port can belong to multiple STPs when the port is a member of more than one VLAN.

The STP parameter specifies an STP name. If no parameter is entered, the default is **all**.

Non-default STP parameter values configured for a port are not retained when the VLAN to which the port belongs is moved to another STP by using the **add stp vlan** or **delete stp vlan** commands.

The **port** parameter specifies a list of ports that can belong to any STP. The default is **all**.

The **default** parameter sets the **pathcost** and **portpriority** parameters back to their defaults. This parameter cannot be specified with either of the **pathcost** and **portpriority** parameters. The **edgeport** and **ptp** parameters are not affected by this command.

The **pathcost** parameter sets the path cost for each port. The **pathcost** for a LAN port should be set to a maximum of 1,000,000 in standard mode and 200,000,000 in rapid mode. If the port is to be the root port then this value determines the total cost from the switch to the Root Bridge. Each STP has its own independent **pathcost** parameter for each member port. The default **pathcost** values and the range of recommended **pathcost** values depend on the port speed and mode (see Table 8-31 on page 8-162 and Table 8-32 on page 8-162).

Table 8-31: Path cost values and port speed for standard mode

Port Speed	Default pathcost	Recommended pathcost range
10Mbps	100	50 - 600
100Mbs	19	10 -60
1Gbps	4	3 -10

Table 8-32: Path cost values and port speed for rapid mode

Port Speed	Default pathcost	Recommended pathcost range
Less than 100 Kb/s	200000000	20000000-200000000
1Mbps	20000000	2000000-20000000
10Mbps	2000000	200000-2000000
100 Mbps	200000	20000-200000
1 Gbps	20000	2000-20000
10 Gbps	2000	200-2000
100 Gbps	200	20-200
1Tbps	20	2-200
10 Tbps	2	2-20

When STP mode is changed from standard to rapid, or rapid to standard, then the **pathcost** parameter is mapped from one range to the other based on relative deviation from the nearest default. We recommend that the **pathcost** values be checked when changing mode to confirm that they are appropriate for the network configuration.

If the **pathcost** of a port has not been explicitly set by the user or the defaults have been restored to the port, then the default **pathcost** for the port varies as the speed of the port varies.

IEEE Standard 802.1d, limited the range of the path cost parameter to a 16-bit unsigned integer value. The recommended path cost values for rapid mode, IEEE Standard 802.1w, make use of the full 32-bit range available in BPDUs. The recommended values for an intermediate link speed can be calculated as 20000000000/(Link Speed in KB/s). This means that the accumulated Path Cost values cannot exceed 32 bits over a concatenation of 20 hops. In LANs where the recommended values defined in IEEE Standard 802.1d and IEEE Standard 802.1w are required to interwork, one set of path cost values must be reconfigured so that they are the same. The range of path costs that can be configured in an older bridge is insufficient to accommodate the range of data rates available.

The **portpriority** parameter sets the value of the priority field contained in the port identifier. The Spanning Tree Algorithm uses the port priority when determining the root port for each switch. The port with the lowest value is considered to have the highest priority. The default is 128. Each STP has its own independent **portpriority** parameter for each member port.

If the STP mode is rapid, then the values specified for the **portpriority** parameter must be multiples of 16. If a user specifies a value that is not a multiple of 16, it is rounded down to the nearest multiple of 16. The rounding scheme is identified in Table 8-33 on page 8-163.

Table 8-33: Rounding scheme for **portpriority** value when the mode is rapid

Lower boundary	Upper boundary	Rounded Value
0	15	0
16	31	16
32	47	32
48	63	48
64	69	64
80	95	80
96	111	96
112	127	112
128	143	128
144	159	144
160	175	160
176	191	176
192	207	192
208	223	208
224	239	224
240	255	240

The **edgeport** parameter specifies whether the port is an edge port. An edge port is a port that attaches to a LAN that is known to have no other bridges attached. If **no** is specified, then the port is not considered to be an edge port. The values **no**, **off**, and **false** are equivalent. If **yes** is specified, then the port is considered to be an edgeport. The values **yes, on**, and **true** are equivalent. If **edgeport** is set to **yes** and an RST BPDU is received on the port, which indicates that another bridge is connected to the LAN, then the port is no longer treated as an edge port. The default is **no**. If STP is running in rapid mode, then the rapid transition of a port to the forwarding state depends on the port being considered an edgeport or part of a Point-to-Point link.

The **ptp** parameter specifies whether the port has a point-to-point connection with another bridge. If **auto** is specified, then the point-to-point status of the port is determined automatically by the switch. If **yes** is specified, then the port is treated as a point-to-point LAN segment. The values **yes**, **on**, and **true** are equivalent. If **no** is specified, then the port is not treated as a point-to-point LAN segment. The values **no**, **off**, and **false** are equivalent. If STP is running in rapid mode, then the rapid transition of a port to the forwarding state depends on the port being considered an edgeport or part of a Point-to-Point link. The default is **auto**.

Examples

To set a port priority of 42 for port 10 in STP1, use the command:

```
set stp=1 port=10 portpriority=42
```

To set a path cost of 120 for all ports on all STPs, use the command:

```
set stp=all port=all pathcost=120
```

To set the port parameters for ports 1 to 10 in STP3 to their standard defaults, use the command:

```
set stp=3 port=1-10 default
```

To set port 10 in STP3 as an edgeport, use the command:

```
set stp=3 port=10 edgeport=yes
```

To force port 10 in STP3 to be treated as if it were part of a point to point LAN segment, use the command:

```
set stp=3 port=10 ptp=yes
```

Related Commands

purge stp
reset stp
set stp
show stp

set switch ageingtimer

Syntax

```
SET SWItch AGEingtimer=10..1000000
```

Description

This command sets the threshold value, in seconds, of the ageing timer, after which a dynamic entry in the Layer 2 forwarding database is automatically removed. The maximum setting of 1 000 000 seconds is approximately 11 days 13 hours. The default is 300 seconds (5 minutes).

Example

To set the ageing timer to 180 seconds (3 minutes), use the command:

```
set switch ageingtimer=180
```

Related Commands

disable switch ageingtimer
enable switch ageingtimer
show switch

set switch hwfilter classifier

Syntax

```
SET SWItch HWFilter CLASSifier=classifier-list
   [ACtion={SETPRIORITY|SENDCOS|SETTOS|DENY|SENDEPORT|
   SENDMIRROR|MOVEPRIOTOTOS|MOVETOSTOPRIO|SETIPDSCP|
   SENDNONUNICASTTOPORT|NODROP|FORWARD}[,...]]
   [NEWIPDscp=0..63] [NEWTos=0..7]
   [NOMATCHAction={SETPRIORITY|SENDCOS|SETTOS|DENY|
   SENDEPORT|SENDMIRROR|MOVEPRIOTOTOS|MOVETOSTOPRIO|
   SETIPDSCP|SENDNONUNICASTTOPORT|FORWARD}[,...]]
   [NOMATCHDscp=dscp-value] [NOMATCHPOrt=port-number]
   [NOMATCHPRiority=0..7] [NOMATCHTos=0..7]
   [POrt=port-number] [PRIOrity=0..7]
```

where:

- *classifier-list* is either an integer from 1 to 9999; a range of integers (specified as 1-4), or a comma-separated list of classifier numbers and/or ranges (1, 3, 4-9).
- *port-number* is the switch port number from 1 to *m* where *m* is the highest numbered Ethernet switch port, including uplink ports.

Description

This command sets the properties of hardware-based filters based on the specified classifier(s). All of the specified classifiers must exist and must already be incorporated into a filter entry. The **switch hwfilter classifier** commands may not be used with the **switch l3filter** commands.

On the Rapier *i* Series switches only, a port can belong to multiple STPs when the port is a member of more than one VLAN. On the Rapier Series switches, a port can belong to a single STP. This means that when the port is member of multiple VLANs, all these VLANs must belong to the same STP.

The **action** parameter specifies a comma-separated list of actions to take when a packet matches the filter criteria specified in this entry. If **setpriority** is specified, the packet's 802.1p priority is set to the value specified by the **priority** parameter. If **sendcos** is specified, the packet is sent to the priority queue specified by the **priority** parameter. If **settos** is specified, the packet's TOS (Type of Service) field is set to the value specified by the **newtos** parameter. If **deny** is specified, the packet is discarded. If **sendeport** is specified and the frame is not a broadcast, multicast, DLF frame or marked for dropping or to be sent to the CPU, the new output port is set to the value of the **port** parameter. If **sendmirror** is specified, the packet is sent to the mirror port. If **forward** is specified, the packet is forwarded using the default Class of Service (priority). The default is **forward**. On the Rapier *i* Series switches only the following additional parameter options are available. If **movepriototos** is specified, the IP TOS field in the frame is replaced with the 802.1 priority value. If **movetostoprio** is specified, the 802.1 priority field in the frame is replaced with the IP TOS value, this also determines the egress priority queue. If **setipdscp** is specified and the frame is an IPv4 frame, the Diffserv Codepoint field in the frame is set to the value specified by the **newipdscp** parameter. Actions that modify both the IP TOS and IP DSCP values in the frame are mutually exclusive. If **sendnonunicasttoport** is specified, matching frames that are broadcast or DLF, multicast, marked for dropping or to be sent to the CPU are sent to the egress port specified by the **port** parameter. If **nodrop** is specified, matching frames previously marked for dropping are not dropped.

If the **sendeport** action directs packets to a particular egress port, then the packet is transmitted from the mirror port with a VLAN tag.

On the Rapier *i* Series switches only, the **newipdscp** parameter indicates the value to set in an IPv4 packet Diffserv CodePoint field when the **action** parameter is set to **setipdscp**. The range of values for this parameter is from 0 to 63.

The **newtos** parameter specifies the new type of service value, assigning a new value to the TOS precedence field in the IP Header. This parameter is used only when the **action** parameter is set to **settos**.

On the Rapier *i* Series switches only, the **nomatchaction** parameter specifies a comma-separated list of actions to take when a frame matches both the **iport** and **eport** values (if they are specified in the match) on an associated entry but there is no match for the frame contents. If **setpriority** is specified, the packet's 802.1p priority is set to the value specified by the **priority** parameter. If **sendcos** is specified, the packet is sent to the priority queue specified by the **priority** parameter. If **settos** is specified, the packet's TOS (Type of Service) field is set to the value specified by the **newtos** parameter. If **deny** is specified, the packet is discarded. If **sendeport** is specified and the frame is not a broadcast, multicast, DLF frame or marked for dropping or to be sent to the CPU, the new output port is set to the value of the **port** parameter. If **sendmirror** is specified, the packet is sent to the mirror port. If **forward** is specified, the packet is forwarded using the default Class of Service (priority). If **movepriototos** is specified the IP TOS field in the frame is replaced with the 802.1 priority value. If **movetostoprio** is specified, the 802.1 priority field in the frame is replaced with the IP TOS value, this also determines the egress priority queue. If **setipdscp** is specified and the frame is an IPv4 frame, the Diffserv Codepoint field in the frame is set to the value specified by the **newipdscp** parameter. Actions that modify both the IP TOS and IP DSCP values in the frame are mutually exclusive. If **sendnonunicasttoport** is specified, matching frames that are broadcast or DLF, multicast, marked for dropping or to be sent to the CPU are sent to the egress port specified by the **port** parameter. The default is **forward**.

The **nomatchdscp** parameter indicates the value to set in an IPv4 packet Diffserv CodePoint field when the **nomatchaction** parameter is set to **setipdscp**. The range of values for this parameter is from 0 to 63. This parameter is only available on Rapier *i* Series switches.

The **nomatchport** parameter specifies the new output port number. This port overrides the egress port selected by the forwarding database. This parameter is only available on Rapier *i* Series switches.

The **nomatchpriority** parameter specifies the packet priority. There are eight levels of priority, from 0 to 7. This parameter is used only when the **nomatchaction** parameter is set to **setpriority** or **sendcos**. This parameter is only available on Rapier *i* Series switches.

The **nomatchtos** parameter specifies the new type of service value, assigning a new value to the TOS precedence field in the IP Header. This parameter is used only when the **nomatchaction** parameter is set to **settos**. This parameter is only available on Rapier *i* Series switches.

The **port** parameter specifies the new output port number. This port overrides the egress port selected by the forwarding database.

The **priority** parameter specifies the packet priority. There are eight levels of priority from 0 to 7. This parameter is used only when the **action** parameter is set to **setpriority** or **sendcos**.

Examples To change the hardware packet filter that acts on traffic matched by classifier 1 so that it to denies this traffic, use the command:

```
set switch hwfilter classifier=1 action=deny
```

To set the transmit priority on all packets matching Classifier 100 to 3, and set the transmit priority on packets that partially match this classifier to 0, use the command:

```
set switch hwfilter classifier=100 action=sendcos
   nomatchaction=sendcos priority=3 nomatchpriority=0
```

This functionality is available on Rapier i Series switches only.

Related Commands
add switch hwfilter classifier
delete switch hwfilter classifier
show switch hwfilter

set switch l3ageingtimer

Syntax

```
SET SWItch L3Ageingtimer=[30..43200]
```

Description This command sets the threshold value of the ageing timer for dynamic entries in the Layer 3 forwarding database. After a cycle of this timer, entries not used during the cycle remain in the table but their hit bits are reset to zero. After the next cycle, entries with hit bit still set to zero are deleted. Therefore, entries in the table are deleted when they are unused during two consecutive cycles of the timer. The default is 900 seconds.

This command can be executed only when the hardware forwarding entry ageing timer is enabled by using the **enable switch ageingtimer** command. This ageing timer is enabled by default.

Examples To set the threshold of the Layer 3 forwarding table ageing timer to 30 minutes, use the command:

```
set switch l3ageingtimer=1800
```

Related Commands
disable switch ageingtimer
enable switch ageingtimer
show switch

set switch l3filter entry

Syntax

```
SET SWItch L3Filter=filter-id ENTry=entry-id
   [ACTION={SETPRIORITY|SENDCOS|SETTOS|DENY|SENDEPORT|
   SENDMIRROR|MOVEPRIOTOTOS|MOVETOSTOPRIO|SETIPDSCP|
   SENDNONUNICASTTOPORT|FORWARD}[,...]] [DIPADDR=ipadd]
   [EPORT=port-number] [IPORT=port-number]
   [NEWIPDSCP=0..63] [NEWTOS=0..7] [PORT=port-number]
   [PRIORITY=0..7] [PROTOCOL={TCP|UDP|ICMP|IGMP|protocol}]
   [SIPADDR=ipadd] [TCPACK={TRUE|FALSE}]
   [TCPDPORT=port-id] [TCPFIN={TRUE|FALSE}]
   [TCPSPORT=port-id] [TCPSYN={TRUE|FALSE}] [TOS=0..7]
   [TTL=0..255] [TYPE=protocol-type] [UDPSPORT=port-id]
   [UDPDPORT=port-id]
```

where:

- *filter-id* is a decimal number in the range 1 to the number of filters defined.
- *entry-id* is a decimal number in the range 1 to the number of entries defined.
- *ipadd* is an IP address in dotted decimal notation.
- *port-number* is the switch port number from 1 to *m* where *m* is the highest numbered Ethernet switch port, including uplink ports.
- *protocol* is an IP protocol number from 1 to 255.
- *port-id* is an IP port number.
- *protocol-type* is a valid protocol-type number. A protocol type number is 2 bytes for Ethernet type II and 802.3 (DSAP/SSAP) encapsulation, or 5 bytes for SNAP encapsulation, and is specified in hexadecimal.

Description

This command modifies the selector values for an existing filter entry. The **l3filter** and **entry** parameters specify the number of the filter and the filter entry to be modified, respectively. Filter and filter entry numbers are in the output of the **show switch l3filter** command on page 8-220. The **switch hwfilter classifier** commands may not be used with the **switch l3filter** commands.

On the Rapier *i* Series switches only, a port can belong to multiple STPs when the port is a member of more than one VLAN. On the Rapier Series switches, a port can belong to a single STP. This means that when the port is member of multiple VLANs, all these VLANs must belong to the same STP.

The **action** parameter specifies a comma-separated list of actions to take when a packet matches the filter criteria specified in this entry. If **deny** is specified, the packet is discarded. If **forward** is specified, the packet is forwarded using the default Class of Service (priority). If **sendcos** is specified, the packet is sent to the priority queue specified by the **priority** parameter. If **sendeport** is specified, the new output port is set to the value of the **port** parameter. If **sendmirror** is specified, the packet is sent to the mirror port. If **setpriority** is specified, the packet's 802.1p priority is set to the value specified by the **priority** parameter. If **settos** is specified, the packet's **tos** (Type of Service) field is set to the value specified by the **newtos** parameter. The default is **forward**. On the Rapier *i* Series switches only, the following additional parameter options are available. If **movepriototos** is specified, the **ip tos** field in the frame is replaced with the 802.1 priority value. If **movetostoprio** is specified, the 802.1 priority field in the frame is replaced with the **ip tos** value, this also determines

the egress priority queue. If **nodrop** is specified, matching frames previously marked for dropping are not dropped. If **sendeport** is specified and the frame is not a broadcast, multicast, DLF frame or marked for dropping or to be sent to the CPU, the new output port is set to the value of the **port** parameter. If **sendnonunicasttoport** is specified, matching frames that are broadcast or DLF, multicast, marked for dropping or to be sent to the CPU are sent to the egress port specified by the **port** parameter. If **setipdscp** is specified and the frame is an IPv4 frame, the Diffserv Codepoint field in the frame is set to the value specified by the **newipdscp** parameter. Actions that modify both the TOS and DSCP values in the frame are mutually exclusive. The default is **forward**.

The **dipaddr** parameter specifies the destination IP addresses to match.

The **eport** parameter specifies the egress port number to be matched by this filter entry, if the **emport** parameter in the filter match is set to **true**. The default is no port, that is, the filter entry does not apply to any egress ports. If the **emport** parameter in the filter match is set to **false**, the **eport** parameter is ignored, and the filter entry applies to all egress ports.

The **iport** parameter specifies the ingress port number to be matched by this filter entry, if the **import** parameter in the filter match is set to **true**. The default is no port, that is, the filter entry does not apply to any ingress ports. If the **import** parameter in the filter match is set to **false**, the **iport** parameter is ignored, and the filter entry applies to all ingress ports.

On the Rapier *i* Series switches only, the **newipdscp** parameter indicates the value to set in an IPv4 packet Diffserv CodePoint field when the **action** parameter is set to **setipdscp**. The range of values for this parameter is from 0 to 63.

The **newtos** parameter specifies the new type of service value, assigning a new value to the TOS precedence field in the IP Header. This parameter is used only when the **action** parameter is set to **settos**.

The **port** parameter specifies the new output port number. This port overrides the egress port selected by the forwarding database.

The **priority** parameter specifies the new packet priority. There are eight levels of priority from 0 to 7. This parameter is used only when the **action** parameter is set to **setpriority** or **sendcos**.

The **protocol** parameter specifies the IP protocol to match.

The **sipaddr** parameter specifies the source IP address to match.

The **tcpack** parameter specifies the ACK (acknowledgement) flag in the TCP header to match when the protocol is TCP. This parameter is required when **tcpack** is specified in the **add** or **set switch l3filter match** parameter, otherwise it is invalid.

The **tcpdport** parameter specifies the destination TCP port to match when the protocol is TCP.

The **tcpfin** parameter specifies the FIN flag in the TCP header to match when the protocol is TCP. This parameter is required when **tcpfin** is specified in the **add** or **set switch l3filter match** parameter, otherwise it is invalid.

The **tcpsport** parameter specifies the source TCP port to match, if the protocol is TCP.

The **tcpsyn** parameter specifies the SYN flag in the TCP header to match, if the protocol is TCP. This parameter is required if **tcpsyn** is specified in the **add** or **set switch l3filter match** parameter, otherwise it is invalid.

The **tos** parameter specifies the type of service to match.

The **ttl** parameter specifies the *Time to Live* to match.

The **type** parameter specifies a protocol-type number to match. The number is entered in hexadecimal, e.g. 0800 for an Ethernet type II IP packet. This parameter may not be used with any other packet field matching criteria, nor may it be used with the **settos** action. With all other packet matching criteria there is an implicit match to an IP protocol Ethernet type II packet.

The **udpdport** parameter specifies the UDP destination port to match, if the protocol is UDP.

The **udpsport** parameter specifies the UDP source port to match, if the protocol is UDP.

Example To modify entry 2 of filter 1 to match UDP port 23, use the command:

```
set switch l3filter=1 entry=2 prot=udp tcpdport=23
```

Related Commands

add switch l3filter entry
delete switch l3filter entry
show switch l3filter

set switch l3filter match

Syntax

```
SET SWItch L3Filter=filter-id MAtch={DIPaddr|IPDSCP|
   PROTocol|SIPaddr|TCPAck|TCPFin|TCPDPORT|TCPSPORT|
   TCPSYN|TOS|TTL|UDPDPORT|UDPSPORT}[,...] [DCLass={A|B|C|
   Host}] [EMPort={Yes|No|ON|OFF|True|False}]
   [IMPort={Yes|No|ON|OFF|True|False}]
   [NOMATCHAction={SETPRIORITY|SENDCOS|SETTOS|DENY|
   SENDEPORT|SENDMIRROR|MOVEPRIOTOTOS|MOVETOSTOPRIO|
   SETIPDSCP|SENDNONUNICASTTOPORT|FORWARD}[,...]]
   [NOMATCHDscp=0..63] [NOMATCHPOrt=port-number]
   [NOMATCHPRiority=0..7] [NOMATCHTos=0..7] [SClass={A|B|
   C|HOST}] [TYpe={802|Ethii|Snap}]
```

where:

- *filter-id* is a decimal number in a range from 1 to the number of filters defined.
- *port-number* is the switch port number from 1 to m where m is the highest numbered Ethernet switch port, including uplink ports.

Description

This command modifies an existing filter that specifies matching filter criteria for the packet filtering mechanism. The **l3filter** parameter specifies the number of the filter to be modified. Filter numbers are displayed in the output of the **show switch l3filter** command on page 8-220. The **switch hwfilter classifier** commands may not be used with the **switch l3filter** commands.

On the Rapier *i* Series switches only, a port can belong to multiple STPs when the port is a member of more than one VLAN. On the Rapier Series switches, a port can belong to a single STP. This means that when the port is member of multiple VLANs, all these VLANs must belong to the same STP.

The **match** parameter specifies a comma-separated list of packet fields and/or types to match. There is no default.

The **dclass** parameter specifies the IP destination address mask to apply to the destination IP address field in packets when matching destination IP addresses. If A is specified, a Class A mask of 255.0.0.0 is used. If B is specified, a Class B mask of 255.255.0.0 is used. If C is specified, a Class C mask of 255.255.255.0 is used. If **host** is specified, a host mask of 255.255.255.255 is used.

The **emport** parameter specifies whether the filter applies to all egress ports or to a particular egress port specified in a filter entry. If **no, off**, or **false** is specified, the filter is applied to all egress ports. If **yes, on,** or **true** is specified, the filter is applied to the egress port specified by the **eport** parameter in the **add** or **set switch l3filter entry** command. The default is **false**, meaning the filter applies to all egress ports.

The **import** parameter specifies whether the filter applies to all ingress ports or to a particular ingress port specified in a filter entry. If **no**, **off**, or **false** is specified, the filter is applied to all ingress ports. If **yes**, **on**, or **true** is specified, the filter is applied to the ingress port specified by the **iport** parameter in the **add** or **set switch l3filter entry** command. The default is **false**, meaning the filter applies to all ingress ports.

On the Rapier *i* Series switches only, the **nomatchaction** parameter specifies a comma-separated list of actions to take when a frame matches both the **iport**

and **eport** values (if they are specified in the match) on an associated entry but there is no match for the frame contents. If **setpriority** is specified, the packet's 802.1p priority is set to the value specified by the **priority** parameter. If **sendcos** is specified, the packet is sent to the priority queue specified by the **priority** parameter. If **settos** is specified, the packet's TOS (Type of Service) field is set to the value specified by the **newtos** parameter. If **deny** is specified, the packet is discarded. If **sendeport** is specified and the frame is not a broadcast, multicast, DLF frame or marked for dropping or to be sent to the CPU, the new output port is set to the value of the **port** parameter. If **sendmirror** is specified, the packet is sent to the mirror port. If **forward** is specified, the packet is forwarded using the default Class of Service (priority). If **movepriototos** is specified, the IP TOS field in the frame is replaced with the 802.1p priority value. This also determines the egress priority queue. if **setipdscp** is specified and the frame is an IPv4 frame, the Diffserv Codepoint field in the frame is set to the value specified by the **newipdscp** parameter. Actions that modify both the IP TOS and the IP DSCP values in the frame are mutually exclusive. If **sendnonunicasttoport** is specified, matching frames that are broadcast or DLF, multicast, marked for dropping or to be sent to the CPU are sent to the egress port specified by the **port** parameter. The default is **forward**.

The **nomatchdscp** parameter indicates the value to set in an IPv4 packet DiffServe CodePoint field if the **nomatchaction** parameter is set to **setipdscp**. The range of values for this parameter is from 0 to 63. This parameter is only available on Rapier *i* Series switches.

The **nomatchport** parameter specifies the new output port number. This port overrides the egress port selected by the forwarding database. This parameter is only available on Rapier *i* Series switches.

The **nomatchpriority** parameter specifies the packet priority. There are eight levels of priority, from 0 to 7. This parameter is used only when the **nomatchaction** parameter is set to **setpriority** or **sendcos**. This parameter is only available on Rapier *i* Series switches.

The **nomatchtos** parameter specifies the new Type of Service value, assigning a new value to the TOS precedence field in the IP header. This parameter is used only when the **nomatchaction** parameter is set to **settos**. This parameter is only available on Rapier *i* Series switches.

The **sclass** parameter specifies the IP source address mask to apply to the source IP address field in packets when matching source IP addresses. If A is specified, a Class A mask of 255.0.0.0 is used. If B is specified, a Class B mask of 255.255.0.0 is used. If C is specified, a Class C mask of 255.255.255.0 is used. If **host** is specified, a host mask of 255.255.255.255 is used.

The **type** parameter specifies the format of the protocol-type. This parameter may be used with the **emport** and **import** parameters, but not with the other packet matching criteria. When other criteria are used, there is an implicit match to an IP protocol Ethernet type II packet. If 802 is specified, then the match is on the 2-byte DSAP/SSAP field of an 802.3 packet. If **ethii** is specified, then the match is on the 2-byte type field of an Ethernet type II packet. If **snap** is specified, then the match is on the 5-byte variable part of the identifier field of a SNAP packet (SNAP identifiers have the format *aa-aa-03-xx-xx-xx-xx-xx*).

Example To modify filter 1 to match UDP port, use the command:

```
set switch l3filter=1 match=udpdport,prot
```

Related Commands

add switch l3filter entry
add switch l3filter match
delete switch l3filter
show switch l3filter

set switch mirror

Syntax

`SET SWItch MIRRor={NONE|`*port*`}`

where *port* is a single switch port number. Port numbers start at 1 and end at *m*, where *m* is the highest numbered Ethernet switch port.

Description

This command sets the mirror port for the switch, and removes it from the default VLAN. If another port was previously set as the mirror port, this command returns it to the default VLAN as an untagged port. The mirror port is the one where mirrored traffic is sent. Configure the source of mirror traffic with the **set switch port** command on page 8-174.

Port mirroring does not duplicate packets. If one mirrored packet is captured in different ports, only one copy of the packet is sent to the mirror port.

If a packet is Layer 3 switched and mirrored, then the packet is always transmitted from the mirror port with a VLAN tag.

The **mirror** parameter specifies the switch port where mirror traffic is to be sent. The specified port must belong only to the default VLAN as an untagged or tagged port. The port cannot be part of a trunk group. If the value **none** is specified, no mirror port is defined for the switch and mirroring is disabled. The mirror port cannot be added to any VLAN.

Example

To set the mirror port to port 12, use the command:

```
set switch mirror=12
```

Related Commands

disable switch mirror
enable switch mirror
set switch port
show switch
show switch port

set switch port

Syntax

```
SET SWItch POrt={port-list|ALL} [ACCeptable={ALL|VLAN}]
   [BCLimit={NONE|limit}] [DESCription=description]
   [DLFLimit={NONE|limit}] [EGResslimit={NONE|DEFault|0|
   1000..127000|8..1016}] [INFILTering={OFF|ON}]
   [INGresslimit={NONE|DEFAULT|0|64..127000|8..1016}]
   [LEARn={NONE|0|1..256] [INTRusionaction={DISable|
   DIScard|TRap}] [MCLimit={NONE|limit}] [MIRRor={BOTH|
   NONE|RX|TX}] [MODe={AUTOnegotiate|MASTer|SLAve}]
   [MULTicastmode={A|B|C}] [SPeed={AUTOnegotiate|10MHALF|
   10MFULL|10MHAUTO|10MFAUTO|100MHALF|100MFULL|100MHAUTO|
   100MFAUTO|1000MHALF|1000MFULL|1000MHAUTO|1000MFAUTO}]
```

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 Ethernet port, including uplink ports.
- *limit* is a decimal number, from 0 to the maximum value of the limit variable based on the particular switch hardware. The maximum packet storm protection limit is 262143.
- *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.

The **port** parameter specifies the ports for which parameters are modified. When the command succeeds on a subset of the specified ports but causes errors on the others, then the command as a whole fails and has no effect. Reference in the descriptions below to an individual port should be taken as a reference to all ports selected by the **port** parameter. If packet storm protection limits are set on the switch, the **port** parameter must specify complete processing blocks (see the note after the **bclimit** parameter description).

While the user may specify **set switch port** commands using groups of ports, the **create config** command on page 5-22 of Chapter 5, Managing Configuration Files and Software Versions generates a separate **set switch port** command for each port.

The **acceptable** parameter sets the Acceptable Frame Types parameter, in the Ingress Rules, which controls reception of VLAN-tagged and VLAN-untagged frames on the port. If **all** is specified, then the Acceptable Frame Types parameter is set to Admit All Frames. If VLAN is specified, the parameter is set to Admit Only VLAN-tagged Frames, and any frame received that carries a null VLAN Identifier (VID) is discarded by the ingress rules. Untagged frames and priority-tagged frames carry a null VID. Untagged frames admitted according to the **acceptable** parameter have the VID of the VLAN for which the port is untagged associated with them. The **acceptable** parameter can be set only when the port is untagged for one VLAN. In this case, the default is **all**, admitting all tagged and untagged frames. If the port is tagged for all the VLANs to which it belongs, the **acceptable** parameter is automatically set to VLAN, and cannot be changed to admit untagged frames.

The **bclimit** parameter specifies a limit on the rate of reception of broadcast packets for the port(s). The value of this parameter represents a per second rate of packet reception above which packets are discarded for broadcast packets. If

the value **none** or 0 is specified, then packet rate limiting for broadcast packets is turned off. If another value is specified, the reception of broadcast packets is limited to this number. See the note below for important information about packet rate limiting. The default is **none**.

Limiting packet reception rates for different classes of packets depends on the particular switch hardware. In particular, groups of ports may have to have the same limits set, and the same limit may be set for the different types of packets, depending on the hardware. When packet rate limits are set on switches with this type of constraint, the most current parameter values supersede earlier ones. When a command for specific ports changes parameters for other ports, a message reports these changes.

Packet storm protection limits cannot be set for each individual port on the switch, but can be set for each processing block of ports. The processing blocks are sets of 8 ports (e.g. as many as are applicable of ports 1-8, 9-16 and 17-24) and each uplink port is a further processing block. Therefore, a 16-port switch has four processing blocks and a 24-port switch has five. The two uplink ports are numbered sequentially after the last port, and therefore are 17 and 18 for a 16-port and 25 and 26 for a 24-port switch. Only one limit can be set per processing block, and then applies to all three packet types. Thus each of the packet types are either limited to this value, or unlimited (**none**).
For the Rapier G6 series switches, each port is a processing block, and therefore packet storm protection limits can be set for each port individually.

The **description** parameter can be used to describe the port. It is displayed by the **show switch port** command on page 8-222, but does not affect the operation of the switch in any way. The default is no description.

The **dlflimit** parameter specifies a limit on the rate of reception of destination lookup failure packets for the port. The value of this parameter represents a per second rate of packet reception above which packets will be discarded for destination lookup failure packets. If the value **none** or 0 is specified, then packet rate limiting is turned off for these packets. If another value is specified, the reception of these packets is limited to this number. See the note after the **bclimit** parameter description for important information about packet rate limiting. The default is **none**. If packet storm protection limits are set on the switch, the **port** parameter must specify complete processing blocks.

A destination lookup failure packet is one for which the switch hardware does not have a record of the destination address of the packet, either Layer 2 or Layer 3 address. These packets are passed to the CPU for further processing, so limiting the rate of reception of these packets may be a desirable feature to improve system performance.

On the Rapier *i* Series switches only, the **egresslimit** parameter specifies the maximum bandwidth for traffic egressing a specific port in kbps (10/100 Mbps ports) or Mbps (Gigabit ports). If **none** or 0 (zero) is specified, egress limiting is disabled for the specified port. For 10/100 Mbps ports the input value (1000..127000) in kbps is rounded up to the nearest 1000 (or 1 Mbps). For Gigabit ports the input value (8..1016) in Mbps is rounded up to the nearest 8 Mbps. The default is **none**.

The **infiltering** parameter enables or disables Ingress Filtering of frames admitted according to the **acceptable** parameter, on the specified ports. Each port on the switch belongs to one or more VLANs. If **infiltering** is set to **on**, Ingress Filtering is enabled; frames received on a specified port are admitted when the port belongs to the VLAN with which the frames are associated. Conversely, frames are discarded when the port does not belong to the VLAN

with which the frames are associated. Untagged frames admitted by the **acceptable** parameter are admitted since they have the numerical VLAN Identifier (VID) of the VLAN for which the port is an untagged member. If **off** is specified, Ingress Filtering is disabled, and no frames are discarded by this part of the Ingress Rules. The default is **off**. Ingress filtering is supported only for ports that are members of trunk groups on Rapier i and Rapier G Series switches.

On the Rapier *i* Series switches only, the **ingresslimit** parameter specifies the maximum bandwidth for traffic ingressing a specific port in kbps (10/100 Mbps ports) or Mbps (Gigabit ports). If **none** or 0 (zero) is specified, ingress limiting is disabled for the specified port. For 10/100 Mbps ports the input value (64..127000) in kbps is rounded up to the nearest 64kbps if below 1000, otherwise it is rounded up to the nearest 1000 (or 1 Mbps). For Gigabit ports the input value (8..1016) in Mbps is rounded up to the nearest 8 Mbps. The default is **none**.

The **intrusionaction** parameter specifies the action taken when the port receives packets from addresses that are not part of the learned list of addresses as specified by the **learn** parameter. If **discard** is specified, packets are discarded that come from MAC addresses not on the port's learn list. If **trap** is specified, these packets are discarded and an SNMP trap is generated. If **disable** is specified, the packet is discarded the first time it is received, an SNMP trap is generated, and the port is disabled. To re-enable the port, disable the Port Security function on the port. The default is **discard**.

The **learn** parameter specifies whether the security feature of limiting the number of MAC addresses learned on this port is enabled. If **none** or zero is specified, all MAC addresses are learned on this port and the Port Security function is disabled. When a port has been automatically disabled by the switch's port security, setting the Learn parameter to 0 (zero) re-enables it. If a number from 1 to 256 is specified, the switch stops learning MAC addresses on this port when the number of MAC addresses is reached, and the port is locked. If the **learn** parameter is set to a value lower than the number of MAC addresses currently learned, then the port is unlocked if previously locked, all learned MAC addresses are cleared from the forwarding database for the port, and learning restarts. Packets from other addresses after this time are handled as intrusion packets (see the **intrusionaction** parameter). The default is **none**.

Learned addresses on locked ports can be saved as part of the switch configuration and become part of the configuration after a power cycle by using the **create config** command on page 5-22 of Chapter 5, Managing Configuration Files and Software Versions. If the configuration is not saved when there is a locked list for a port, the learning process begins again after the router is restarted.

The **mclimit** parameter specifies a limit on the rate of reception of multicast packets for the port. The value of this parameter represents a per second rate of packet reception above which packets are discarded for multicast packets. If the value **none** or 0 is specified, then packet rate limiting for multicast packets is turned off. If another value is specified, the reception of multicast packets is limited to this number. See the note after the **bclimit** parameter description for important information about packet rate limiting. The default is **none**. If packet storm protection limits are set on the switch, the **port** parameter must specify complete processing blocks.

The **mirror** parameter specifies the role of these ports as a source of mirror traffic. Be aware that four or more ports set to mirror traffic to the mirror port may significantly reduce switch performance. If **none** is specified, no traffic

received or sent on these ports is mirrored. If RX is specified, all traffic received on these ports is mirrored. If TX is specified, all traffic transmitted is mirrored. If **both** is specified, all traffic received and transmitted is mirrored. Traffic is mirrored only when a mirror port is defined and mirroring is enabled. The default is **none**.

The **multicastmode** parameter indicates how the switch handles traffic addressed to a multicast group to which the specified port or list of ports belongs. If A is specified, all traffic is flooded on all ports on the VLAN, irrespective of whether the ports have joined the multicast group. The effect of this option is to disable IGMP snooping without disabling IGMP. (See Chapter 24, IP Multicasting). If B is specified, the traffic is sent to ports that have joined the multicast group unless no ports have joined, in which case the traffic is flooded on all ports on the VLAN. If C is specified, the traffic is sent to ports that have joined the multicast group; if no ports have joined, the traffic is discarded. This option allows the manager more control over who receives traffic. The default is B.

The **mode** parameter applies to gigabit copper interfaces only. It forces the interface to operate in master or slave mode by setting it to **master** or **slave**. This is not typically required and should be used when the link partner does not support autonegotiation of master/slave mode. The default is **autonegotiate**.

The **speed** parameter specifies the configured line speed and duplex mode of the port(s) (Table 8-34 on page 8-177.) If **autonegotiate** is specified, the port autonegotiate the highest mutually possible line speed and duplex mode with the link partner. If **10mfauto, 10mhauto, 100mfauto, 100mhauto, 1000mfauto**, or **1000mhauto** is specified, the port autonegotiates with the link partner and accepts operation at the specified speed and duplex mode. If **10mhalf, 10mfull, 100mhalf, 100mfull, 1000mhalf**, or **1000mfull** is specified, then autonegotiation is disabled and the interface must operate at the specified speed and duplex mode regardless of whether the link partner is capable of working at that speed. When a port is included in a trunk group, it must operate at the speed specified for the trunk group and in full duplex mode. This speed is selected by autonegotiation with the link partner. If the port is removed from the trunk group, the previously configured speed and duplex mode are restored. The default is **autonegotiate**. Gigabit fibre ports can operate at 1000Mbit/s full duplex, and gigabit copper ports on some units can only operate at 1000MBit/s half or full duplex.

Table 8-34: **switch port speed** values

Value	Meaning
10MHALF	10 Mbps, half duplex, fixed
10MFULL	10 Mbps, full duplex, fixed
10MHAUTO	10 Mbps, half duplex, autonegotiate
10MFAUTO	10 Mbps, full duplex, autonegotiate
100MHALF	100 Mbps, half duplex, fixed
100MFULL	10 Mbps, full duplex, fixed
100MHAUTO	100 Mbps, half duplex, autonegotiate
100MFAUTO	10 Mbps, full duplex, autonegotiate
1000MHALF	1000 Mbps, half duplex, fixed
1000MFULL	1000 Mbps, full duplex, fixed

Table 8-34: **switch port speed** values (Continued)

Value	Meaning
1000MHAUTO	1000 Mbps, half duplex, autonegotiate
1000MFAUTO	1000 Mbps, full duplex, autonegotiate

If you override a port's autonegotiation on Rapier i Series switches by setting it to a fixed speed/duplex setting, automatic MDI/MDI-X detection is also overridden. The port defaults to MDI-X.

Examples To set the speed of port 5 to 10Mbps, half duplex, use the command:

```
set switch port=5 speed=10mhalf
```

To limit the rate of destination lookup failure packets to 1000 packets per second for the processing block of ports 17-24, use the command:

```
set switch port=17-24 dlflimit=1000
```

To accept only VLAN-tagged frames on port 2, use the command:

```
set switch port=2 acceptable=vlan
```

To set the maximum bandwidth for port 1to 512Kbps, use the command:

```
set switch port=1 maxbandwidth=512
```

Related Commands

disable switch port
enable switch port
show switch port

set switch qos

Syntax `SET SWItch QOS=P0,P1,P2,P3,P4,P5,P6,P7`

where *P0-P7* 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.

On the Rapier *i* Series switches only, this command also updates the Quality of Service module Hardware Priority settings (see the **set qos hwpriority** command on page 35-32 and the **show qos hwpriority** command on page 35-39 in Chapter 35, Quality of Service (QoS) on Switch Ports.

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 switch has four QOS egress queues. Its default QOS values are 1,0,0,1,2,2,3,3 as shown in Table 8-35 on page 8-179.

Packets that originate on the switch or are routed by the switch'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 8-35: Default priority level to queue mapping for four QOS egress queues

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

Example To set the mapping shown in Table 8-36 on page 8-179, use the command:

```
set switch qos=0,0,0,1,1,2,2,3
```

Table 8-36: Example priority level to QOS egress queue mapping

Priority level	Queue
0	0
1	0
2	0
3	1

Table 8-36: Example priority level to QOS egress queue mapping (Continued)

Priority level	Queue
4	1
5	2
6	2
7	3

Related Commands show switch qos

set switch trunk

Syntax

```
SET SWItch TRunk=trunk [SELect={MACSrc|MACDest|MACBoth|
   IPSrc|IPDest|IPBoth}] [SPeed={10M|100M|1000M}]
```

where *trunk* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

Description This command sets parameters for the specified trunk group on the switch.

The **trunk** parameter specifies the name of the trunk group. The name is not case sensitive. The name uniquely identifies the trunk group. The specified trunk group must already exist.

The **select** parameter specifies the port selection criterion for the trunk group. Each packet to be sent on the trunk group is checked by using the selection criterion, and a port in the trunk group is chosen to send the packet. If **macsrc** is specified, the source MAC address is used. If **macdest** is specified, the destination MAC address is used. If **macboth** is specified, both source and destination MAC addresses are used. If **ipsrc** is specified, the source IP address is used. If **ipdest** is specified, the destination IP address is used. If **ipboth** is specified, both the source and destination IP addresses are used. The user of the switch should choose the value of this parameter to try to spread the load as evenly as possible on the trunk group. The default for this parameter is **macboth**.

The **speed** parameter specifies the speed of the ports in the trunk group. For gigabit fibre ports, only the **1000m** value is allowed. For gigabit copper ports, **10m**, **100m**, and **1000m** values are allowed except that the uplink bays of some units are not 10/100M capable. For 10/100 switch ports, **10m** and **100m** values are allowed. The default is 100M. When a port is added to a trunk group, its current speed and duplex mode settings are ignored and the port uses the speed of the trunk group and full duplex mode. The ports that are members of the trunk group are constrained to autonegotiate to the trunk speed only.

Example To set the speed of a trunk group called Trunk1 to 100 Mbps, use the command:

```
set switch trunk=trunk1 speed=100m
```

Related Commands add switch trunk
create switch trunk
delete switch trunk
destroy switch trunk
show switch trunk

set vlan port

Syntax

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

where:

- *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* 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 switch Ethernet 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 of the VLAN or the numerical VLAN Identifier 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. When the command succeeds on a subset of the specified ports but causes errors 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 the specified VLAN include a VLAN tag header. If **frame** is set to **untagged**, the port becomes an untagged port for the specified VLAN, and the **acceptable** switch parameter for the port is set to **all**. The user can then change the **acceptable** parameter for the port. **frame** may only be set to **untagged** when the port was previously a tagged port in the same VLAN, and is not an **untagged** port of another VLAN. If **frame** is set to **tagged**, then the port becomes a tagged port for the VLAN and the **acceptable** switch parameter for the port is set to VLAN. The user cannot change the **acceptable** parameter for the tagged port. **frame** can be set to **tagged** only when the ports were previously untagged ports in the same VLAN.

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 lacp

Syntax `SHow LACP`

Description This command displays the state of LACP on the switch.

Figure 8-16: Example output from the **show lacp** command

```
LACP Information
----------------------------------------------------------------
Status ......................... Enabled
   Actor System Priority ........... 80-00
   Actor System .................... 00-3e-0a-12-00-01
   LACP Ports ...................... 1-3,5,7,9-12
      Active ....................... 1-3,5
      Passive ...................... 7,9-12
```

Table 8-37: Parameters in output of the **show lacp** command

Parameter	Description
Status	Whether LACP is enabled.
Priority	User-configurable priority of the system. This parameter is concatenated with the Actor System parameter to generate the Actor System ID.
Actor System	MAC address of the local system.
LACP Ports	A list of ports currently under LACP control.
Active	A list of ports currently in LACP Active mode.
Passive	A list of ports currently in LACP Passive mode.

show lacp port

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

where *port-list* is a port number, range (specified as *n-m*), or a comma-separated list of port 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 displays LACP information about a specific switch port or all of them (Figure 8-17).

Figure 8-17: Example output from the **show lacp port** command

```
LACP Port Information
--------------------------------------------------------------------------------
Actor Port ....................... 1
  Trunk Group ..............  lacp1       Partner Information
  Selected ................. Selected    Partner System Priority ........ 8000
  Port Priority .................8000    Partner System      00-3e-0a-12-00-01
  LACP Port Number ............. 0001     Port Key ..........................4
  Port Key ... ......................6    Port Priority ................... 500
    Admin Key ..................... 12    Port Number ..................... 0002
  Mode ........................ Active    Mode ......................... Active
  Periodic..................... Fast      Periodic........................ Fast
  Individual ...................... No     Individual ....................... No
  Synchronised ..................Yes      Synchronised ..................Yes
  Collecting ....................Yes      Collecting ....................Yes
  Distributing .................. Yes     Distributing ..................... Yes
  Defaulted ....................... No     Defaulted ........................ No
  Expired ......................... No     Expired .......................... No
  Actor Churn................. .....No
  Partner Churn................. ...No
--------------------------------------------------------------------------------
```

Table 8-38: Parameters in output of the **show lacp port** command

Parameter	Meaning
Port	Number of the port.
Trunk Group	Name of trunk group to which the port belongs. It is a name that LACP has automatically assigned to an aggregated link.You cannot manually create a trunk starting with the letters LACP. If LACP created, then the name has the prefix LACP followed by a numeric, such as LACP72. This number is the same as the new interface index shown by the **show interface** command.
Priority	User-configurable priority assigned to the port.
LACP Port Number	LACP encoded port number.
Port Key	Key that LACP has assigned to the port.
Admin Key	User-configurable key assigned to the port.
Mode	The participation mode. If active, the port sends LACPDU packets regardless of the partner port's participation. If passive, the port sends LACPDU packets after receiving one from its partner port.
Periodic	User-configurable time period between transmission of periodic LACPDU packets; one of "Fast" (1 second) or "Slow" (30 seconds).

Table 8-38: Parameters in output of the **show lacp port** command (Continued)

Parameter	Meaning
Individual	User-configurable setting that determines whether the port is an individual. If no, the port may be aggregated; if yes, it is not aggregated.
Synchronised	If yes, the port is considered to be in a synchronised state—the port has been correctly associated with an aggregator.
Collecting	Whether this port has been enabled to receive packets.
Distributing	Whether this port has been enabled to transmit packets.
Defaulted	Whether this system is using defaults for the partner information. If no, the values have been received from the partner via a LACPDU.
Expired	The port has not received a frame from its partner for 3 times the periodic time (3 or 90 seconds).
Actor Churn	Whether churning of the actor port has been detected.
Partner Churn	Whether churning of the partner port has been detected.
Partner Information	Information that has been received about the partner port. The partner port is the port on the connected device.
Partner System Priority	Partner's system priority.
Partner System	Partner's system identifier.
Port Key	Partner port's key.
Port Priority	Partner port's key priority.
Port Number	Partner port's port number.
Mode	Whether the mode is active or passive. If active, the partner port sends LACPDU packets regardless of this port's participation. If passive, the partner port sends LACPDU packets only after receiving one from this port.
Periodic	The setting of the partner port for the time period between transmission of periodic LACPDU packets; one of "Fast" (1 second) or "Slow" (30 seconds).
Individual	The setting of the partner port determining whether the port is an individual. If no, the partner port is not an individual and may be aggregated; if yes, it cannot be aggregated.
Synchronised	If yes, the partner system considers the partner port to be in a synchronised port—the port has been correctly associated with an aggregator; otherwise, no.
Collecting	Whether the partner port has been enabled for receiving packets.
Distributing	Whether the partner port has been enabled for transmitting packets.
Defaulted	Whether the partner system is using the defaults for this port's information. If no, the values have been received from this system via a LACPDU. If yes, the defaults are still in use.
Expired	When the partner port has not received a frame for 3 times the periodic time (3 or 90 seconds).

Examples To show the LACP port information for all ports, use the command:

```
sh lacp po
```

Related Commands

add lacp port
delete lacp port
set lacp port
show lacp

show lacp port counter

Syntax

```
SHow LACP POrt[={port-list|ALL}] COUnter
```

where *port-list* is a port number, range (specified as *n-m*), or a comma-separated list of port 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 displays LACP counters for the specified switch ports, or all switch ports.

Figure 8-18: Example output from the **show lacp port counter** command

```
LACP Port Counters
-------------------------------- ------------------------------------------------
-
Port 1
  Received:                                  Transmitted
  LACP Pkts....................... 0        LACP Pkts ....................... 0
  Invalid LACP Pkts............... 0
--------------------------------------------------------------------------------
```

Table 8-39: Parameters in output of the **show lacp port counter** command

Parameter	Meaning
Received	Counters for LACP frames received
LACP Pkts	The number of valid LACPDU frames received
Invalid LACP Pkts	The number of invalid LACP packets received. This includes those with an invalid type/length field, subtype field, actor information length field, partner information length field, collector information length field, terminator information length field, or invalid frame length.
Transmitted	Counters for LACP packet transmitted.
LACP Pkts	The number of LACPDU frames transmitted.

Examples

To show the LACP port counters for all ports, use the command:

```
sh lacp po cou
```

Related Commands

reset lacp port counter
show lacp
show lacp port

show lacp trunk

Syntax `SHow LACP TRunk`

Description This command displays the currently dynamically configured trunks for the LACP module.

Figure 8-19: Example output from the **show lacp trunk** command

```
LACP Dynamic Trunk Group Information
--------------------------------------------------------------------------------

Trunk group name .......... lacp53:
   Speed ..................... 100 Mbps
   Ports in Trunk .......... 10,15
   LAG ID:
   [(8000,00-00-cd-03-00-79,0005,00,0000),(8000,00-00-cd-08-76-60,0002,00,0000)]
 --------------------------------------------------------------------------------
```

Related Commands **show lacp trunk**
show lacp

show mstp

Syntax `SHow MSTp [CONFIGID] [TAble]`

Description This command displays information about MSTP. See Figure 8-20 on page 8-187, and Table 8-40 on page 8-187.

If the **configid** parameter is specified, the MST Configuration Identification is displayed as shown in Figure 8-21 on page 8-188, and Table 8-41 on page 8-188.

If the **table** parameter is specified, the MST Configuration Table that contains the map between MSTIs and VLANs is displayed as shown in Figure 8-22 on page 8-188, and Table 8-42 on page 8-188.

Figure 8-20: Example output from the **show mstp** command

```
MSTP Information
--------------------------------------------------------------------------------
MSTP Status ................................ Enabled
MST Configuration Name ..................... mstRegion1
MST Revision Level ......................... 0
Number of MSTIs ............................ 10
Hello Time ................................. 2
Forward Delay .............................. 15
Max Message Age ............................ 100
Max Hops ................................... 5
Protocol Version ........................... MSTP
Support Static VLANs ....................... Enabled
Transmission Limit ......................... 3
Migrate Time ............................... 8
--------------------------------------------------------------------------------
```

Table 8-40: Parameters in output of the **show mstp** command

Parameter	Description
MSTP Status	Whether MSTP is enabled.
MST Configuration Name	Name of the MST region.
MST Revision Level	Revision level of the MST region.
Number of MSTIs	Number of Multiple Spanning Tree instances.
Protocol Version	Spanning Tree Protocol version: STP, RSTP, or MSTP.
Max Hops	Maximum hop count in transmitting information within an MST region
Transmission Limit	Number of bridge protocol messages (BPDUs) that may be transmitted in the interval specified by Hello Time
Migrate Time	A constant timer value used as the initial value of the migration delay. The value of Migrate Time is 3 seconds
Hello Time	The seconds between transmissions of spanning tree configuration information (BPDUs)
Forward Delay	Number of seconds that controls how fast a port changes its spanning tree state when moving towards the forwarding state
Max Message Age	Maximum age of received bridge protocol message (BPDU) information before it is discarded
Support Static VLAN	Whether a supporting static VLAN configuration is enabled.

Figure 8-21: Example output from the **show mstp configid** command

```
MST Configuration Identification
--------------------------------------------------------------------------------
Configuration Name ..................... mstRegion1
Format Selector ........................ 0
Revision Level ......................... 12
Configuration Digest ................... AC36177F50283CD4B83821D8AB26D8AB
--------------------------------------------------------------------------------
```

Table 8-41: Parameters displayed in the output of the **show mstp configid** command

Option	Description
Configuration Name	The name of the MST region
MST Configuration Name	A Configuration Identifier Format Selector
MST Revision Level	The revision level of the MST region
Configuration digest	A 16 octet signature of type HMAC-MID5 created from the MST Configuration Table

Figure 8-22: Example output from the **show mstp table** command

```
MST Configuration Table
--------------------------------------------------------------------------------
Multiple Spanning Tree Instance        VLAN Members
--------------------------------------------------------------------------------
CIST                                   15-19,31-4094
MSTI 1                                 1,2,10,20-30
MSTI 2                                 3-9
MSTI 3                                 11-14
--------------------------------------------------------------------------------
```

Table 8-42: Parameters displayed in the output of the **show mstp cist** command

Option	Description
Multiple Spanning Tree Instance	The instance of a spanning tree, the instance is either a CIST or an MSTI
VLAN Members	A list of the VLANs that are mapped to a specified MSTI

Example To show information about MSTP, use the command:

```
show mstp
```

Related Commands

enable mstp
disable mstp
create stp
destroy mstp msti
add mstp msti vlan
delete mstp msti vlan
set mstp
set mstp cist
set mstp msti

show mstp cist

Syntax `SHow MSTp CIST`

Description This command displays the information about the Common Internal Spanning Tree (Figure 8-23 on page 8-189, Table 8-43 on page 8-189).

Figure 8-23: Example output from the **show mstp cist** command

```
Common Internal Spanning Tree
--------------------------------------------------------------------------------
Bridge Identifier..............................32768 : 00-00-cd-05-19-28
Bridge Role....................................Root Bridge
VLAN Members...................................1, 2-10, 20
CIST Root Bridge...............................32768 : 00-00-cd-05-19-28
CIST Regional Root Bridge......................32768 : 00-00-cd-05-19-28
Designated Bridge..............................32768 : 00-00-cd-05-19-28
Root Port......................................N/A
External Root Path Cost........................0
Internal Root Path Cost........................0
Performance:
  Max Age......................................20
  Hello Time...................................2
  Forward Delay................................20
  Max Hops.....................................5
  Bridge Max Age...............................20
  Bridge Hello Time............................20
  Bridge Forward Delay.........................20
  Bridge Max Hops..............................20
  Transmission Limit...........................3
Topology Changes:
  Time Since Topology Change.....................100
  Topology Change Count..........................3
  Topology Change................................FALSE
--------------------------------------------------------------------------------
```

Table 8-43: Example output from the **show mstp cist** command

Parameter	Meaning
Bridge Identifier	The unique bridge identifier of the switch. This parameter consists of two parts, one part is derived from the switch's unique MAC Address, and the other part is the priority value entered for the switch.
Bridge Role	The role of the bridge in the CIST. This can be either, the root bridge regional root bridge or designated bridge.
VLAN Members	A list of the VLANs that are mapped to the Multiple spanning tree instance specified.
CIST Root Bridge	The bridge identifier of the CIST Root of the bridged local area network.
CIST Regional Root Bridge	The bridge identifier of the root bridge for the CIST in an MST region (MSTR).
Designated Bridge	The bridge identifier of the bridge through which the root bridge may be reached from this device.

Table 8-43: Example output from the **show mstp cist** command

Parameter	Meaning
Root Port	The port number of the root port for the switch. This parameter is not valid if the switch is the root bridge. In this situation the output will be shown as N/A.
External Root Path Cost	The path cost to the region containing the CIST root from this region.
Internal Root Path Cost	The path cost to the CIST Regional Root.
Max Age	The maximum age of received bridge protocol message (BPDU) information before it is discarded.
Hello Time	The time, in seconds, between transmissions of spanning tree configuration information (BPDUs)
Forward Delay	The maximum time taken to transition from the discarding state to the learning state, and from the learning state to the forwarding state.
Max Hops	Specifies the maximum hop count within an MST region for CIST information transmitted from this switch.
Bridge Max Age	The value of the Max Age parameter when the switch is either the root or is attempting to become the root. This parameter is set by the **maxage** parameter in the **set mstp** command.
Bridge Hello Time	The value of the Hello Time parameter when the switch is the root or is attempting to become the root. This parameter is set by the **hellotime** parameter in the **set mstp** command.
Bridge Forward Delay	The value of the Forward Delay parameter when this switch is the root or is attempting to become the root. This parameter is set by the **forwarddelay** parameter in the **set mstp** command.
Bridge Max Hops	The value of the Max Hops parameter when the switch is either the root or is attempting to become the root. This parameter is set by the **maxhops** parameter in the **set mstp** command.
Transmission Limit	The number of BPDUs that may be transmitted in the interval specified by the **hellotime** parameter. The value of this fixed parameter is 3.
Time Since Topology Change	The count in seconds of the time elapsed since the last topology changed.
Topology Change Count	The number of times the topology has changed since the bridge was powered or initialised.
Topology Change	Indicates whether the topology is in the middle of changing.

Example To display the current CIST information, use the command:

```
show mstp cist
```

Related Commands

disable mstp
enable mstp
set mstp cist
set mstp cist port
enable mstp cist port
disable mstp cist port

show mstp cist port

Syntax `SHow MSTp CIST 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 Ethernet switch port, including uplink ports.

Description This command displays the port information about the common internal spanning tree (CIST). See Figure 8-24 on page 8-191, and Table 8-44 on page 8-191.

The **port** parameter specifies the ports to display. If **all** is specified, all ports in the switch are displayed.

Figure 8-24: Example output from the **show mstp cist port** command

```
CIST Port Information
--------------------------------------------------------------------------------
Port Number.............................1
  Port Identifier.......................127:1
  Port Role.............................Designated Port
  Port State............................Forwarding

Port Number.............................2
  Port Identifier.......................127:2
  Port Role.............................Designated Port
  Port State............................Forwarding

Port Number.............................3
  Port Identifier.......................127:3
  Port Role.............................Designated Port
  Port State............................Forwarding
--------------------------------------------------------------------------------
```

Table 8-44: Parameters displayed in the output of the **show mstp cist port** command

Parameter	Meaning
Port Number	The number of the port in the switch.
Port Identifier	The unique identifier of the port. This parameter consists of two parts, one part is the port number, and the other is the priority configured for the port.
Port Role	The role of the port, this can be either; Disabled, Alternate, Backup, Designated, or Root.
Port State	The state of the port, this can be either; Disabled, Discarding, Learning, or Forwarding.

Figure 8-25: Example output from the **show mstp cist port** command

```
CIST Port Information
--------------------------------------------------------------------------------
Port Number.............................1
  Port Identifier.......................128:1
  Port Role.............................Disabled Port
  Port State............................Discarding
  Switch Port State.....................Enabled
  Link Status...........................Down
  Port Path Cost........................200000
  External Port Path Cost...............200000
  Designated Bridge.....................32768 : 00-00-cd-08-35-e0
  Designated Port.......................128:1
  Regional Root Path Cost...............0
  External Root Path Cost...............0
  Edge Port.............................No
  Point to Point Link...................Yes (Auto)
  Boundary Port.........................Yes
--------------------------------------------------------------------------------
```

Table 8-45: Parameters displayed in the output of the **show mstp cist port** command

Parameter	Meaning
Port Number	The number of the port in the switch.
Port Identifier	The unique identifier of the port. This parameter consists of two parts, one part is the port number, and the other is the priority configured for the port.
Port Role	The role of the port, this can be either; Disabled, Alternate, Backup, Designated, or Root.
Port State	The state of the port. The state can be either; Disabled, Discarding, Learning, or Forwarding.
Switch Port State	The state of the port; one of "Enabled" or "Disabled"
Link Status	The link state of the port, one of "Up" or "Down"
Port Path Cost	The path cost of the port within the region.
External Port Path Cost	The path cost of the port outside the region, when the port is a boundary port
Edge Port	An edge port is one port that attaches to a LAN that is known to have no other bridges attached. The command output will be either **yes** or **no**.
Point to Point Link	Indicates whether the port has a point to point connection with another bridge. The command output will be either **yes** or **no**.
Boundary Port	Indicates whether the port is a boundary port in the MST region. The command output will be either **yes** or **no**.

Example To display port 1 information in the CIST, use the command:

```
show mstp cist port=1
```

Related Commands **disable mstp**
enable mstp

set mstp cist
set mstp cist port
enable mstp cist port
show mstp

show mstp counter port

Syntax `SHow MSTp COUnter POrt={`*`port-list`*`|ALL}`

where *port-list* is a port number, a range of port numbers (specified as *n-m*), or a comma-separated list of port 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 displays counter information for a specified port or ports. See Figure 8-26 on page 8-194 and Table 8-46 on page 8-194.

The **port** parameter specifies the ports to display. If **all** is specified, all ports on the switch are displayed.

Figure 8-26: Example output from the **show mstp counter port** command

```
MSTP Port Counters
------------------------------------------------------------
Port Number    1
Receive:                        Transmit:
  Total BPDUs             0       Total BPDUs           0
  MSTP BPDUs              0       MSTP BPDUs            0
  RSTP BPDUs              0       RSTP BPDUs            0
  STP BPDUs               0       STP BPDUs             0
  Invalid BPDUs           0

Discarded:
  Port Disabled           0
  Invalid Protocol        0
  Invalid Type            0
  Invalid BPDU length     0
 ------------------------------------------------------------
```

Table 8-46: Parameters in output of the **show mstp counter port** command

Parameter	Meaning
Receive	BPDUs received.
Total BPDUs	Total number of received BPDUs.
MSTP BPDU	Number of received MSTP BPDUs.
RSTP BPDUs	Number of received RSTP BPDUs.
STP BPDUs	Number of received STP BPDUs.
Invalid BPDUs	Number of received invalid BPDUs.
Transmit	BPDUs transmitted.
Total BPDUs	Total number of transmitted BPDUs.
MSTP BPDU	Number of transmitted MSTP BPDUs.
RSTP BPDUs	Number of transmitted RSTP BPDUs.
STP BPDUs	Number of transmitted STP BPDUs.
Discard	BPDUs discarded.
Port Disabled	Number of BPDUs discarded because the port that the BPDU was received on was disabled.

Table 8-46: Parameters in output of the **show mstp counter port** command

Parameter	Meaning
Invalid Protocol	Number of BPDUs that had an invalid Protocol Identifier field or invalid Protocol Version Identifier field.
Invalid Type	Number of BPDUs that had an invalid Type field.
Invalid Message Age	Number of BPDUs that had an invalid message age.
Invalid BPDU Length	Number of BPDUs that had an incorrect length.

Examples To display the counters for port 1 to 3, use the command:

```
sh mst po=1-3 cou
```

Related Commands
enable mstp
disable mstp
reset mstp counter port
set mstp cist

show mstp debug

Syntax `SHow MSTp DEBug MSTI={CIST|`*`instance`*`|ALL}`

where *instance* is an instance number from 1 to 4094 for a specific MSTI.

Description This command displays the MSTP debugging modes that are enabled on a specified MSTP instance or all instances.

Example To display the debug mode for all MSTIs, use the command:

```
show mstp debug msti=all
```

Figure 8-27: Example output from the **show mstp debug msti** command

```
MSTP Instance   Port  Debug Modes                Output          Timeout
                       State Machine Debug Modes
-------------------------------------------------------------------------
CIST            1     MSG, STATE                 Asyn 0 (16)     None
                      PTM, PIM, PST, PST
                2     PKT                        Asyn 0 (16)     1
                      All
                3     MSG, PKT, STATE            Asyn 0 (16)     2
                      PRX, PPM, PTX, PRS, PRT, PST
                4     MSG, STATE                 Asyn 0 (16)     3
                      PTM, PIM, PST, PST
-------------------------------------------------------------------------
```

Related Commands
enable mstp debug
disable mstp debug

show mstp msti

Syntax `SHow MSTp MSTI[={`*instance*`|All}]`

where *instance* is the instance number of the specified MSTI in a range from 1 to 4094.

Description This command displays the information about the specified Multiple Spanning Tree Instance (Figure 8-28 on page 8-196, Table 8-47 on page 8-196).

The **msti** parameter specifies the instance number for the specified Multiple Spanning Tree Instance to be displayed. If **all** is specified, all of the MSTIs will be displayed. If no value is specified for the **msti** parameter, summary information about all MSTIs is shown

Figure 8-28: Example output from the **show mstp msti** command

```
Multiple Spanning Tree Instances
-------------------------------------------------------------
MSTI ........................... 1
  Bridge Identifier ............ 32768 : 00-00-cd-05-19-28
  Bridge Role .................. Designated Bridge
  VLAN Members ................. 1,3-5,7,9

MSTI ........................... 2
  Bridge Identifier ............ 32767 : 00-00-cd-05-19-28
  Bridge Role .................. Designated Bridge
  VLAN Members ................. 2,6,8,10-12

MSTI ........................... 3
  Bridge Identifier ............ 32766 : 00-00-cd-05-19-28
  Bridge Role .................. Designated Bridge
  VLAN Members ................. 13-20,22
-------------------------------------------------------------
```

Table 8-47: Parameters displayed in the output of the **show mstp msti** command

Parameter	Meaning
MSTI	The instance number of the spanning tree.
Bridge Identifier	The unique bridge identifier of the switch. this parameter consists of two parts, one is derived from the switch's unique MAC Address, and the other is the priority value entered for the switch.
Bridge Role	The role of the bridge in the spanning tree. This can be either root bridge or designated bridge.
VLAN Members	A list of the VLANs that are mapped to a specified multiple spanning tree instance.

Figure 8-29: Example output from the **show mstp msti=1** command

```
Multiple Spanning Tree Instance
------------------------------------------------------------
MSTI ............................ 1
  Bridge Identifier ............. 32768 : 00-00-cd-05-19-28
  Bridge Role ................... Root Bridge
  VLAN Members .................. vlan1, vlan2-vlan10, vlan20
  Regional Root Identifier ...... 32768 : 01-00-cd-05-19-28
  Designated Bridge ............. 32768 : 02-00-cd-05-19-28
  Root Path Cost ................ 32
  Root Port ..................... 2
  Topology Changes:
    Time Since Topology Change .. 100
    Topology Change Count ....... 3
    Topology Change ............. FALSE
------------------------------------------------------------
```

Table 8-48: Parameters displayed in the output of the **show mstp msti** command

Parameter	Meaning
MSTI	The instance number of the spanning tree.
Bridge Identifier	The unique Bridge Identifier of the switch. This parameter consists of two parts, one part is derived from the switch's unique MAC Address, and the other part is the priority value entered for the switch.
Bridge Role	The role of the bridge in the spanning tree. This can be either root bridge or designated bridge.
VLAN Members	A list of the VLANs that are mapped to a specified multiple spanning tree instance.
Regional Root Identifier	The bridge identifier of the root bridge for the MSTI in an MST region.
Designated Bridge	The bridge identifier for the transmitting bridge for the spanning tree.
Root Path Cost	The path cost to the regional root.
Root Port	The port number of the root port for the switch. This parameter is invalid if the switch is the root bridge. In this situation n/a will be displayed.
Time Since Topology Change	The time elapsed, in seconds, since the last topology change.
Topology Change Count	The number of times that the topology has changed since the bridge was powered or initialised.
Topology Change	The indication whether the topology is in the middle of changing.

Example To display the information about a specified MSTI5, use the command:

```
show mstp msti=5
```

Related Commands

disable mstp
enable mstp
set mstp cist
set mstp cist port

show mstp msti port

Syntax `SHow MSTp MSTI=`*`instance`* `POrt={`*`port-list`*`|All}`

where:

- *instance* is the instance number of the specified MSTI in a range from 1 to 4094.
- *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 Ethernet switch port, including uplink ports.

Description This command displays the port information of a specified multiple spanning tree instance (MSTI). See Figure 8-30 on page 8-198, and Table 8-49 on page 8-198).

The **msti** parameter specifies the instance number for the specified MSTI to be displayed.

The **port** parameter specifies the ports to display. If **all** is specified, all ports on the switch are displayed.

Figure 8-30: Example output from the **show mstp msti=1 port=1** command

```
MSTI 1 Port Information
------------------------------------------------------
Port Number ................. 1
  Port Identifier ........... 127:1
  Port Role ................. Designated Port
  Port State ................ Forwarding
  Link Status ................Forwarding
  Port Path Cost..............200,000
  Switch Port State ..........Enabled
  Port Path Cost ............ 200
  Designated Bridge...........4096 : 00-00-cd-10-00-37
  Designated Port.............128:3
  ------------------------------------------------------
```

Table 8-49: Parameters displayed in the output of the **show mstp msti port** command

Parameter	Meaning
Port Number	The number of the port in the switch.
Port Identifier	The unique identifier of the port. This parameter consists of two parts, one part is the port number, and the other is the priority configured for the port.
Port Role	The role of the port, this can be either; **disabled**, **alternate**, **backup**, **designated**, or **root**.
Port State	The state of the port. The state can be either; Disabled, Discarding, Learning, or Forwarding.
Switch Port State	The state of the port. This can be either **enabled** or **disabled**
`Link Status`	The link state of the port. This can be either **up** or **down**
Port Path Cost	The path cost of the port.

Table 8-49: Parameters displayed in the output of the **show mstp msti port** command

Parameter	Meaning
Designated Bridge	Either the unique Bridge Identifier of the switch, or the unique Bridge Identifier of the switch believed to be the Designated Bridge for the LAN to which the port is attached.
Designated Port	Port Identifier of the port on the Designated Bridge through which the Designated Bridge transmits Configuration BPDU information stored by this port.

Example To display the information of port 1 for MSTI5, use the command:

```
show mstp msti=5 port=1
```

Related Commands

disable mstp
enable mstp
set mstp cist
set mstp cist port

show stp

Syntax `SHow STP[={stp-name|ALL}] [SUMmary]`

Description This command displays information about the specified Spanning Tree Protocol instance (STP), or all STPs (Figure 8-31, Table 8-50 on page 8-201).

If the **summary** parameter is specified, then a summary table of all configured STPs is displayed (Figure 8-32 on page 8-202, Figure 8-51 on page 8-202).

Figure 8-31: Example output from the **show stp** command

```
 STP Information
-------------------------------------------------------------
 Name ................... grey
 Mode ................... Rapid
 RSTP Type .............. Normal
 VLAN members ........... vlan4 (4)
 Status ................. ON
 Number of Ports ....... 2
   Number Enabled ...... 2
   Number Disabled ..... 0
 Bridge Identifier ..... 32768 : 00-00-cd-05-19-28
 Bridge Priority ....... 32768
 Root Bridge ........... 32768 : 00-00-cd-05-19-28
 Designated Bridge ..... 32768 : 00-00-cd-05-19-28
 Root Port ............. (n/a)
 Root Path Cost ........ 0
 Max Age ............... 20
 Hello Time ............ 2
 Forward Delay ......... 15
 Switch Max Age ........ 20
 Switch Hello Time ..... 2
 Switch Forward Delay .. 15
 Transmission Limit .... 3

 Name ................... default
 Mode ................... Standard
 RSTP Type .............. (n/a)
 VLAN members ........... default (1)
                          vlan8 (8)
                          vlan9 (9)
                          vlan10 (10)
                          vlan11 (11)
                          vlan12 (12)
                          vlan13 (13)
                          vlan14 (14)
 Status ................. OFF
 Number of Ports ....... 22
   Number Enabled ...... 0
   Number Disabled ..... 22
 Bridge Identifier ..... 32768 : 00-00-cd-05-19-28
 Bridge Priority ....... 32768
 Designated Root ....... 32768 : 00-00-cd-05-19-28
 Root Port ............. (n/a)
 Root Path Cost ........ 0
 Max Age ............... 20
 Hello Time ............ 2
 Forward Delay ......... 15
 Switch Max Age ........ 20
 Switch Hello Time ..... 2
 Switch Forward Delay .. 15
 Hold Time ............. 1
```

Table 8-50: Parameters in the output of the **show stp** command

Parameter	Meaning
STP Name	The name of the Spanning Tree Protocol entity.
Mode	Whether STP is running in standard, or rapid mode.
RSTP Type	Whether RSTP is operating normally, or as STP compatible. In STP compatible mode, the rapid transitions to forwarding do not occur.
VLAN members	A list of the VLANs that are members of the STP. VLAN Identifiers are shown in brackets.
Status	The status of the STP; either ON or OFF.
Number of Ports	The number of ports belonging to the STP.
Number Enabled	Number of ports enabled with the **enable stp** command and are being considered by the Spanning Tree Algorithm.
Number Disabled	Number of ports disabled with the **disable stp** command and are not being considered by the Spanning Tree Algorithm.
Bridge Identifier	The unique Bridge Identifier of the switch. This parameter consists of two parts, one is derived from the unique Switch Address, and the other is the priority of the switch.
Bridge Priority	The settable priority component that permits the relative priority of bridges to be managed. The range of values is between 0 and 65535. A lower number indicates a higher priority.
Designated Root	The unique Bridge Identifier of the bridge assumed to be the root (standard mode only).
Root Bridge	The unique Bridge Identifier of the bridge assumed to be the Root (rapid mode only).
Designated Bridge	The unique Bridge Identifier of the bridge assumed to be the designated bridge. Displayed when STP is in rapid mode.
Root Port	The port number of the root port for the switch. If the switch is the Root Bridge this parameter is not valid, and (n/a) is shown.
Root Path Cost	The cost of the path to the Root from this switch. If the switch is the Root Bridge this parameter is not valid and is not shown.
Max Age	The maximum age of received Configuration Message information before it is discarded.
Hello Time	The time interval between successive transmissions of the Configuration Message information by a switch that is the Root or is trying to become the Root.
Forward Delay	In STP standard mode, the time ports spend in the Listening state before moving to the Learning state and the Learning state before moving to the Forwarding state. In rapid mode, the maximum time taken to transition from discarding to learning and learning to forwarding. In both modes, the value is also used for the ageing timer for the dynamic entries in the forwarding database.
Switch Max Age	The value of the Max Age parameter when this switch is the Root or is attempting to become the root. This parameter is set by the **maxage** parameter in the **set stp** command.

Table 8-50: Parameters in the output of the **show stp** command (Continued)

Parameter	Meaning
Switch Hello Time	The value of the Hello Time parameter when this switch is the Root or is attempting to become the Root. This parameter is set by the **hellotime** parameter in the **set stp** command.
Switch Forward Delay	The value of the Forward Delay parameter when this switch is the Root or is attempting to become the Root. This parameter is set by the **forwarddelay** parameter in the **set stp** command.
Hold Time	The minimum time in seconds between the transmission of configuration BPDUs through a given LAN Port. The value of this fixed parameter is 1, as specified in IEEE Standard 802.1d. This parameter applies only to STP running in standard mode.
Transmission Limit	In rapid mode, this indicates the number of BPDUs that may be transmitted in the interval specified by Hello Time. The value of this fixed parameter is 3, as specified in IEEE Standard 802.1t.

Figure 8-32: Example output from the **show stp summary** command

```
STP Name  Mode  Ports Enabled  Ports Disabled   Bridge Role
-------------------------------------------------------------
Rstp1      Rapid       0            2            Root Bridge
Default    Standard    0           21            Root Bridge
-------------------------------------------------------------
```

Table 8-51: Parameters in the output of the **show stp summary** command

Parameter	Meaning
STP name	Name of the Spanning Tree Protocol entry.
Mode	Whether STP is running in standard or rapid mode.
Ports Enabled	Number of ports being considered by the Spanning Tree Algorithm.
Ports Disabled	Number of ports that have been disabled and are not active in the Spanning Tree Algorithm.
Bridge Role	Role of the bridge in the STP, either None, Designated, or Root.

Example To show the current settings of the company STP, use the command:

```
show stp=company
```

Related Commands

create stp
destroy stp
disable stp
enable stp
show stp counter
show stp port
set stp

show stp counter

Syntax `SHow STP[={stp-name|ALL}] COUnter`

where *stp-name* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *stp-name* cannot be **all**.

Description This command displays Spanning Tree Protocol counters for the specified STP or all STPs (Figure 8-33 on page 8-203, Table 8-52 on page 8-203). If no STP is specified, then counters for all STPs are displayed. If the port link status is **down**, then no STP BPDUs are transmitted on the port.

Figure 8-33: Example output from the **show stp counter** command

```
STP Counters
---------------------------------------------------------------
STP Name: default
  Receive:                      Transmit:
  Total STP Packets       0     Total STP Packets          1677
  Configuration BPDU      0     Configuration BPDU          0
  TCN BPDU                0     TCN BPDU                    0
  RST BPDU                0     RSTP BPDU                1677
  Invalid BPDU            0

 Discarded:
  Port Disabled           0
  Invalid Protocol        0
  Invalid Type            0
  Invalid Message Age     0
  Config BPDU length      0
  TCN BPDU length         0
  RST BPDU length         0
---------------------------------------------------------------
```

Table 8-52: Parameters in the output of the **show stp counter** command

Parameter	Meaning
STP Name	Name of the STP.
Receive	STP packets received.
Total STP Packets	Total number of STP packets received. Valid STP packets comprise Configuration BPDUs and Topology Change Notification (TCN) BPDUs.
Configuration BPDU	Number of valid Configuration BPDUs received.
TCN BPDU	Number of valid Topology Change Notification BPDUs received.
RST BPDU	Number of valid Rapid Spanning Tree BPDUs received (rapid mode only).
Invalid BPDU	Number of invalid STP packets received.
Transmit	STP packets transmitted.
Total STP packets	Total number of STP packets transmitted.
Configuration BPDU	Number of Configuration BPDUs transmitted.
TCN BPDU	Number of Topology Change Notification BPDUs transmitted.

Table 8-52: Parameters in the output of the **show stp counter** command (Continued)

Parameter	Meaning
RST BPDU	Number of valid Rapid Spanning Tree BPDUs transmitted (rapid mode only).
Discarded	STP packets discarded.
Port Disabled	Number of BPDUs discarded because the port that the BPDU was received on was disabled.
Invalid Protocol	Number of STP packets that had an invalid Protocol Identifier field or invalid Protocol Version Identifier field.
Invalid Type	Number of STP packets that had an invalid Type field.
Invalid Message Age	Number of STP packets that had an invalid message age.
Config BPDU length	The number of Configuration BPDUs that had an incorrect length.
TCN BPDU length	Number of Topology Change Notification BPDUs that had an incorrect length.
RST BPDU length	Number of Rapid Spanning Tree BPDUs that had an incorrect length (rapid mode only).

Example To show the counters for all STPs, use the command:

```
SHOW STP COUNTER
```

Related Commands

reset stp
show stp
show stp port

show stp debug

Syntax `SHow STP[={stp-name|ALL}] DEBug`

where *stp-name* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

Description This command shows the debugging modes enabled on each port (Figure 8-34 on page 8-205, Table 8-53 on page 8-205).

On the Rapier *i* Series switches only, an STP name can be specified. If no parameter is entered, then the default is **all**.

Figure 8-34: Example output from the **show stp debug** command

```
STP Name
         Port    Enabled Debug Modes         Output          Timeout
-------------------------------------------------------------------------
default
         Port1   MSG, PKT, STATE            Console (16)    NONE
         Port2   STATE                      Console (16)    12345
         Port3   None
-------------------------------------------------------------------------
Admin
         Port1   MSG, PKT, STATE            TTY (12)        100
-------------------------------------------------------------------------
```

Table 8-53: Parameters in the output of the **show stp debug** command

Parameter	Meaning
Port	Port number on the switch.
Enabled Debug Modes	Whether the debugging option for the port is MSG, PKT, STATE, or NONE.
Output	Output device for the port.
Timeout	Time in seconds that the port stays in debug mode. If a timeout value is not set, "None" is shown.
STP name	Name of the STP instance.

Example To display the debug status for all ports in the switch, use the command:

```
show stp debug
```

On a Rapier *i* Series switches only, to show STP on just the ADMIN network, use the command:

```
show stp=admin debug
```

Related Commands
disable stp debug
enable stp debug
show stp counter

show stp port

Syntax `SHow STP[={stp-name|ALL}] 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 Ethernet switch port, including uplink ports.

Description This command displays Spanning Tree Protocol port information for the specified ports, or all ports for the specified STP, or all STPs, (Figure 8-35 on page 8-206, Table 8-54 on page 8-207). The STP parameter specifies an STP name. If no parameter is entered, the default is **all**.

Figure 8-35: Example output from the **show stp port** command

```
STP Port Information
------------------------------------------------------------
 STP ..................... grey
   STP Status ............ ON
   Port .................. 3
     RSTP Port Role ...... Disabled
     State ............... Discarding
     Point To Point ...... No (Auto)
     Port Priority ....... 128
     Port Identifier ..... 8003
     Pathcost ............ 200000
     Designated Root ..... 32768 : 00-00-cd-05-19-28
     Designated Cost ..... 0
     Designated Bridge ... 32768 : 00-00-cd-05-19-28
     Designated Port ..... 8003
     EdgePort ............ No
     VLAN membership ..... 1
     Counters:
       Loopback Disabled          0

   Port .................. 4
     RSTP Port Role ...... Disabled
     State ............... Discarding
     Point To Point ...... No (Auto)
     Port Priority ....... 128
     Port Identifier ..... 8004
     Pathcost ............ 200000
     Designated Root ..... 32768 : 00-00-cd-05-19-28
     Designated Cost ..... 0
     Designated Bridge ... 32768 : 00-00-cd-05-19-28
     Designated Port ..... 8004
     EdgePort ............ No
     VLAN membership ..... 1
     Counters:
       Loopback Disabled          0

STP ..................... default
   STP Status ............ OFF
   Port .................. 1
     State ............... Disabled
     Port Priority ....... 128
     Port Identifier ..... 8001
     Pathcost ............ 19
     Designated Root ..... 32768 : 00-00-cd-05-19-28
     Designated Cost ..... 0
     Designated Bridge ... 32768 : 00-00-cd-05-19-28
     Designated Port ..... 8001
     VLAN membership ..... 1
```

Table 8-54: Parameters in the output of the **show stp port** command

Parameter	Meaning	
STP	Name of the STP of which the port is a member.	
STP Status	Whether the STP is enabled.	
Port	Port number.	
RSTP Port Role	Role of the port, rapid mode only:	
	Disabled	
	Alternate	
	Backup	
	Backup (Loopback Disabled)	Same as Backup except all packets are dropped, including BPDUs. The port transmitted and received the same RSTP BPDU.
	Designated	
	Root	
State	Status of the port:	
	Disabled	Standard and rapid modes
	Blocking	Standard mode
	Listening	Standard mode
	Learning	Standard and rapid modes
	Forwarding	Standard and rapid modes
	Discarding	Rapid mode
Point To Point	Whether the port has a point to point connection with another bridge (rapid mode only).	
Port Priority	Priority of the port. Used as part of the Port Identifier field. In standard mode it forms the upper 8 bits of the Port Identifier field. In rapid mode it forms the upper 4 bits of the Port Identifier field.	
Port Identifier	Unique identifier of the port. This parameter determines the root port or designated port of the switch.	
Pathcost	Path cost of the port.	
Designated Root	Unique Bridge Identifier of the Root Bridge, as recorded in the configuration BPDU.	
Designated Cost	Designated Cost for the port.	
Designated Bridge	Either the unique Bridge Identifier of the switch, or the unique Bridge Identifier of the switch believed to be the Designated Bridge for the LAN to which the port is attached.	
Designated Port	Port Identifier of the port on the Designated Bridge through which the Designated Bridge transmits Configuration BPDU information stored by this port.	
Edge Port	Whether this is an edge port, which is one that attaches to a LAN and is known to have no other bridges attached (rapid mode only).	
VLAN membership	Number of VLANs the port is a member of within this STP instance.	
Counters		
Loopback Disabled	Number of transitions to the Backup (Loopback Disabled) RSTP port role.	

Example To show STP information for port 2 on the STP named ‘grey’, use the command:

```
show stp=grey port=2
```

Related Commands

disable stp port
enable stp port
set stp port
show stp

show switch

Syntax `SHow SWItch`

Description This command displays configuration information for the switch functions (Figure 8-36 on page 8-209, Table 8-55 on page 8-209).

Figure 8-36: Example output from the **show switch** command

```
Switch Configuration
------------------------------------------------------------
Switch Address ............. 00-00-cd-04-e0-75
Learning ................... ON
Ageing Timer ............... ON
Number of Fixed Ports ...... 24
Number of Uplink Ports ..... 0
Mirroring .................. DISABLED
Mirror port ................ None
Ports mirroring on Rx ...... None
Ports mirroring on Tx ...... None
Ports mirroring on Both .... None
Number of WAN Interfaces ... 0
Name of Interface(s) ....... -
Ageingtime ................. 300
L3 Ageingtime .............. 900
UpTime ..................... 00:04:30
------------------------------------------------------------
```

Table 8-55: 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.
Learning	Whether the switch's dynamic learning and updating of the forwarding database is enabled.
Ageing Timer	Whether the ageing timer is enabled.
Number of Fixed Ports	Number of fixed Ethernet switch ports.
Number of Uplink Ports	Number of Ethernet uplink ports.
Mirroring	Whether traffic mirroring is enabled.
Mirror port	Switch port where mirror traffic is sent.
Ports mirroring on Rx	Ports that are set to send all the traffic they receive to the mirror port.
Ports mirroring on Tx	Ports that are set to send all the traffic they transmit to the mirror port.
Ports mirroring on Both	Ports that are set to send all the traffic they both receive and transmit to the mirror port.
Number of WAN Interfaces	Total number of installed WAN interfaces.
Name of Interface(s)	Name of the installed WAN interface(s).
Ageingtime	Length in seconds after which a dynamic entry is removed from the forwarding database.
L3 Ageingtime	Length in seconds after which a dynamic entry is removed from the Layer 3 forwarding database.

Table 8-55: Parameters in the output of the **show switch** command (Continued)

Parameter	Meaning
Uptime	Time in hours:minutes:seconds since the switch was last powered up, rebooted, or restarted. This is the same value as the MIB object sysUpTime.
Uptime	Time in hours:minutes:seconds since the switch was last powered up, rebooted, or restarted. This is the same value as the MIB object sysUpTime.

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 information about the forwarding counters associated with the switch (Figure 8-37 on page 8-211, Table 8-56 on page 8-211).

To display reception and transmission packet counters for the switch, see the **show switch port counter** command on page 8-225.

Figure 8-37: Example output from the **show switch counter** command

```
Switch Counters
------------------------------------------------------------
Packet DMA counters

  Receive:                          Transmit:
Packets                  407     Packets                  708
Discards                   0     Discards                   0
TooFewBuffers              0     Aborts                     0
DescriptorsExhausteds      0     DescriptorAreaFilleds      0
QueueLength                0     QueueLength                0

  PCI bus counters:
ParityErrors               0     ErrorChannel               0
FatalErrors                0

  General counters:
Resets                     0
------------------------------------------------------------
```

Table 8-56: Parameters in the output of the **show switch counter** command

Parameters	Meaning
Packet DMA counters	
Receive	Counters for packets received.
Packets	The number of packets received by the CPU from the switch chip.
Discards	The number of packets received from the switch chip that were discarded because either the receive queue was greater than 4096, or because the free buffers in the switch were below BufferLevel3, or because there were no data bytes in the packet.
TooFewBuffers	The number of packets received from the switch chip that were discarded because the free buffers in the switch were below BufferLevel3.
DescriptorsExhausteds	The number of times the switch chip reported that it could not transfer a packet by DMA to a switch buffer because there were no more receive buffer descriptors.
QueueLength	The number of packets received from the switch chip waiting to be processed by the CPU.
Transmit	Counters for packets transmitted.
Packets	The number of packets transferred from the CPU to the switch chip.

Table 8-56: Parameters in the output of the **show switch counter** command

Parameters	Meaning
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 transmission of a packet was aborted due to it taking an excessive length of time for the transmission to complete, perhaps due to a port being in a blocked state or due to a busy PCI bus.
DescriptorAreaFilleds	The number of times the transmit descriptor area filled due to a high rate of transfer of packets from the CPU to the switch chip or high PCI bus utilisation causing the DMA to proceed slowly.
QueueLength	The number of packets currently queued for transmission, or that have been transmitted and are waiting to be purged from the transmit queue.
PCI bus counters	
ParityErrors	The number of times the switch chip reported a parity error for a transaction on the PCI bus.
FatalErrors	The number of times the switch chip reported a fatal error for a transaction on the PCI bus.
ErrorChannel	The DMA channel for making the transaction for which the error occurred.
General counters	
Resets	The number of times the receive and transmit DMA channels have been reset due to the occurrence of an error.

Example To display the switching counters, use the command:

```
show switch counter
```

Related Commands

reset switch
show switch
show switch port counter

show switch debug

Syntax `SHow SWItch DEBug`

Description This command displays debugging information for the switch (Figure 8-38 on page 8-213, Table 8-57 on page 8-213).

Figure 8-38: Example output from the **show switch debug** command

```
Enabled Switch Debug Modes    Output     Timeout
-----------------------------------------------------------
ARL, DMA                      16         12345
-----------------------------------------------------------
```

Table 8-57: Parameters in the output of the **show switch debug** command

Parameter	Meaning
Enabled Switch Debug Modes	Whether the debugging option for the switch is ARL, CMIC", DMA, QOS, S5600, PHY, or None.
Output	Output device for the switch. This is shown when a debug mode is enabled.
Timeout	Time in seconds that debugging options for the switch are enabled. This is shown when a debug mode is enabled.

Example To display debugging information for the switch, use the command:

```
show switch debug
```

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

show switch fdb

Syntax

```
SHow SWItch FDB[={SW|HW}] [Address=macadd]
   [DIScard={SOurce|DEStination}] [HIT={Yes|No}] [L3={Yes|
   No}] [POrt={port-list|ALL}] [STAtus={STAtic|DYnamic}]
   [VLAN={vlan-name|1..4094}]
```

where:

- *macadd* is an Ethernet six-octet MAC address, expressed as six pairs of hexadecimal digits delimited by hyphens.
- *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.
- *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* cannot be a number or **all**.

Description

This command displays the contents of the forwarding database (Figure 8-39 on page 8-215, Table 8-58 on page 8-215). It requires a user with Security Officer privilege when the switch is in security mode.

The **fdb** parameter specifies the version of the Forwarding Database that is displayed. The Forwarding Database is stored in hardware and a copy is held in software. If SW is specified, the software copy of the Forwarding Database is displayed; if HW is specified, the hardware version is displayed. Under normal circumstances, the two versions are identical. The default is SW.

The **address** parameter specifies the MAC address of the device for which the contents of the Forwarding Database are to be displayed.

The **discard** parameter specifies whether to display entries in the Forwarding Database where frames are discarded on the basis of the received frame's source or destination address.

The **hit** parameter specifies whether to display filter entries in the Forwarding Database where a frame matching the entry either was or was not received during the latest Ageing Timer period.

The **l3** parameter specifies whether to display filter entries in the Forwarding Database that were or were not created as part of a Layer 3 interface configuration.

The **port** parameter specifies that only those entries in the Forwarding Database that were learned from the specified port are to be displayed.

The **status** parameter specifies whether to display only static filter entries or only dynamically-learned filter entries.

The **vlan** parameter specifies the VLAN identifier of the VLAN for which the contents of the Forwarding Database are to be displayed.

Figure 8-39: Example output from the **show switch fdb** command

```
Switch Forwarding Database (software)
-------------------------------------------------------------------------
 VLAN  MAC Address          Port  Status    Discard  L3  Hit  QOS  QSD
-------------------------------------------------------------------------
 1     00-00-cd-00-45-c7    CPU   static    -        y   y    0:0  dest
 42    00-00-c0-1d-2c-f8    1     dynamic   -        n   y    0:0  dest
 42    00-00-c0-71-e0-e4    1     dynamic   -        n   y    0:0  dest
 42    00-00-cd-00-a4-d6    1     dynamic   -        n   y    0:0  dest
 42    00-00-cd-00-ab-dc    1     dynamic   -        n   y    0:0  dest
 42    00-60-b0-ac-18-51    1     dynamic   -        n   y    0:0  dest
 42    00-90-27-23-a4-e9    1     dynamic   -        n   y    0:0  dest
 42    00-90-27-32-ad-61    1     dynamic   -        n   y    0:0  dest
 42    00-90-27-76-8a-55    1     dynamic   -        n   y    0:0  dest
 42    00-90-27-76-9a-99    1     dynamic   -        n   y    0:0  dest
 42    00-90-27-87-a5-22    1     dynamic   -        n   y    0:0  dest
 42    00-90-27-bd-c8-93    1     dynamic   -        n   y    0:0  dest
 42    00-90-27-bd-c9-7f    1     dynamic   -        n   y    0:0  dest
 42    00-90-27-d0-ae-c2    1     dynamic   -        n   y    0:0  dest
 42    00-90-27-d0-c7-12    1     dynamic   -        n   y    0:0  dest
 42    08-00-09-be-06-cd    1     dynamic   -        n   y    0:0  dest
-------------------------------------------------------------------------
```

Table 8-58: Parameters in the output of the **show switch fdb** command

Parameter	Meaning
VLAN	VLAN Identifier of the VLAN.
MAC Address	MAC address as learned from the source address field of a frame, or entered as part of a static filter entry.
Port	Port from which the MAC address was learned.
Status	Whether the entry was a static filter entry or dynamically learned.
Discard	Whether to discard frames on the basis of the source address or the destination address of the received frame.
L3	Whether the entry was created as part of a Layer 3 interface configuration.
Hit	Whether a frame matching this filter entry was received during the latest Ageing Timer period. If the Ageing Timer is enabled, entries with 'n' are purged from the Forwarding Database.
QOS	Quality of Service of the frame. The first number is the QoS based on the source address. The second number is the QoS based on the destination address.
QSD	Whether the source address QoS or the destination address QoS has priority in determining the QoS of frames received that do not contain priority information.

Example To display the contents of the Forwarding Database, use the command:

```
show switch fdb
```

Related Commands

enable switch learning
show switch
show switch filter

show switch filter

Syntax

```
SHow SWItch FILter [POrt={port-list|ALL}]
   [ACtion={FORward|DIScard}] [DESTaddress=macadd]
   [ENTry=entry-list] [VLAN={vlan-name|1..4094}]
```

where:

- *macadd* is an Ethernet six-octet MAC address, expressed as six pairs of hexadecimal digits delimited by hyphens.
- *entry-list* is an entry number, range (specified as *n-m*), or comma-separated list of numbers and/or ranges. Entry numbers start at 0 and end at *m*, where *m* is the highest filter entry currently defined in the Permanent Forwarding Database. Each port has its own Permanent Forwarding Database.
- *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.
- *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* cannot be a number or **all**.

Description

This command displays information about some or all of the static switch filter entries (Figure 8-40 on page 8-216, Table 8-59 on page 8-217). The output can be limited to display only entries matching the optional parameters as described below.

The **action** parameter specifies whether frames matching the filter entry are forwarded or discarded.

The **entry** parameter must specify an existing filter entry or entries in the Permanent Forwarding Database.

The **destaddress** parameter specifies the destination MAC address in the filter entry.

The **port** parameter specifies the outbound ports over which frames matching this filter entry are discarded or forwarded.

The **vlan** parameter specifies the numerical VLAN Identifier with which the filter entry is associated.

Figure 8-40: Example output from the **show switch filter** command

```
 Switch Filters
-------------------------------------------------------------------------
 Entry             VLAN         Destination Address   Port  Action  Source
-------------------------------------------------------------------------
    0           default (1)       aa-ab-cd-00-00-01     1  Forward  static
    1           default (1)       aa-ab-cd-00-00-02     1  Forward  static

    0           marketing (2)     aa-ab-cd-00-00-01     2  Discard  static
    1           marketing (2)     aa-ab-cd-00-00-02     2  Discard  learn
-------------------------------------------------------------------------
```

Table 8-59: Parameters in the output of the **show switch filter** command

Parameter	Meaning
Entry	Number identifying the filter entry.
Destination Address	Destination MAC address for the entry.
VLAN	VLAN name and identifier for the entry.
Port	The outbound port to match for the filter entry to be applied.
Action	Whether the action specified by the filter entry to forward or discard.
Source	This parameter is either "static" (indicating the filter is a static filter) or "learned" (indicating the filter is present either because it has been added with the **learn** parameter of the **set switch port** command, or has been dynamically learned during normal intrusion detection operation).

Examples To display information about the entire Permanent Forwarding Database, use the command:

```
show switch filter port=all
```

To display information about the Permanent Forwarding Database for port 3, use the command:

```
show switch filter port=3
```

To display information about the Permanent Forwarding Database for the *marketing* VLAN, use the command:

```
show switch filter port=all vlan=marketing
```

To display the port to which the MAC address 00-00-00-12-34-56 belongs, use the command:

```
show switch filter port=all destaddress=00-00-00-12-34-56
```

Related Commands

add switch filter
delete switch filter

show switch hwfilter

Syntax `SHow SWItch HWFilter [CLASSifier=`*`classifier-list`*`]`

where *classifier-list* is either an integer from 1 to 9999; a range of integers (specified as 1-4), or a comma-separated list of classifier numbers and/or ranges (1, 3, 4-9).

Description This command displays hardware-based filtering entries created when using the **add switch hwfilter classifier** command on page 8-77 (Figure 8-41 on page 8-218, Figure 8-42 on page 8-218, Table 8-60 on page 8-219). All of the specified classifiers must exist and must already be incorporated into a filter entry. If **classifier** is not specified, summary information is displayed for filters currently defined.

Figure 8-41: Example output from the **show switch hwfilter** command

```
Switch Hardware Filter Summary Information
------------------------------------------------------------
Status ............... ENABLED
Number of Filters .... 12

Filter ............... 1
Classifier ........... 3

Filter ............... 2
Classifier ........... 100

Filter ............... 3
Classifier ........... 101
------------------------------------------------------------
```

Figure 8-42: Example output from the **show switch hwfilter classifier** command

```
------------------------------------------------------------
Filter ............... 1
Classifier ........... 3
Action ............... sp
New IP DSCP .......... -
New TOS .............. -
Port ................. -
Priority ............. 5
No Match Action ...... st, sp
No Match DSCP ........ -
No Match TOS ......... 2
No Match Port ........ -
No Match Priority .... 1
------------------------------------------------------------
```

Table 8-60: Parameters in the output of the **show switch hwfilter classifier** command

Parameter	Meaning
Status	Whether hardware filtering on the switch is enabled.
Number of Filter	Current total of filters created with the **add switch hwfilter classifier** command.
Filter	Filter number.
Classifier	Number of the classifier this filter entry is based on.
Action	Action to take when a packet matches this entry; one or more of "sp" (SETPRIORITY), "sc" (FORWARD or SENDCOS), "st" (SETTOS), "dn" (DENY), "se" (SENDEPORT), "sm" (SENDMIRROR), "mpt" (MOVEPRIOTOTOS) "mtp" (MOVETOSTOPRIO), "sds" (SETIPDSCP), "sn" (SENDNONUNICASTTOPORT), "nd" (NODROP).
New IP DSCP	New IP DSCP value to assign to packets matching the entry.
New TOS	New TOS value to assign to packets matching the entry.
Port	New output port to use for packets matching the entry.
Priority	New priority value to assign to packets matching the entry.
No Match Action	Action to take when a packet matches the specified ingress/egress ports for this entry; one or more of "sp" (SETPRIORITY), "sc" (FORWARD or SENDCOS), "st" (SETTOS), "dn" (DENY), "se" (SENDEPORT), "sm" (SENDMIRROR), "mpt" (MOVEPRIOTOTOS) "mtp" (MOVETOSTOPRIO), "sds" (SETIPDSCP), "sn" (SENDNONUNICASTTOPORT).
No Match DSCP	New IP DSCP value to assign to packets on a partial match.
No Match TOS	New TOS value to assign to packets on a partial match.
No Match Port	New output port to use for packets on a partial match.
No Match Priority	New priority value to assign to packets on a partial match.

Example To display a summary of all filters, use the command:

```
sh swi hwf
```

To display details of the filter that uses classifier 1, use the command:

```
show swi hwf class=1
```

Related Commands

add switch hwfilter classifier
delete switch hwfilter classifier
set switch hwfilter classifier
show classifier in Chapter 34, Generic Packet Classifier

show switch l3filter

Syntax `SHow SWItch L3Filter[=`*`filter-id`* `[ENTry=`*`entry-id`*`]]`

where:

- *filter-id* is a decimal number in the range 1 to the number of filters defined.
- *entry-id* is a decimal number in the range 1 to the number of entries defined.

Description This command displays hardware-based Layer 3 filtering match criteria and their filter entries (Figure 8-43 on page 8-220, Table 8-61 on page 8-220).

Figure 8-43: Example output from the **show switch l3filter** command

```
Filter ............... 1
Matched fields ....... tos, ttl, sipaddr, dipaddr, protocol
Source address mask .. 255.255.255.0
Dest. address mask ... 255.255.255.0
Ingress port mask .... true
Egress port mask ..... true
No match action ...... none

Ent.  S-Address           D-Address       Prot   TTL  TOS  NewTOS  Type
      S-Mask              D-Mask          Iport  Eport       Port    Syn/Ack/Fin
      S-Port              D-Port          Action
-------------------------------------------------------------------------------
1     192.168.1.0         192.168.2.0     ICMP   30   2    1       0
      255.255.255.0       255.255.255.0   2      3                   0/0/0
      -                   -               dn
-------------------------------------------------------------------------------
2     192.168.2.0         192.168.1.0     ICMP   30   2    1       0
      255.255.255.0       255.255.255.0   2      3                   0/0/0
      -                   -               sc
-------------------------------------------------------------------------------
```

Table 8-61: Parameters in the output of the **show switch l3filter** command

Parameter	Meaning
Filter	Filter number.
Match fields	A list of the fields matched by this filter; one or more of "tos", "ttl", "protocol", "sipaddr", "dipaddr", "tcpsport", "tcpdport", "tcpsyn", "tcpack", "tcpfin", "udpsport", or "udpdport".
Source address mask	Mask to apply to source IP address fields to determine a match.
Destination address mask	Mask to apply to destination IP address fields to determine a match.
Ingress port mask	Whether the filter applies to ingress ports.
Egress port mask	Whether the filter applies to egress ports.

Table 8-61: Parameters in the output of the **show switch l3filter** command (Continued)

Parameter	Meaning
No Match Action	Action to take when a packet matches the specified ingress/ egress ports for this entry; one or more of "sp" (SETPRIORITY), "sc" (FORWARD or SENDCOS), "st" (SETTOS), "dn" (DENY), "se" (SENDEPORT), "sm" (SENDMIRROR), "mpt" (MOVEPRIOTOTOS), "mtp" (MOVETOSTOPRIO), "sds" (SETIPDSCP), "sn" (SENDNONUNICASTTOPORT).
Ent.	Filter entry number.
S-Address, S-Mask, S-Port	Source IP address, source mask and source port to match.
D-Address, D-Mask, D-Port	Destination IP address, destination mask and destination port to match.
Prot	Protocol to match.
Iport	Ingress port number to match.
Action	Action to take when a packet matches this entry; either "sp" (SETPRIORITY), "sc" (FORWARD or SENDCOS), "st" (SETTOS), "dn" (DENY), "se" (SENDEPORT), or "sm" (SENDMIRROR).
TTL	TTL value to match.
Eport	Egress port number to match.
TOS	TOS value to match.
NewTOS	New TOS value to assign to packets matching the entry.
Type	Value of the protocol-type to match. If a 5 byte hexadecimal number is shown then the packet type is SNAP, if 2 bytes are shown then the packet type is either Ethernet type II or 802.3 and (E-II) or (SNAP) is appended respectively.
Port	New output port to use for packets matching the entry.
Priority	New priority value to assign to packets matching the entry.

Example To display all filters, use the command:

```
sh swi l3f
```

To display entry 3 from filter 1, use the command:

```
sh swi l3f=1 ent=3
```

Related Commands

add switch l3filter match
add switch l3filter entry
delete switch l3filter
delete switch l3filter entry
disable switch l3filter
enable switch l3filter
set switch l3filter match
set switch l3filter entry

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 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 displays general information about the specified switch ports or all switch ports (Figure 8-44 on page 8-222, Table 8-62 on page 8-222).

Figure 8-44: Example output from the **show switch port** command

```
Switch Port Information
------------------------------------------------------------------------------
 Port ........................... 1
   Description ................... To intranet hub, port 4
   Status ........................ ENABLED
   Link State .................... Up
   UpTime ........................ 00:10:49
   Port Media Type ............... ISO8802-3 CSMACD
   Configured speed/duplex ....... Autonegotiate
   Actual speed/duplex ........... 1000 Mbps, full duplex
   Configured master/slave mode .. Autonegotiate
   Actual master/slave mode ...... Master
   Acceptable Frame Types ........ Admit All Frames
   Broadcast rate limit .......... 1000/s
   Multicast rate limit .......... -
   DLF rate limit ................ -
   Learn limit ................... -
   Intrusion action .............. Discard
   Current learned, lock state ... 15, not locked
   Mirroring ..................... Tx, to port 22
   Is this port mirror port ...... No
   Enabled flow control .......... Pause
   Ingress Filtering ............. OFF
   Trunk Group ................... -
   STP ........................... company
   Multicast filtering mode ...... (B) Forward all unregister groups

   GBIC vendor name .............. AGILENT
   GBIC part number .............. HFCT-5611
   GBIC vendor SN ................ 0111131243329572
   GBIC data code ................ 01111300
------------------------------------------------------------------------------
```

Table 8-62: Parameters in the output of the **show switch port** command

Parameter	Meaning
Port	Number of the switch port.
Description	Description of the port.
Status	Whether the port is enabled.
Link state	Whether the link of the port is up or down.
Uptime	Hours:minutes:seconds of the elapsed time since the port was last reset or initialised.
Port Media Type	MAC entity type as defined in the MIB object ifType.

Table 8-62: Parameters in the output of the **show switch port** command

Parameter	Meaning
Configured speed/duplex	Speed mode configured for this port. Either "Autonegotiate" or a combination of a speed (one of "10 Mbps", "100 Mbps" or "1000 Mbps") and a duplex mode (one of "half duplex" or "full duplex"), and optionally "(by autonegotiation)".
Actual speed/duplex	The port speed and duplex mode that this port is actually running at. A combination of a speed (either "10 Mbps", "100 Mbps" or "1000 Mbps") and a duplex mode (either "half duplex" or "full duplex").
Configured master/slave mode	The master/slave mode configured for this port; either "Autonegotiate', "Master", "Slave", or "Not applicable".
Actual master/slave mode	The master/slave mode actually selected; either "-", "Master", "Slave", or "Not applicable".
Acceptable Frame Types	The value of the Acceptable Frame Types parameter, either: "Admit All Frames" or "Admit Only VLAN-tagged Frames".
Broadcast rate limit	The limit of the rate of reception of broadcast frames for this port, in frames per second.
Multicast cast rate limit	The limit of the rate of reception of multicast frames for this port, in frames per second.
DLF rate limit	The limit of the rate of reception of DLF (destination lookup failure) frames for this port, in frames per second.
Learn limit	The number of MAC addresses that may be learned for this port. Once the limit is reached, the port is locked against any new MAC addresses. Either "None" or a number from 1 to 256.
Intrusion action	Whether the port should discard, trap, or disable when a frame is received from an unknown MAC address and the port is locked.
Current learned, lock state	The number of MAC addresses currently learned on this port and the state of locking for this port. The current learned parameter is incremented when a Learn Limit is set for the port. The lock state is either "not locked", "locked by limit", or "locked by command".
Mirroring	The traffic mirroring for traffic in and out of this port. Either "None", "Rx" (for traffic received by this port), "Tx" (for traffic sent on this port), or "Both". The port where mirrored frames are sent is also displayed.
Is this port mirror port	Whether this port is a mirror port. Either "No" or "Yes".
Enabled flow control	Flow control parameters set for the port; "Pause" or "-". If flow control is implemented on the switch, then Pause flow control is applied to the port.
Send tagged pkts for VLAN(s)	Name and VLAN Identifier (VID) of the tagged VLAN(s), if any, to which the port belongs.
Port-based VLAN	Name and VLAN Identifier (VID) of the port-based VLAN to which the port belongs.
Ingress Filtering	Whether ingress filtering is on.
Trunk Group	Name of trunk group to which the port belongs, if any.
STP	Name of the STP to which the port belongs.

Table 8-62: Parameters in the output of the **show switch port** command

Parameter	Meaning
Multicast filtering mode	Either "(A) forward all groups", "(B) forward all unregistered groups", or "(C) filter all unregistered groups".
GBIC vendor name	Name of the GBIC vendor. This is shown when a valid GBIC is installed in the port.
GBIC part number	Vendor part number or product name.This is shown when a valid GBIC is installed in the port.
GBIC vendor SN	Vendor serial number. This is shown when a valid GBIC is installed in the port.
GBIC data code	Data code of this GBIC. This is shown when a valid GBIC is installed in the port.

Example To display the configuration for switch port 1, use the command:

```
show switch port=1
```

Related Commands set switch port

show switch port counter

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

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 Ethernet switch port, including uplink ports.

Description This command displays counters for a specific switch port or all switch ports (Figure 8-45 on page 8-225, Table 8-63 on page 8-226).

Figure 8-45: Example output from the **show switch port counter** command

```
Port 1. Fast Ethernet MAC counters:
 Combined receive/transmit packets by size (octets) counters:
  64                                65 512 - 1023                          0
  65 - 127                           5 1024 - MaxPktSz                     0
  128 - 255                          0 1519 - 1522                         0
  256 - 511                          0

General Counters:
 Receive                             Transmit
  Octets                           246 Octets                          4340
  Pkts                               3 Pkts                              67
  FCSErrors                          0 FCSErrors                          0
  MulticastPkts                      0 MulticastPkts                     65
  BroadcastPkts                      3 BroadcastPkts                      2
  PauseMACCtlFrms                    0 PauseMACCtrlFrm                    0
  OversizePkts                       0 OversizePkts                       0
  Fragments                          0 Fragments                          0
  Jabbers                            0 Jabbers                            0
  MACControlFrms                     0
  UnsupportOpcode                    0
  AlignmentErrors                    0
  OutOfRngeLenFld                    0
  SymErDurCarrier                    0
  CarrierSenseErr                    0
  UndersizePkts                      0
                                       PauseCtrlFrms                      0
                                       FrameWDeferrdTx                    0
                                       FrmWExcesDefer                     0
                                       SingleCollsnFrm                    0
                                       MultCollsnFrm                      0
                                       LateCollsns                        0
                                       ExcessivCollsns                    0
                                       CollisionFrames                    0

Layer 3 Counters:
  ifInUcastPkts                      0 ifOutUcastPkts                     0
  ifInDiscards                       0 ifOutErrors                        0
  ipInHdrErrors                      0

Miscellaneous Counters:
  DropEvents                         0
  ifOutDiscards                      0
  taggedPktTx                        0
  totalPktTxAbort                    0

HW Multicasting Counters:
  TTL expired                        0
  Bridged Frames                     0
  Routed Frames                      0
  Receive Drops                      0
  Transmit Drops                     0
```

Table 8-63: Parameters in output from **show switch port counter** command

Parameter	Description
Ethernet MAC counters	
Combined receive/transmit packets by size (octets) counters	Number of packets in each size range received and transmitted.
64	Number of 64 octet packets received and transmitted.
65 - 127	Number of 65 - 127 octet packets received and transmitted.
128 - 255	Number of 128 - 255 octet packets received and transmitted.
256 - 511	Number of 256 - 511 octet packets received and transmitted.
512 - 1023	Number of 512 - 1023 octet packets received and transmitted.
1024 - MaxPktSz	Number of packets received and transmitted with size 1024 octets to the maximum packet length.
1519 - 1522	Number of 1519 - 1522 octet frames received and transmitted.
General Counters	
Receive	Counters for traffic received.
Octets	Number of octets.
Pkts	Number of packets.
FCSErrors	Number of frames containing a Frame Check Sequence error.
MulticastPkts	Number of multicast packets.
BroadcastPkts	Number of broadcast packets.
PauseMACCtlFrms	Number of valid PAUSE MAC Control frames.
OversizePkts	Number of oversize packets.
Fragments	Number of fragments.
Jabbers	Number of jabber frames.
MACControlFrms	Number of MAC Control frames (Pause and Unsupported).
UnsupportOpcode	Number of MAC Control frames with unsupported opcode (i.e. not Pause).
AlignmentErrors	Number of frames with alignment errors.
OutOfRngeLenFld	Number of packets with length out of range.
SymErDurCarrier	Number of frames with invalid data symbols.
CarrierSenseErr	Number of false carrier conditions between frames.
UndersizePkts	Number of undersized packets.
Transmit	Counters for traffic transmitted
Octets	Number of octets.
Pkts	Number of packets.
FCSErrors	Number of frames containing a Frame Check Sequence error.
MulticastPkts	Number of multicast packets.
BroadcastPkts	Number of broadcast packets.

Table 8-63: Parameters in output from **show switch port counter** command

Parameter	Description
PauseMACCtlFrms	Number of valid PAUSE MAC Control frames.
OversizePkts	Number of oversize packets.
Fragments	Number of fragments.
Jabbers	Number of jabber frames.
PauseCtrlFrms	Number of Pause control frames.
FrameWDeferrdTx	Number of frames deferred once before successful transmission.
FrmWExcesDefer	Number of frame aborted after too many deferrals.
SingleCollsnFrm	Number of frames that experienced exactly one collision.
MultCollsnFrm	Number of frames that experienced 2 to 15 collisions (including late collisions).
LateCollsns	Number of frames that experienced late collisions.
ExcessivCollsns	Number of frames aborted before transmission after 16 collisions.
CollisionFrames	Total number of collisions.
Layer 3 Counters (do not include packets sent to CPU for processing)	
ifInUcastPkts	Number of L3 switched unicast packets.
ifInDiscards	Number of packets for Layer 3 interfaces that are discarded.
ipInHdrErrors	Number of packets discarded due to IP header errors.
ifOutUcastPkts	Number of L3 switched unicast packets.
ifOutErrors	N number of L3 switched packets discarded at egress due to transmission errors.
Miscellaneous Counters	
DropEvents	Number of packets discarded at ingress port.
ifOutDiscards	Number of packets for transmission discarded due to ageing.
taggedPktTx	Number of VLAN tagged packets transmitted.
totalPktTxAbort	Number of Layer 2 and 3 packets aborted during transmission.
HW Multicasting Counters	
TTL expired	Number of packets dropped by the router because their IP multicasting Time to Live (TTL) counter was too low.
Bridged Frames	Number of IP multicasting packets received on this port and bridged (L2 switched) out another port.
Routed Frames	The number of IP multicasting packets received on this port and routed (L3 switched) out another port. Note that, for Rapier 48i switches, when a packet is received on a port in one switch instance and multicast L3 switched out a port in the other switch instance, this counter is not incremented. Ports 1-24 and 49 are in switch instance 1; ports 25-48 and 50 are in instance 2.
Receive Drops	Number of IP multicasting packets dropped by this port on ingress.

Table 8-63: Parameters in output from **show switch port counter** command

Parameter	Description
Transmit Drops	Number of IP multicasting packets dropped by this port on egress.

Example To display counters for switch port 1, use the command:

```
show switch port=1 counter
```

Related Commands **set switch port**
show switch counter
show switch port

show switch port intrusion

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

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 Ethernet switch port, including uplink ports.

Description This command shows a list of MAC addresses for devices that are active on a port, but which are not valid devices allowed or learned for the port. The list contains entries when the **intrusionaction** parameter (**set switch port** command) is of the type TRAP (Figure 8-46 on page 8-228).

Figure 8-46: Example output from the **show switch port intrusion** command

```
Switch Port Information
------------------------------------------------------------------------------
Port 2 -    13 intrusion(s) detected
    00-00-c0-1d-2c-f8  00-90-27-87-a5-22  00-00-cd-01-00-4a
    00-d0-b7-4d-93-c0  08-00-5a-a1-02-3f  00-d0-b7-d5-5f-a9
    00-b0-d0-20-d1-01  00-90-99-0a-00-49  00-10-83-05-72-83
    00-00-cd-00-45-9e  00-00-c0-ad-a3-d0  00-a0-24-8e-65-3c
    00-90-27-32-ad-61
------------------------------------------------------------------------------
```

Example To display a list of MAC addresses for devices active on port 2, but which are not valid devices, use the command:

```
show switch port=2 intrusion
```

Related Commands **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 (Figure 8-47 on page 8-229, Table 8-64 on page 8-229).

Packets that originate on the switch or are routed by the switch'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.

Figure 8-47: Example output from the **show switch qos** command

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

Table 8-64: Parameters in the output of the **show switch qos** command

Parameter	Meaning
Priority level	Priority level of the received frame.
QOS egress queue	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
set qos hwpriority in Chapter 35, Quality of Service (QoS) on Switch Ports
show qos hwpriority in Chapter 35, Quality of Service (QoS) on Switch Ports

show switch trunk

Syntax `SHow SWItch TRunk[=`*`trunk`*`]`

where *trunk* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

Description This command displays information about the specified trunk group, or all trunk groups on the switch (Figure 8-48 on page 8-230, Table 8-65 on page 8-230).

The **trunk** parameter specifies the name of the trunk group. The name is not case sensitive. The name uniquely identifies the trunk group. The trunk group specified must already exist.

Figure 8-48: Example output from the **show switch trunk** command

```
Switch trunk groups
-------------------------------------------------------------
Trunk group name ............... Uplink
  Speed ........................... 1000Mbps
  Selection criterion ............. Destination MAC address
  Ports ........................... 25,26
-------------------------------------------------------------
```

Table 8-65: Parameters in the output of the **show switch trunk** command

Parameter	Meaning
Trunk group name	Name of the trunk group.
Speed	Configured speed of the trunk group ports, either "10Mbps", "100Mbps" or "1000Mbps", or "-" (speed has not been set yet).
Selection criterion	Selection criterion used to choose the trunk port on which a packet is to be sent.
Ports	List of the ports in the trunk group, by port number.

Example To display information about all trunk groups, use the command:

```
show switch trunk
```

To display the settings for the *Uplink* trunk group, use the command:

```
show switch trunk=uplink
```

Related Commands

add switch trunk
create switch trunk
delete switch trunk
destroy switch trunk
set switch trunk

show vlan

Syntax SHow VLAN[={*vlan-name*|1..4094|ALL}]

where *vlan-name is* a unique name from 1 to 32 characters. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen. The *vlan-name* 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 8-49 on page 8-231, Table 8-66 on page 8-232).

Figure 8-49: Example output from the **show vlan** command

```
VLAN Information
------------------------------------------------------------------------
 Name ............... default
 Identifier ......... 1
 Status ............. static
 Private VLAN ....... No
 Protected .......... No
 Untagged ports ..... 1,3-23
 Tagged ports ....... None
 Spanning Tree ...... default
 Trunk ports ........ None
 Mirror port ........ None
 Attachments:
 Module           Protocol         Format    Discrim     MAC address
 ------------------------------------------------------------------
 GARP             Spanning tree    802.2     42              -
 IP               IP               Ethernet  0800            -
 IP               ARP              Ethernet  0806            -
 ------------------------------------------------------------------

 Name ............... v2
 Identifier ......... 2
 Status ............. dynamic
 Private VLAN ....... Yes
 Protected .......... No
 Untagged ports ..... 2,24
 Tagged ports ....... None
 Spanning Tree ...... default
 Trunk ports ........ None
 Mirror port ........ None
 Attachments:
 Module           Protocol         Format    Discrim     MAC address
 ------------------------------------------------------------------
 GARP             Spanning tree    802.2     42              -
 ------------------------------------------------------------------
Private Uplink:
 Uplink ports ...... 21-24

Private Groups:
 Group  ports ...... 3-5
 Group  ports ...... 6-9
------------------------------------------------------------------
```

Table 8-66: Parameters in the output of the **show vlan** command

Parameter	Meaning
Name	Name of the VLAN.
Identifier	Numerical VLAN identifier of the VLAN.
Status	Status of the VLAN, either dynamic or static.
Protected	Whether the VLAN is a protected VLAN.
Private	Whether the VLAN is a private VLAN. A private VLAN contains ports or groups of ports that are isolated from the other ports in the VLAN. This option is only valid for Rapier i Series switches.
Untagged Ports	List of untagged ports that belong to the VLAN.
Configured	Specifies which ports are configured for the specified VLAN if the VLAN has ports that are either assigned to another VLAN, or configured for another VLAN but assigned to this VLAN by Dynamic VLAN Assignment.
Actual	Specifies which ports are actually in the specified VLAN if the VLAN has ports that are either assigned to another VLAN, or configured for another VLAN but assigned to this VLAN by Dynamic VLAN Assignment.
Tagged Ports	List of tagged ports that belong to the VLAN.
Spanning Tree	Name of the Spanning Tree Protocol to which the VLAN belongs.
Trunk ports	List of switch ports that belong to trunk groups. This field is displayed when a port in the VLAN also belongs to a trunk group.
Mirror port	Mirror port for the switch, or "None". Displayed for the default VLAN only.
Attachments – information about attachments to the VLAN made by other modules in the switch.	
Module	Name of the software module attached to the VLAN.
Protocol	Name of the protocol, which is determined from the format and identification number.
Format	Encapsulation format specified by the module.
Discrim	Discriminator specified by the module to identify which packets of the given format should be received.
MAC Address	Media Access Control source address for which the module wants to receive packets. This is commonly known as the Ethernet address.
Uplink ports	For private VLANs, the uplink for the VLAN. This is either a single uplink port, or a number of ports trunked together. This option is valid for Rapier i Series switches only.
Group ports	For private VLANs, a list of the private groups in the VLAN and the port or ports in each group. This option is valid for Rapier i Series switches only.

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

```
show vlan=marketing
```

Related Commands **create vlan**
destroy vlan

show vlan debug

Syntax `SHow VLAN DEBug`

Description This command displays debug information for all VLANs (Figure 8-50 on page 8-233, Table 8-67 on page 8-233).

Figure 8-50: Example output from the **show vlan debug** command

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

Vlan      Enabled Debug Modes       Output     Timeout
----------------------------------------------------------
Vlan4060  None
----------------------------------------------------------
```

Table 8-67: 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. This is shown when a debug mode is enabled.
Timeout	Seconds during which debugging options for the VLAN are enabled. This is shown when a debug mode is enabled. If a timeout value is not set, "None" is shown.

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

```
show vlan debug
```

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

show vlanrelay

Syntax `SHow VLANRelay[=`*`name`*`]`

where *name* is a unique name for the VLAN relay entity 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits, the underscore, and the hyphen.

Description This command displays information about one or all of the currently-configured VLAN relay entities (Figure 1, Table 1).

The **vlanrelay** parameter specifies the name of the VLAN relay entity for which to show information. If the name is not given, information about all VLAN relay entities is displayed.

Figure 8-51: Example output from the **show vlanrelay** command

```
VLAN relay entities
-------------------------------------------------------------
Name ............................. SNARelay
 Enabled ......................... Yes
 Debugging ....................... No
 Protocol ........................ 00
 Protocol ........................ 04
 VLAN ............................ 2 (Accounts)
 VLAN ............................ 5 (Admin)
 VLAN ............................ 16 (Sales)
Packet counters:
  VLAN 2 to VLAN 5 ................ 2345
           VLAN 16 ................ 148
  VLAN 5 to VLAN 2 ................ 2567
           VLAN 16 ................ 754
  VLAN 16 to VLAN 2 ............... 174
            VLAN 5 ................ 802
-------------------------------------------------------------
```

Table 8-68: Parameters in the output of the **show vlanrelay** command

Parameter	Meaning
Name	Name of the VLAN relay entity.
Enabled	Whether the VLAN relay entity is enabled.
Debugging	Whether packet debugging for the VLAN relay entity is enabled.
Protocol	Protocol number of each protocol that is relayed by the VLAN relay entity.
VLAN	Numerical VLAN Identifier and name of each VLAN added to the VLAN relay entity.
Packet counters	Number of packets relayed between VLANs by this VLAN relay entity.

Example To show the configuration and counters for the VLAN relay entity SNARelay, use the command:

```
show vlanrelay=snarelay
```

Related Commands

add vlanrelay
create vlanrelay
delete vlanrelay
destroy vlanrelay